PUBLIC HEARING DRAFT AMENDMENT 2 TO THE FISHERY MANAGEMENT PLAN FOR THE QUEEN CONCH FISHERY OF PUERTO RICO AND THE U.S. VIRGIN ISLANDS AND AMENDMENT 5 TO THE REEF FISH FISHERY MANAGEMENT PLAN OF PUERTO RICO AND THE U.S. VIRGIN ISLANDS

(with Draft Environmental Impact Statement and Regulatory Impact Review)

July 14, 2010

National Oceanic & Atmospheric Administration
National Marine Fisheries Service
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701
727-824-5308
727-824-5305 (fax)
http://sero.nmfs.noaa.gov

Caribbean Fishery Management Council
268 Muñoz Rivera Avenue, Suite 1108
San Juan, Puerto Rico 00918-1920
(787) 766-5926 (Phone)
(787) 766-6239 (Fax)
http://www.caribbeanfmc.com

Table of Contents

Table of Contents for EIS 6
Acronyms/Abbreviations 7
DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) COVER SHEET 10
1.0 EXECUTIVE SUMMARY 11
2.0 PURPOSE AND NEED.....32
2.1 Purpose Statement 32
2.2 Need for Action 32
3.0 INTRODUCTION 34
3.1 Background 34
3.2 History of Federal Fisheries Management 35
3.2.1 Fishery Management Plan for the Queen Conch Resources of Puerto Rico and the U.S. Virgin Islands 35
3.2.2 Fishery Management Plan for the Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands 39
3.2.3 Generic FMP Amendments.....41
3.3 Overview of Data History 42
3.3.1 Commercial Data History 42
3.3.2 Recreational Data History 44
4.0 MANAGEMENT ALTERNATIVES.....52
4.1 ACTION 1: Amend the Stock Complexes in the Reef Fish Fishery Management Units (FMU) 52
4.1.1 Action 1(a) Grouper complex 52
4.1.2 Action 1(b) Snapper complex 53
4.1.3 Summary Comparison of Alternatives to Amend the Stock Complexes in the Reef Fish Fishery Management Units (FMU) 54
4.2 ACTION 2: MANAGEMENT REFERENCE POINTS 55
4.2.1 Action 2(a) Snapper, Grouper and Parrotfish Complexes 56
4.2.2 Action 2(b) Queen Conch Complex 65
4.2.3 Summary Comparison of Management Reference Point Alternatives 70
4.3 ACTION 3: Annual Catch Limit Allocation/Management.....78
4.3.1 Action 3(a) Snapper and grouper unit allocation/management 78
4.3.2 Action 3(b) Commercial and recreational sector allocation/management (Puerto Rico only).....82
4.3.3 Action 3(c) Geographic allocation/management 83
4.3.4 Summary Comparison of Annual Catch Limit Allocation/Management Alternatives 88
4.4 ACTION 4: Management Measures 93
4.4.1 Action 4(a) Species-specific parrotfish prohibitions 93
4.4.2 Action 4(b) Recreational bag limits 95
4.4.3 Summary Comparison of Management Measures Alternatives 98
4.5 ACTION 5: Accountability Measures 101
4.5.1 Action 5(a) Triggering accountability measures.....101
4.5.2 Action 5(b) Applying accountability measures 104

4.5.3 Summary comparisons of accountability measures alternatives 104
4.6 Action 6: Framework Measures 106
4.6.1 Action 6(a): Establish Framework Measures for Reef Fish FMP 106
4.6.2 Action 6(b): Establish Framework Measures for Queen Conch FMP 107
4.6.3 Summary Comparison of Framework Measures Alternatives 110
5.0 AFFECTED ENVIRONMENT 112
5.1 Physical Environment 112
5.1.1 Geology 113
5.1.2 Oceanography and climate 113
5.1.3 Major habitat types 115
5.2 Biological Environment 116
5.2.1 Conch 116
5.2.2 Reef fish 119
5.2.3 Protected Species, Including Threatened and Endangered Species 137
5.3 DESCRIPTION OF THE ECONOMIC AND SOCIAL ENVIRONMENT 147
5.3.1. Introduction 147
5.3.2 Puerto Rico Fisheries 148
5.3.3 U.S. Virgin Islands Fisheries 203
5.3.4 Brief Economic History and Overview 222
5.3.5 Demographics 243
5.4 Administrative Environment 252
5.4.1 Federal Fishery Management 252
5.4.2 Territory Fishery Management 253
6.0 ENVIRONMENTAL CONSEQUENCES 254
6.1 ACTION 1: Amend the Stock Complexes in the Reef Fish Fishery Management Units (FMU) 254
6.1.1 Direct and Indirect Effects on the Physical, Biological, and Ecological Environment 254
6.1.2 Direct and Indirect Effects on the Economic and Social Environments 255
6.1.3 Direct and Indirect Effects on the Administrative Environment 255
6.2 ACTION 2: Management Reference Points 256
6.2.1 Direct and Indirect Effects on the Physical, Biological, and Ecological Environment 256
6.2.2 Direct and Indirect Effects on the Economic and Social Environments 275
6.2.3 Direct and Indirect Effects on the Administrative Environment 279
6.3 ACTION 3: Annual Catch Limit Allocation/Management 280
6.3.1 Direct and Indirect Effects on the Physical, Biological, and Ecological Environment 280
6.3.2 Direct and Indirect Effects on the Economic and Social Environments 283
6.3.3 Direct and Indirect Effects on the Administrative Environment 289
6.4 ACTION 4: Management Measures 293
6.4.1 Direct and Indirect Effects on the Physical, Biological, and Ecological Environment 293
6.4.2 Direct and Indirect Effects on the Economic and Social Environments 295
6.4.3 Direct and Indirect Effects on the Administrative Environment 299
6.5 ACTION 5: Accountability Measures 300

DRAFT

6.5.1 Direct and Indirect Effects on the Physical, Biological, and Ecological Environment....300
6.5.2 Direct and Indirect Effects on the Economic and Social Environments....303
6.5.3 Direct and Indirect Effects on the Administrative Environment....305
6.6 ACTION 6: Framework Measures....306
6.6.1 Direct and Indirect Effects on the Physical, Biological, and Ecological Environment....306
6.6.2 Direct and Indirect Effects on the Economic and Social Environments....307
6.6.3 Direct and Indirect Effects on the Administrative Environment....307
6.7 Cumulative Effects Analysis....308
6.8 Unavoidable Adverse Effects....322
6.9 Relationship Between Short-Term Uses and Long-Term Productivity....323
6.10 Mitigation, Monitoring, and Enforcement Measures....323
6.11 Irreversible and Irretrievable Commitments of Resources....324
6.12 Any Other Disclosures....324
7.0 REGULATORY IMPACT REVIEW....325
7.1 Introduction....325
7.2 Problems and Objectives....325
7.3 Methodology and Framework for Analysis....325
7.4 Description of Relevant Fisheries....325
7.5 Economic Impacts of Management Measures....325
7.5.1. Action 1. Amend Stock Complexes in Reef Fish FMU....325
7.5.2. Action 2. Redefine management reference points or proxies....326
7.5.3. Action 3. Annual catch limit allocation/management....329
7.5.4 Action 4. Management measures....334
7.5.5. Accountability measures....337
7.5.6 Framework Measures....368
7.6 Public and Private Costs of Regulations....369
7.7 Determination of Significant Regulatory Action....369
8.0 SOCIAL IMPACT ASSESSMENT REQUIREMENTS AND DATA ISSUES....370
8.1 Introduction....370
8.2 Data Limitations and Methods....370
8.3 Summary of Social Impact Assessment....371
9.0 REFERENCES....372
10.0 LIST OF PREPARERS....394
11.0 LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THE STATEMENT ARE SENT....395
12.0 INDEX....396
APPENDICES....405
Appendix 1. Scenarios from the Scientific and Statistical Committee....406
Appendix 2. Reef Fish FMU....407
Appendix 3. Bycatch Practicability Analysis....411
Appendix 4. Scoping Locations and Outcomes....418
Appendix S-1....424
Appendix S-2....430

DRAFT

Appendix 5. Alternatives the Council considered but eliminated from detailed study, and a brief discussion of the reasons for their elimination. 446
Appendix 6. Other Applicable Laws 455
Appendix 7. Research Needs 463
Appendix 8. Response to Comments on DEIS 464

DRAFT

Table of Contents for EIS

Please note that this fishery action is presented as an integrated document. It addresses different applicable laws including the National Environmental Policy Act (NEPA). Therefore, the document does not follow a standard EIS format, however, elements of the EIS are present and identified in the following table of contents for the EIS.

Cover Sheet.....10
Executive Summary.....11
Purpose and Need.....32
Management Alternatives.....52
Affected Environment.....112
Environmental Consequences.....254
References.....372
List of Preparers.....394
List of Agencies, Organizations, and Persons to Whom Copies of
This Statement are Sent.....395
Index.....396
Appendices.....405
Response to Comments on DEIS.....464

DRAFT

Acronyms/Abbreviations

A	fish returned to shore for ID by interviewer
ABC	acceptable biological catch
ACL	annual catch limit
ACLG	Annual Catch Limit Working Group
ACT	Annual catch target
AM	accountability measure
APA	Administrative Procedure Act
B	Biomass
B1	fish filleted or used for bait but identified by interviewer
B2	fish identified but released alive
$B_{CURRENT}$	current biomass of stock
B_{MSY}	Biomass at MSY
C	Average catch
CCA	Crustose coralline algae
CEA	Cumulative effects analysis
CEQ	Council on Environmental Quality
CFMC	Caribbean Fishery Management Council
CFR	Code of federal regulations
CHTS	Coastal household telephone survey
CPUE	Catch per unit effort
CY	Calendar year
CZMA	Coastal Zone Management Act
DEIS	Draft environmental impact statement
DQA	Data Quality Act
EA	Environmental assessment
EEZ	Exclusive economic zone
EFH	Essential fish habitat
EIS	Environmental impact statement
E.O.	Executive order
EPA	Environmental Protection Agency
ESA	Endangered Species Act
F	Instantaneous fishing mortality rate
FAC	Fisheries Advisory Committee
FAG	Fish aggregation device
FAO	Food and Agriculture Organization (United Nations)
F_{CURR}	Current fishing mortality rate
FEIS	Final environmental impact statement
FL	Fork length
FMP	Fishery management plan
F_{MSY}	Fishing mortality rate yielding MSY
FMU	Fishery management unit
FONSI	Finding of no significant impact
F_{OY}	Fishing mortality rate yielding OY
FR	Federal regulations
GDP	Gross domestic product

DRAFT

GM	Genetically modified
GNI	Gross national income
GNP	Gross national product
HMS	Highly migratory species
IPT	Interdisciplinary Plan Team
ITCZ	Inter-tropical convergence zone
IRFA	Initial regulatory flexibility analysis
IUCN	International Union for the Conservation of Nature
MCD	Marine conservation district
MFMT	Maximum fishing mortality threshold
MMPA	Marine Mammal Protection Act
MRFSS	Marine Recreational Fisheries Statistics Survey
MRIP	Marine Recreational Information Program
MSA	Magnuson-Steven Fishery Conservation and Management Act (Magnuson-Stevens Act)
MSRA	Magnuson-Stevens Fishery Conservation and Management Reauthorization Act
MSST	Minimum stock size threshold
MSY	maximum sustainable yield
NEPA	National Environmental Policy Act
NGO	Non-governmental Organization
NMFS	National Marine Fisheries Service
NMSA	National Marine Sanctuaries Act
NOAA	National Oceanic and Atmospheric Administration
NS	National standard
OFL	Overfishing level
OMB	Office of Management and Budget
OY	Optimum yield
PCE	Primary constituent element
PR	Puerto Rico
PRA	Paperwork Reduction Act
PRDNER	Puerto Rico Department of Natural and Environmental Resources
PSE	Proportional standard error
RA	Regional Administrator of NMFS
RFA	Regulatory Flexibility Act
RIR	Regulatory impact review
SBA	Small Business Administration
SEAMAP	Southeast Area Monitoring and Assessment Program
SEDAR	Southeast data assessment review (stock assessment)
SEFSC	Southeast Fisheries Science Center
SEIS	Supplemental environmental impact statement
SFA	Sustainable Fisheries Act
SSC	Scientific and Statistical Committee
STFA	St. Thomas Fishermen's Association
STJ	St. Johns, U.S. Virgin Islands
STT	St. Thomas, U.S. Virgin Islands

DRAFT

STX	St. Croix, U.S. Virgin Islands
TAC	Total allowable catch
TMCT	Technical Monitoring and Compliance Team
U.S. Caribbean	Caribbean islands of Puerto Rico, St. Thomas, St. John, and St. Croix
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
USVI	United States Virgin Islands
VEC	Valued ecosystem component
VIDPNR	Virgin Islands Department of Planning and Natural Resources

DRAFT

DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS) COVER SHEET

Responsible Agencies and Contact Persons

Lead Agency for EIS:
United States Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701
(727) 824-5301 (Phone)
(727) 824-5308 (Fax)
www.sero.nmfs.noaa.gov
Contact: Dr. Roy Crabtree, Regional Administrator

Lead Agency for FMP:
Caribbean Fishery Management Council
268 Muñoz Rivera Avenue, Suite 1108
San Juan, Puerto Rico 00918-1920
(787) 766-5926 (Phone)
(787) 766-6239 (Fax)
http://www.caribbeanfmc.com
Contact: Miguel A. Rolón. Executive Director

Name of Action

Draft amendment 2 to the fishery management plan for the queen conch fishery of Puerto Rico and the U.S. Virgin Islands and amendment 5 to the reef fish fishery management plan of Puerto Rico and the U.S. Virgin Islands.

Type of Action:

(X) Administrative ( ) Legislative

(X) Draft ( ) Final

Abstract: This amendment to the fishery management plans for reef fish and queen conch in the U.S. Caribbean is designed to bring those fisheries into compliance with the 2007 revisions to the Magnuson-Stevens Fishery Conservation and Management Act. Included are provisions to re-arrange the fishery management units for snapper and grouper, to transition management from the 2005 Comprehensive Sustainable Fisheries Act to the mandated provisions of the MSA, to allocate harvest among island groups (Puerto Rico, St. Thomas/St. John, and St. Croix), to implement certain management details to constrain parrotfish harvest and to limit recreational harvest of snapper, grouper, and parrotfish, to define and implement accountability measures, and to modify framework provisions to ensure a rapid response to developing issues. The present amendment focuses on those species previously defined as undergoing overfishing; a subsequent amendment will address those species not determined to be undergoing overfishing.

Date DEIS files: Date DEIS comments due:

Date FEIS files: Date FEIS comments due:

DRAFT

1.0 EXECUTIVE SUMMARY

The purpose of this amendment is to revise management reference points and status determination criteria for the Caribbean queen conch, snapper, grouper, and parrotfish; specify Annual Catch Limits (ACLs) and Accountability Measures (AMs) for those species/species groups classified as overfished or undergoing overfishing to prevent overfishing of these species/species groups; establish framework measures to facilitate regulatory modifications; adjust management measures as needed to constrain harvest to specified annual catch limits; and minimize, to the extent practicable, negative socioeconomic impacts that may result from the amendment actions.

To achieve these goals, six actions are included in the amendment. Action 1 amends the stock complexes in the reef fish fishery management unit. Action 2 revises management reference points to transition U.S. Caribbean reef fish and queen conch management from that established in the Comprehensive Sustainable Fisheries Amendment (SFA) of 2005 (CFMC 2005) to that mandated by the Magnuson-Stevens Fishery Conservation and Management Act as Amended Through January 12, 2007 (MSRA). Action 3 works in concert with Action 2 and provides the specific details regarding the distribution and numerical value of ACLs for the various U.S. Caribbean island groups, including Puerto Rico (PR), St. Croix (STX) in the United States Virgin Islands (USVI), and the island group of St. Thomas and St. John (STT/STJ) in the USVI. Action 4 proposes management measures with specific emphasis on harvest prohibitions for three parrotfish species (midnight, blue, rainbow) that serve an essential ecological function and which are relatively large and long-lived. Action 4 also proposes recreational bag limits for reef fish. Action 5 provides alternative guidelines for triggering AMs and for applying those accountability measures. Finally, Action 6 establishes framework provisions separately for reef fish and queen conch. In concert, these actions serve to provide a basic foundation for place-based reef fish and queen conch fisheries management in the U.S. Caribbean.

<u>Action 1</u>

Two sub-actions are included in Action 1, the first of which addresses amending the U.S. Caribbean grouper complex and the second of which amends the snapper complex (Table 1.0.1). For each of these sub-alternatives, the choice is between taking no action (**Alternative 1**) and amending the complex (**Alternative 2**). In the case of grouper, **preferred Alternative 2** separates current Grouper Unit 4 (GU4) into GU4 and GU5 by moving misty and yellowedge grouper from GU4 into the new GU5 and adding black grouper to GU4. It is additionally proposed to move creole-fish from GU3 into the 'data collection only' category (i.e., making creole-fish and Ecosystem Component Species). Both black grouper and creole-fish are rarely caught in the commercial fishery, but black grouper apparently are caught by recreational fishers. Therefore, it is important to include black grouper in the U.S. Caribbean reef fish management program to ensure the long-term health and abundance of this population. Both yellowedge and misty grouper are relatively deep-water species that have been improperly grouped with member of GU4 that tend to occupy much more shallow habitats. In the case of snapper, there is confusion

regarding catch of the conspecifics *Pristipomoides aquilonaris* (wenchman) and *P. macrophthalmus* (cardinal snapper). Of specific concern for this amendment is the placement of wenchman in Snapper Unit 2 (SU2) along with queen snapper. Statistical analyses indicate that queen snapper are more closely associated with cardinal snapper based upon habitat utilization and catch patterns, whereas wenchman are more closely associated with members of SU1.

Alternatives included in Action 1 are generally considered to be non-controversial. As noted in Table 1.0.1, there are positive biological and ecological outcomes associated with the action alternative for each of the two sub-actions contained in Action 1.

Action 2

As noted above, Action 2 of the present amendment transitions reef fish and queen conch fisheries management in the U.S. Caribbean from that established by the SFA to that mandated by the MSRA. The former provided a valuable and comprehensive format for fisheries management in the U.S. Caribbean, but was dependent upon data sources of variable accuracy and precision. Moreover, the SFA is not fully compliant with the mandates of the MSRA. Action 2 herein reiterates the management reference points established in the SFA as **Alternative 1** of each sub-action (Table 1.0.2). Unfortunately, the U.S. Caribbean is considered to be data poor with regard to fisheries landings information, severely compromising the Council's ability to establish quantitative benchmarks for those reference points. There are two sub-actions within Action 2: the first addresses reef fish (snapper, grouper, and parrotfish) and the second addresses queen conch. Each sub-action contains three alternatives: **Alternative 2** derives an average annual catch based upon the longest pre-SFA time series for which the data are considered to be consistently reliable across all islands; **Alternative 3** derives an average annual catch based upon the longest time series for which the data are considered to be consistently reliable across all islands; and, **Alternative 4** derives an average annual catch for the most recent five year period (2003-2007) for which the data are considered to be consistently reliable across all islands. In specific cases, such as queen conch in the USVI, specific fishing level recommendations by the Council's Scientific and Statistical Committee (SSC) are included. Adjustments to account for scientific and management uncertainty are also included as sub-alternatives within each of **Alternatives 2-4**.

Alternatives contained within Action 2 have been controversial. U.S. Caribbean commercial fishers have expressed concern regarding the year sequences to be used, arguing for the year-sequences that provide the highest average annual landings estimate and therefore the largest ACL. But, the greatest controversy has surrounded the choice of "uncertainty" factors. Those factors range from a value of 1.00, in which case there would be no downward adjustment to the average annual catch when deriving the ACL, to a value of 0.50 in which case the average annual catch would be reduced by 50% to derive the ACL. Fishers have argued most strongly for an 0.85 adjustment factor, whereas other interested parties including representative Non-governmental organizations (NGOs) have expressed concern for Caribbean reef resources and a desire to choose an uncertainty

DRAFT

factor that best defends the long-term sustainability of the fisheries and associated resources from which harvest derives.

Action 3

Action 3 customizes the ACL-based management reference points for each island group. Action 3 includes three sub-actions (Table 1.0.3). Sub-action 3(a) addresses the need to aggregate reference points for either or both of the snapper and grouper complexes within either or both of PR and the USVI. There remain severe limitations to the reef fish landings data acquired since 1999. For parrotfish, it is not possible to establish reference points for sub-units of the complex because > 99% of the data in PR and 100% of the data in the USVI are not classified to a particular species. Parrotfish are therefore not included in sub-action 3(a). Similarly, 100% of snapper landings in the USVI are not classified, so those data also cannot be used to establish unit-specific reference points. However, less than 10% of commercial snapper landings in PR are not classified, so it is possible to use the predominant proportion of snapper landings data from PR to establish unit-specific average annual landings and to thereby derive unit-specific ACLs. Intermediate between the parrotfish and snapper extremes lie grouper. The grouper complex also is not amenable to establishment of unit-specific reference points in the USVI because 100% of USVI landings are not classified to species. In PR, generally between 30-50% of landings are unclassified, so the Council has a viable choice between managing at the level of the complex versus at the level of the unit. The preferred alternative is to manage snapper in PR at the level of the unit, to manage grouper in PR as the level of the complex, and to manage both snapper and grouper at the complex level in the USVI.

Sub-action 3(b) specifies separate commercial and recreational ACLs in PR based upon the preferred management reference point time series. The two alternatives of this sub-action are to take no action (**Alternative 1**) or to proceed with establishing separate reference points for the two sectors (**Alternative 2**). This sub-action is specific to PR because practicable recreational landings data are presently not available for the USVI. Note that this sub-action will need to be revisited as recreational landings data for the USVI become available. Until recreational data are available for the USVI the recreational fishery management will follow that of the commercial fishery. In other words, in the USVI if the ACL for the commercial fishery is met, both the commercial and the recreational fishery will be subject to appropriate AMs. A primary outcome of **Alternative 2**, if it is chosen, would be to separate management of the recreational and commercial reef fish quotas in PR, thereby removing the dependence of each fishery on the harvest activities of the other. This outcome is desired by recreational fishers, and particularly by the charter boat industry, who understand that their access to the fishery could otherwise be removed upon fulfillment of the overall quota by combined commercial and recreational fishing activities. Note that Action 4(b), discussed below, further addresses the desire of charter boat captains to maintain year-round access to the fishery, in the case of Action 4(b) by establishing bag limits.

Sub-action 3(c) provides options to spatially define fishing areas within the U.S. Caribbean. This sub-action serves to clarify how island-specific harvest quotas will be

allocated and managed. The no-action alternative continues the present situation of U.S. Caribbean-wide reference points. A possible outcome of this scenario is that harvest from anywhere within the U.S. Caribbean would count against the quota for the island where it is landed. Consequently, harvest activities by citizens of one island could have a negative impact on the availability of that stock on another island by impacting present or future harvest opportunities. **Preferred Alternative 2** defines geographic boundaries between each island group (PR, STX, STT/STJ) and includes three sub-alternatives describing how to draw those boundaries.

The alternatives contained within Action 3 are generally considered to be non-controversial. Average annual catch levels, from which island-specific ACLs are determined, are based upon historic catch levels as reported by the fishermen, with the result that those catch estimates are incontrovertible. Furthermore, the derived ACLs differ only slightly with the choice of year sequence, so the practical effect of choosing among year-sequences is minor. No significant concern has been expressed regarding sector-specific management in PR, and only minor concern has been expressed regarding the choice of geographic reference points with which to separate the island groups.

Action 4

Action 4 addresses additional management measures, including species-specific prohibitions on parrotfish harvest and establishment of recreational bag limits (Table 1.0.4). **Alternative 1** of Action 4(a) would make no change to the present regulations regarding harvest of midnight, blue, and rainbow parrotfish, whereas **Alternative 2** would prohibit harvest of each of these species depending upon the sub-alternative chosen. The sub-alternatives allow for a prohibition on the harvest of each of those three species; combinations of the sub-alternatives would regulate against the harvest of any combination of those three species or all three species if all three sub-alternatives are chosen. Parrotfish are considered to be valued ecosystem components (VECs), and the three largest species that occur in the U.S. Caribbean and that are addressed in this sub-action are considered to be most vulnerable to overharvest because of their large body size, high susceptibility to spear gear and fish traps, and relatively low resilience. Action 4(b) provides a variety of alternatives for establishing recreational bag limits in the U.S. Caribbean. Alternatives include not establishing a bag limit (**Alternative 1**), establishing a 10-fish (**Alternative 2**), 5-fish (**Alternative 3**), or 2-fish (**Alternative 4**) aggregate bag limit including sub-alternatives for applying these bag limits to the snapper, grouper, or parrotfish complexes. Also being considered is a 0-fish aggregate bag limit for parrotfish (**Alternative 5**), a vessel limit (**Alternative 6**) with subalternatives for a two fisher, three fisher, or four fisher equivalent, and the **preferred alternative** (**Alternative 7**) to establish an overall aggregate bag limit that allows a fisher a total of 10 fish per day including not more than two parrotfish (excepting midnight, blue, and rainbow parrotfish). The preferred alternative (**Alternative 7**) also includes a vessel limit of not more than 30 fish per day of which no more than six can be parrotfish.

It is anticipated that a prohibition on take of midnight, blue, and rainbow parrotfish will be controversial on St. Croix where almost 65% of the average 1999-2007 parrotfish harvest

was landed. Bag limits have so far not elicited much controversy but they have not yet been taken to public hearing.

Action 5

The alternatives contained within Action 5 outline procedures for triggering and then applying AMs (Table 1.0.5). Sub-action 5(a) first specifies the criteria for triggering AMs, the no action **Alternative 1** simply states that AMs would not be triggered under any circumstances. This alternative does not comply with the mandates of MSRA. Both **Alternative 2** and **Alternative 3** describe the conditions under which AMs would be triggered, and these two alternatives differ only in that the latter includes a provision requiring input from the NMFS' Southeast Fisheries Science Center, in consultation with the Council and its SSC, prior to determining that an AM has been triggered. This provision is included to ensure that AMs are implemented because a real change in landings has led to exceedance of an ACL rather than that overage being due to an administrative or bookkeeping factor such as improved reporting of landings. Otherwise, both **Alternative 2** and **Alternative 3** include three sub-alternatives that provide for AMs to be triggered if the ACL is exceeded based on a single year of landings, the average of the two most recent years of landings, or the preferred alternative which uses an average of the three most recent years of landings. Sub-action 5(b) then provides remedies for an ACL overage. The no action **Alternative 1** does not apply AMs at all, whereas **preferred Alternative 2** and **Alternative 3** provide for the application of AMs if the ACL is exceeded. The former requires the length of the fishing season in the year following the overage to be reduced by the amount needed to prevent such an overage from occurring again. Changes implemented by the AM would remain in effect until modified. **Alternative 3** reduces the length of the fishing season following the same protocols as **Alternative 2**, but also includes a provision to pay back the overage. The provisions of Action 5 have not been controversial.

Action 6

This action includes framework measures designed to provide a mechanism to expeditiously adjust various reference points and management measures are included in Action 6. This action contains two sub-actions that are almost identical in nature with the exception that sub-action 6(a) applies to the Council's Reef Fish Fishery Management Plan (FMP) and sub-action 6(b) applies to the Conch FMP. For both sub-actions, **Alternative 1** is the no action alternative and no framework measures would be established. **Alternative 2** of both sub-actions includes a lengthy list (see Table 1.0.6) of options for adjusting reference points and management measures, the only difference between them being the inclusion of adjustments to the FMUs for the reef fish. **Alternative 3** reiterates the options available in **Alternative 2** but provides the Council with only a subset of the full range of options presented in **Alternative 2**. The options made available by **Alternative 3** are not specified and would be included in the final list at the discretion of the Council. Again, as with Action 5, these actions are generally not controversial.

Table 1.0.1. Comparison of alternatives for Action 1 to amend the stock complexes in the reef fish fishery management units (FMU).

Action	Alternatives	Biological Effects	Socioeconomic/Administrative Effects
1(a) Grouper Complex	**Alternative 1**: No action. Do not change the species groupings within the grouper complex	No direct or indirect effects on the physical, biological, or ecological environment beyond the baseline.	No added economic or social impacts. (-) Long-term negative effects on the administrative environment
	Alternative 2: (***Preferred***) Separate Grouper Unit 4 into Grouper Unit 4 and Grouper Unit 5. Move creole-fish from Grouper Unit 3 into the 'data collection only' unit	(+) Improved monitoring and management of snapper, better alliance of grouper species with species of similar ecological attributes	No direct socioeconomic effects anticipated. Indirect effects depend upon subsequent regulatory actions. (+) Reduced administrative burden due to removal of creole-fish from consideration, but one-time burden to delete creole-fish from recording forms. Also, addition of black grouper may offset reduction resulting from removal of creole-fish
1(b) Snapper Complex	**Alternative 1**: No action. Do not change the species groupings within the snapper complex	No direct or indirect physical, biological, or ecological effects	No added socioeconomic or administrative impacts.
	Alternative 2: (***Preferred***) Modify the snapper FMUs by adding cardinal snapper to Snapper Unit 2 and moving wenchman into Snapper Unit 1	(+) More careful and responsive management of cardinal snapper.	No direct socioeconomic effects anticipated. Indirect effects depend upon subsequent regulatory actions. Negligible effects on administrative environment due to addition of cardinal snapper to catch forms. May ease law enforcement burden by eliminating need for officers to distinguish between two closely related species

DRAFT

Table 1.0.2. Comparison of alternatives for Action 2 regarding management reference points.

Action	Alternatives	Biological Effects	Socioeconomic/Administrative Effects
2(a) Snapper, grouper, and parrotfish complexes	**Alternative 1**: No action. Retain current management reference points or proxies for species/species groups within the snapper, grouper, and/or parrotfish complexes	(-) Data are not available with which to accurately estimate catch, stock biomass, and fishing mortality rates. Unit-based data not available.	(-) No added socioeconomic impacts, but incompatible with Alternative 2 of Action 1(a) and Alternative 2 of Action 1(b). No anticipated impact on administrative environment.
	Alternative 2: (***Preferred***) Redefine management reference points or proxies for the snapper, grouper, and/or parrotfish complexes based on the longest time series of pre-Comprehensive SFA Amendment catch data that is considered to be consistently reliable across all islands	(+) Accommodates aggregated data available from USVI and to a considerable degree for grouper and parrotfish from PR. (+) Reflects catch rates prior to implementation of Caribbean SFA Amendment in 2006, thereby best approximating sustainable yield.	No direct socioeconomic impacts; indirect impacts dependent upon the AMs, regulations that implement AMs, other regulations, and environmental factors. Stricter catch levels would be anticipated to result in the greatest administrative burden due to more frequent incidents of overharvest.
	Alternative 3: Redefine management reference points or proxies for the snapper, grouper, and/or parrotfish complexes based on the longest time series of catch data that is considered to be consistently reliable across all islands	(+) Accommodates aggregated data available from USVI and to a considerable degree for grouper and parrotfish from PR. (-) Includes catch levels both prior to and following implementation of Caribbean SFA Amendment, thereby complicating interpretation of sustainable yield.	No direct socioeconomic impacts; indirect impacts dependent upon the AMs, regulations that implement AMs, other regulations, and environmental factors. Stricter catch levels would be anticipated to result in the greatest administrative burden due to more frequent incidents of overharvest.
	Alternative 4: Redefine management reference points or proxies for the snapper, grouper, and parrotfish complexes based on the most recent five years of available catch data	(+) Accommodates aggregated data available from USVI and to a considerable degree for grouper and parrotfish from PR. (-) Includes catch levels both prior to and following implementation of Caribbean SFA Amendment, thereby complicating interpretation of sustainable yield.	No direct socioeconomic impacts; indirect impacts dependent upon the AMs, regulations that implement AMs, other regulations, and environmental factors. Stricter catch levels would be anticipated to result in the greatest administrative burden due to more frequent incidents of overharvest.

DRAFT

Table 1.0.2 (continued). Comparison of alternatives for Action 2 regarding management reference points.

Action	Alternatives	Biological Effects	Socioeconomic/Administrative Effects
2(b) Queen conch Complex	**Alternative 1**: No action. Retain current management reference points or proxies for the queen conch complex	(-) Data are not available with which to accurately estimate catch, stock biomass, and fishing mortality rates.	(-) Less socioeconomic benefit relative to the other alternatives. No anticipated impact on administrative environment.
	Alternative 2: (***Preferred***) Redefine management reference points or proxies for queen conch based on the longest time series of pre-Comprehensive SFA Amendment catch data that is considered to be consistently reliable across all islands	(+) Reflects catch rates prior to implementation of Caribbean SFA Amendment in 2006, thereby best approximating sustainable yield.	(+) New targets and thresholds, based upon more recent time-series landings data that are considered to be more reliable and not affected by recent regulatory changes. Indirect socioeconomic impacts dependent on alternative chosen, with higher ACL producing larger short-term socioeconomic benefits but lower ACL producing larger long-term benefits. More restrictive ACLs expected to incur more substantial administrative burden due to increased frequency of management actions.
	Alternative 3: Redefine management reference points or proxies for queen conch based on the longest time series of catch data that is considered to be consistently reliable across all islands	(-) Includes catch levels both prior to and following implementation of Caribbean SFA Amendment, thereby complicating interpretation of sustainable yield.	(-) New targets and thresholds, based upon more recent time-series landings data that are more reliable than baseline but that are affected by recent regulatory changes. Indirect socioeconomic impacts dependent on alternative chosen, with higher ACL producing larger short-term socioeconomic benefits but lower ACL producing larger long-term benefits. More restrictive ACLs expected to incur more substantial administrative burden due to increased frequency of management actions.
	Alternative 4: Redefine management reference points or proxies for queen conch based on the most recent five years of available catch data	(-) Includes catch levels both prior to and following implementation of Caribbean SFA Amendment, thereby complicating interpretation of sustainable yield.	(-) New targets and thresholds, based upon most recent five-year time-series landings data that are more reliable than baseline but that are affected by recent regulatory changes. Indirect socioeconomic impacts dependent on alternative chosen, with higher ACL producing larger short-term socioeconomic benefits but lower ACL producing larger long-term benefits. More restrictive ACLs expected to incur more substantial administrative burden due to increased frequency of management actions.

DRAFT

Table 1.0.3. Comparison of alternatives for Action 3 regarding annual catch limit allocation/management.

Action	Alternatives	Biological Effects	Socioeconomic/Administrative Effects
3(a) Snapper and grouper unit allocation/management	**Alternative 1**: No action. Define reference points for sub-units within the snapper and grouper units	(+) Management at most resolved level, allows most sensitive and directed response to changes, provides greatest assurance that a species is not overfished. (-) Species-specific data are not available in USVI, and non-species-specific data comprise a variable component of landings for all groups in PR.	No direct socioeconomic effects. (-) Adverse short-term and positive long-term indirect effects dependent upon other chosen alternatives, AMs, regulations that implement the AMs, other regulations that combine to rationalize the fishery, and other environmental factors. Not consistent with USVI reporting requirements, thereby requiring use of proxies that may allow overfishing and indirectly lower long-term net benefits. (-) Greatest administrative burden due to disparity between desired and realized harvest reporting goals.
	Alternative 2: Define aggregate reference points for the snapper and grouper units: A. PR only B. USVI only C. Both PR and the USVI	(-) Management by complex, for either or both of PR and USVI, disregards applicable species-specific data for snapper in PR and thereby fails to effectively managed snapper in PR at unit level. If sub-alternative B is chosen, grouper in PR are managed at unit level but with inadequate data. In any case, data not fully exploited and species not managed at maximum sensitivity within constraints of data, thereby risking biological over-exploitation of some species.	No direct socioeconomic effects. (-) Adverse short-term indirect effects dependent upon other chosen alternatives, AMs, regulations that implement the AMs, other regulations that combine to rationalize the fishery, and other environmental factors. Alternative 2A not consistent with USVI reporting requirements, thereby requiring use of proxies that may allow overfishing and indirectly lower long-term net benefits. (+) Administrative burden less than that for Alternatives 1 or 3 but dependent upon sub-alternative chosen, with sub-alternative A being most burdensome and sub-alternative C being least burdensome.

DRAFT

Table 1.0.3 (continued). Comparison of alternatives for Action 3 regarding annual catch limit allocation/management.

Action	Alternatives	Biological Effects	Socioeconomic/Administrative Effects
	Alternative 3: Define aggregate reference points for the grouper unit: A. PR only B. USVI only C. Both PR and the USVI	(-) Management of grouper by complex is feasible and probably necessary. However, available USVI landings data do not allow for effective management of snapper at unit level in USVI	No direct socioeconomic effects. (-) Adverse short-term and positive long-term indirect effects dependent upon other chosen alternatives, AMs, regulations that implement the AMs, other regulations that combine to rationalize the fishery, and other environmental factors. Alternative 3A not consistent with USVI reporting requirements, thereby requiring use of proxies that may allow overfishing and indirectly lower long-term net benefits. Administrative burden falls between 1 and 3, requiring additional record keeping for snapper
	Alternative 4: (***Preferred***) Define aggregate reference points for snapper and grouper in the USVI and define aggregate reference points for grouper but not snapper in PR	(+) Allows management of USVI snapper and grouper at complex level, consistent with data. Allows management of PR grouper at complex level, as best supported by available data, while allowing management of PR snapper at unit level. Managing at most resolved level minimizes likelihood that species or species groups will be overfished with resultant impacts on ecosystem.	No direct socioeconomic effects. Adverse short-term and positive long-term indirect effects dependent upon other chosen alternatives, AMs, regulations that implement the AMs, other regulations that combine to rationalize the fishery, and other environmental factors. (+) Least administratively burdensome of the four alternatives because inherent consistency with present data collection and management efforts in both USVI and PR
3(b) Commercial and recreational sector allocation/management (PR only)	**Alternative 1**: No action. Do not specify sector-specific annual catch limits	No direct or indirect biological or ecological effects, because overall ACL remains the same. (-) Physical impacts due to potential increase in trap deployments/recoveries by commercial fishery	(-) Failure to separate commercial from recreational quota may elicit competition for a single ACL among sectors to the detriment of recreational socioeconomics. No additional administrative burden beyond that resulting from implementation of Action 2(a).

DRAFT

Table 1.0.3 (continued). Comparison of alternatives for Action 3 regarding annual catch limit allocation/management.

Action	Alternatives	Biological Effects	Socioeconomic/Administrative Effects
	Alternative 2: (***Preferred***) Specify separate commercial and recreational annual catch limits based on the preferred management reference point time series	No direct or indirect biological or ecological effects, because overall ACL remains the same. (+) No anticipated increase in physical impacts because no change in trap deployments/recoveries by commercial fishery	(+) Each of the recreational and commercial sectors allocated a subset of the total ACL, eliminating competition among sectors. (-) Race for quota may still occur within each sector, may lead to overcapitalization. Actual socioeconomic impacts dependent on if the regulatory and economic environments support such competition. (-) Additional administrative burden resulting from required separation of catches, establishing separate quotas, and particularly from monitoring, managing, and enforcing quotas. (+) Latter will be ameliorated by reduction in competition between sectors, elimination of dependence of one sector on activities of the other, and resultant reduction in conflict between sectors.
3(c) Geographic allocation/management	**Alternative 1**: No action. Maintain U.S. Caribbean-wide reference points	No change to biological, ecological, or physical environment anticipated.	(-) Potential to create territorial and/or sector competition in the EEZ, possibly resulting in overcapitalization of fishing assets. Little change to the administrative environment.
	Alternative 2: (***Preferred***) Divide and manage annual catch limits by island group (i.e., PR, STT/STJ, STX) based on the preferred reference point time series (Table 4.3.1 and Action 2) A. (***Preferred***) Use a mid-point or equidistant method for dividing the EEZ among islands B. Use a straight line approach for dividing the EEZ among islands C. Use the St. Thomas Fisherman's Association line	With the exception of changes to gear deployment patterns discussed above, no direct or indirect physical impacts expected. (+) Potentially substantial direct and indirect effects to biological and ecological environments. Better distribution of harvest among island groups, decreased likelihood of area-specific overharvest.	(+) Reduced likelihood of direct competition among fishers from different island groups, with maximum socioeconomic benefits accruing to STT/STJ fishers and their communities. (-). Adverse socioeconomic impacts experienced by fishers harvesting from an area that is subsequently closed when its catch limit is met. (-) Increased administrative burden resulting from additional effort to independently track landings, identify potential overages, reduce harvest in a timely manner. (+) Those deficiencies may be offset to some degree by the smaller universe of stakeholders who must be managed and informed.

DRAFT

Table 1.0.4 Comparison of alternatives for Action 4 regarding management measures

Action	Alternatives	Biological Effects	Socioeconomic/Administrative Effects
4(a) Species-specific parrotfish prohibitions	**Alternative 1**: No action. Do not establish species-specific prohibitions on parrotfish harvest	(-) Continued harvest and potentially overharvest of critical coral reef ecosystem engineers.	No socioeconomic impacts beyond the baseline. No additional direct or indirect administrative burdens are anticipated.
	Alternative 2: (***Preferred***) Prohibit fishing for or possessing in the EEZ: A. Midnight parrotfish B. Blue parrotfish C. Rainbow parrotfish	(+) Potentially substantially physical, biological, and ecological benefits to coral reef ecosystem resulting from increased abundance of species that provide essential ecosystem services.	Anticipate few if any socioeconomic impacts because few recreational fishers report catching parrotfish from the U.S. Caribbean EEZ. Any adverse impacts that are realized would be expected to affect STX fishers more than PR or STT/STJ fishers because the STX fishers rely more on parrotfish catch. (-) Increased direct and indirect administrative burdens due to increased law enforcement obligations and pursuit of violators.
4(b) Recreational bag limits	**Alternative 1**: No action. Do not establish bag limit restrictions on recreational reef fish harvest	No change to the present situation regarding physical, biological, or ecological impacts to coral reef ecosystems from unlimited recreational harvest of snapper, grouper, and parrotfish in the U.S. Caribbean EEZ.	No socioeconomic impact beyond the baseline is anticipated. No additional administrative burden is anticipated.
	Alternative 2: Specify a 10-fish aggregate bag limit per person (would not apply to a fisherman who has a valid commercial fishing license issued by PR or the USVI) for: A. Species in the Snapper FMU B. Species in the Grouper FMU C. Species in the Parrotfish FMU	(+) Increased benefit to the physical, biological, and ecological environment of the coral reef ecosystem via capping of daily recreational harvest of ecosystem component species, thereby increasing the relative short-term abundance of targeted species. Of alternatives 2-4, this is the minimally beneficial alternative.	(+) Least socioeconomic impact of alternatives 2-4 due to least restrictive bag limit. Largest socioeconomic impact would fall on STT/STJ fishers because those islands have the largest fishable habitat in the EEZ of all islands in the U.S. Caribbean. (-) Increased administrative burden to codify bag limits and to enforce regulations, but little difference in administrative burden among bag limit options.

DRAFT

Table 1.0.4 (continued). Comparison of alternatives for Action 4 regarding management measures.

Action	Alternatives	Biological Effects	Socioeconomic/Administrative Effects
	Alternative 3: Specify a 5-fish aggregate bag limit per person (would not apply to a fisherman who has a valid commercial fishing license issued by PR or the USVI) for: A. Species in the Snapper FMU B. Species in the Grouper FMU C. Species in the Parrotfish FMU	(+) Increased benefit to the physical, biological, and ecological environment of the coral reef ecosystem via capping of daily recreational harvest of ecosystem component species, thereby increasing the relative short-term abundance of targeted species. Of alternatives 2-4, this alternative provides intermediate benefits.	Intermediate socioeconomic impact relative to alternatives 2 and 4 due to intermediate bag limit. Largest socioeconomic impact would fall on STT/STJ fishers because those islands have the largest fishable habitat in the EEZ of all islands in the U.S. Caribbean. (-) Increased administrative burden to codify bag limits and to enforce regulations, but little difference in administrative burden among bag limit options.
	Alternative 4: Specify a 2-fish aggregate bag limit per person (would not apply to a fisherman who has a valid commercial fishing license issued by PR or the USVI) for: A. Species in the Snapper FMU B. Species in the Grouper FMU C. Species in the Parrotfish FMU	(+) Increased benefit to the physical, biological, and ecological environment of the coral reef ecosystem via capping of daily recreational harvest of ecosystem component species, thereby increasing the relative short-term abundance of targeted species. Of alternatives 2-4, this is the most beneficial alternative.	(-) Greatest socioeconomic impact of alternatives 2-4 due to most restrictive bag limit. Largest socioeconomic impact would fall on STT/STJ fishers because those islands have the largest fishable habitat in the EEZ of all islands in the U.S. Caribbean. (-) Increased administrative burden to codify bag limits and to enforce regulations, but little difference in administrative burden among bag limit options.
	Alternative 5: Establish a 0-fish aggregate bag limit per person (would not apply to a fisherman who has a valid commercial fishing license issued by PR or the USVI) for species in the Parrotfish FMU	(+) Increased benefits to the physical, biological, and ecological environment of the reef fish ecosystem by reducing harvest of ecosystem component species essential to proper reef function	(-) Larger negative socioeconomic impact on charter vessels than other recreational fishers. (-) Increased administrative burden to codify and enforce regulations and to manage violators.

DRAFT

Table 1.0.4 (continued). Comparison of alternatives for Action 4 regarding management measures.

Action	Alternatives	Biological Effects	Socioeconomic/Administrative Effects
	Alternative 6: Establish a vessel limit (would not apply to a fisherman who has a valid commercial fishing license issued by PR or the USVI) equivalent to the combined bag limit of: A. Two fishers B. Three fishers C. Four fishers	(+) Provides an upper limit to reef fish harvest, thereby ensuring maximum physical, biological, and ecological contributions to reef and reef community health and stability.	
	Alternative 7: (***Preferred***) Establish an aggregate bag limit for snapper, grouper, and parrotfish FMUs of: 10 per fisher including not more than two parrotfish per fisher or six parrotfish per boat, and 30 aggregate snapper, grouper, and parrotfish per boat on a fishing day	(+) Provides physical, biological, and ecological benefits via reduction in recreational take of reef fish community constituents including those which provide essential ecological services.	

DRAFT

Table 1.0.5 Comparison of alternatives for Action 5 regarding accountability measures

Action	Alternatives	Biological Effects	Socioeconomic/Administrative Effects
5(a) Triggering accountability measures	**Alternative 1**: No action. Do not trigger AMs	No direct or indirect physical, biological, or physical impacts, but would not comply with MSA mandates.	No direct or indirect socioeconomic impacts beyond the baseline are anticipated. No administrative impacts anticipated.
	Alternative 2: Trigger AMs if the annual catch limit is exceeded based upon: A. A single year of landings beginning with landings from 2010 B. A single year of landings beginning with landings from 2010, then a 2-year running average of landings in 2011 (average of 2010+2011), and thereafter (i.e., 2010, 2010-2011, 2011-2012, etc.) C. A single year of landings beginning with landings from 2010, a 2-year average of landings in 2011 (average of 2010+2011), then a 3-year running average of landings in 2012 (average o f2010+2011+2012) and thereafter (i.e., 2010, 2010-2011, 2010-2012, 2011-2013, etc.)	No direct or indirect physical impacts are anticipated. Biological and ecological impacts dependent upon alternative chosen. Alternative 2A is the least precise and may result in unnecessarily triggering AMs, with precision increasing and the likelihood decreasing with each of alternatives B and C.	Without regulations that implement AMs, Alternative 2 would not changed existing fishing practices and would have no socioeconomic impacts beyond the baseline. A minor administrative burden is anticipated reflecting increased effort by the SEFSC to tally landings numbers and to provide them to the Council.
	Alternative 3: (***Preferred***) Trigger AMs if the annual catch limit is exceeded as defined below and NMFS' SEFSC (in consultation with the Caribbean Fishery Management Council and its Scientific and Statistical Committee) determines that the overage occurred because catches increased versus data collection/monitoring improved: A. A single year of landings effective beginning 2010 B. A single year of landings effective beginning 2010, then a 2-year running average of landings in 2011 and thereafter (i.e., 2010, 2010-2011, 2011-2012, etc.) C. (***Preferred***) A single year of landings effective beginning 2010, a 2-year average of landings effective 2011, then a 3-year running average of landings effective 2012 and thereafter (i.e., 2010, 2010-2011, 2010-2012, 2011-2013, etc.)	No direct or indirect physical impacts are anticipated. Biological and ecological impacts dependent upon alternative chosen. Alternative 3A is the least precise and may result in unnecessarily triggering AMs, with precision increasing and the likelihood decreasing with each of alternatives B and C. (+) Includes consultation with scientists and managers prior to triggering AMs, resulting in more reliable and defensible decisions.	Without regulations that implement AMs, Alternative 3 would not changed existing fishing practices and would have no socioeconomic impacts beyond the baseline. A minor administrative burden is anticipated reflecting increased effort by the SEFSC to tally landings numbers and to provide them to the Council.

DRAFT

Table 1.0.5 (continued). Comparison of alternatives for Action 5 regarding accountability measures.

Action	Alternatives	Biological Effects	Socioeconomic/Administrative Effects
5(b) Applying accountability measures	**Alternative 1**: No Action. Do not apply AMs	No direct or indirect physical, biological, or ecological impacts anticipated, but would not comply with MSA mandates.	No direct or indirect socioeconomic impacts beyond the baseline are anticipated. No additional administrative burden is anticipated.
	Alternative 2: (***Preferred***) If AMs are triggered, then reduce the length of the fishing season for that species or species group the year following the trigger determination by the amount needed to prevent such an overage from occurring again. The needed changes will remain in effect until modified	(+) Reduced fishing season may result in direct increase in individual size and abundance of individuals, but increased regulatory discards also may occur. Indirect impacts via reduced gear interactions and more balanced trophic system also may be realized.	Intermediate socioeconomic impacts relative to alternatives 1 and 3. Likelihood of subsequent overages reduced but no requirement to pay back previous overage. Thus, overall harvest reduction is less than for alternative 3. Moderate impacts to administrative environment emanate from increased burden to alert fishers to closure and to monitor closure, although minimal if any impact on law enforcement is anticipated.
	Alternative 3: If AMs are triggered, then reduce the length of the fishing season for that species or species group the year following the trigger determination by the amount needed to prevent such an overage from occurring again and to pay back the overage. The needed changes will remain in effect until modified	(+) Reduced fishing season may result in direct increase in individual size and abundance of individuals, but increased regulatory discards also may occur. Indirect impacts via reduced gear interactions and more balanced trophic system also may be realized.	(-) Greatest socioeconomic impacts relative to alternatives 1 and 2. Reducing the likelihood of subsequent overages, combined with a requirement to pay back previous overage, maximizes overall harvest reduction and resultant socioeconomic impacts. Moderate impacts to administrative environment emanate from increased burden to alert fishers to closure and to monitor closure, although minimal if any impact on law enforcement is anticipated.

DRAFT

Table 1.1.6 Comparison of alternatives for Action 6 regarding framework measures

Action	Alternatives	Biological Effects	Socioeconomic/Administrative Effects
6(a) Establish framework measures for Reef Fish FMP	**Alternative 1**: No action. Do not amend the framework measures for the Reef Fish FMP	(-) Not allowing regulations to be adjusted through framework would most likely lead to extended delays in implementation of necessary changes. Such a scenario could be biologically or ecologically detrimental since overfishing or other threats would persist and positive opportunities might be lost. No direct or indirect physical impacts are anticipated.	(-) No direct socioeconomic impacts. May result in indirectly lowering long-term net socioeconomic benefits that derive from exploiting the resource. (-) Increased administrative burden because any modifications to regulations would need to be implemented through an FMP amendment.

DRAFT

Table 1.1.6 (continued). Comparison of alternatives for Action 6 regarding framework measures.

Action	Alternatives	Biological Effects	Socioeconomic/Administrative Effects
	Alternative 2: Amend the framework procedures for the Reef Fish FMP to provide a mechanism to expeditiously adjust the following reference points and management measures through framework action: a. Quota Requirements b. Seasonal Closures c. Area Closures d. Fishing Year e. Trip/Bag Limits f. Size Limits g. Gear Restrictions or Prohibitions h. Fishery Management Units (FMUs) i. Total Allowable Catch (TAC) j. Annual Catch Limits (ACLs) k. Accountability Measures (AMs) l. Annual Catch Targets (ACTs) m. Maximum Sustainable Yield (MSY) n. Optimum Yield (OY) o. Minimum Stock Size Threshold (MSST) p. Maximum Fishing Mortality Threshold (MFMT) q. Overfishing Limit (OFL) r. Acceptable Biological Catch (ABC) control rules s. Actions to Minimize the Interaction of Fishing Gear with Endangered Species or Marine Mammals	(+) Positive biological and ecological benefits would accrue because regulations could be made or adjusted as new fishery and stock abundance data become available. Alternative 2 provides the most tangible positive benefits because the framework is more comprehensive and provides the Council with more room to move. No direct or indirect physical impacts are anticipated.	Positive long-term indirect socioeconomic benefits accrue from the availability of framework measures to rapidly and comprehensively respond to changing data and information. The administrative burden would be minimized relative to alternatives 1 and 3 because several steps in the lengthy amendment process would be eliminated.

DRAFT

Table 1.1.6 (continued). Comparison of alternatives for Action 6 regarding framework measures.

Action	Alternatives	Biological Effects	Socioeconomic/Administrative Effects
	Alternative 3: Amend the framework procedures for the Reef Fish FMP to provide the Council with a mechanism to expeditiously adjust a subset of management measures outlined in Alternative 2	(+) Positive biological and ecological benefits would accrue because regulations could be made or adjusted as new fishery and stock abundance data become available. Alternative 3 provides fewer positive benefits because the framework is less comprehensive and provides the Council with fewer options than does Alternative 2. No direct or indirect physical impacts are anticipated.	Positive long-term indirect socioeconomic benefits accrue from the availability of framework measures to rapidly and comprehensively respond to changing data and information. The administrative burden would be intermediate relative to alternatives 1 and 2 because several steps in the lengthy amendment process would be eliminated, but some options included in Alternative 2 are not included here.
6(b) Establish Framework Measures for Queen Conch FMP	**Alternative 1**: No action. Do not amend the framework measures for the Queen Conch FMP	(-) Not allowing regulations to be adjusted through framework would most likely lead to extended delays in implementation of necessary changes. Such a scenario could be biologically or ecologically detrimental since overfishing or other threats would persist and positive opportunities might be lost. No direct or indirect physical impacts are anticipated.	(-) No direct socioeconomic impacts. May result in indirectly lowering long-term net socioeconomic benefits that derive from exploiting the resource. (-) Increased administrative burden because any modifications to regulations would need to be implemented through an FMP amendment.

DRAFT

Table 1.1.6 (continued). Comparison of alternatives for Action 6 regarding framework measures.

Action	Alternatives	Biological Effects	Socioeconomic/Administrative Effects
	Alternative 2: Amend the framework procedures for the Queen Conch FMP to provide a mechanism to expeditiously adjust the following reference points and management measures through framework action: a. Quota Requirements b. Seasonal Closures c. Area Closures d. Fishing Year e. Trip/Bag Limits f. Size Limits g. Gear Restrictions or Prohibitions h. Total Allowable Catch (TAC) i. Annual Catch Limits (ACLs) j. Accountability Measures (AMs) k. Annual Catch Targets (ACTs) l. Maximum Sustainable Yield (MSY) m. Optimum Yield (OY) n. Minimum Stock Size Threshold (MSST) o. Maximum Fishing Mortality Threshold (MFMT) p. Overfishing Limit (OFL) q. Acceptable Biological Catch (ABC) control rules r. Actions to Minimize the Interaction of Fishing Gear with Endangered Species or Marine Mammals	(+) Positive biological and ecological benefits would accrue because regulations could be made or adjusted as new fishery and stock abundance data become available. Alternative 2 provides the most tangible positive benefits because the framework is more comprehensive and provides the Council with more room to move. No direct or indirect physical impacts are anticipated.	Positive long-term indirect socioeconomic benefits accrue from the availability of framework measures to rapidly and comprehensively respond to changing data and information. The administrative burden would be minimized relative to alternatives 1 and 3 because several steps in the lengthy amendment process would be eliminated.

DRAFT

Table 1.1.6 (continued). Comparison of alternatives for Action 6 regarding framework measures.

Action	Alternatives	Biological Effects	Socioeconomic/Administrative Effects
	Alternative 3: Amend the framework procedures for the Queen Conch FMP to provide the Council with a mechanism to expeditiously adjust a subset of management measures outlined in Alternative 2	(+) Positive biological and ecological benefits would accrue because regulations could be made or adjusted as new fishery and stock abundance data become available. Alternative 3 provides fewer positive benefits because the framework is less comprehensive and provides the Council with fewer options than does Alternative 2. No direct or indirect physical impacts are anticipated.	Positive long-term indirect socioeconomic benefits accrue from the availability of framework measures to rapidly and comprehensively respond to changing data and information. The administrative burden would be intermediate relative to alternatives 1 and 2 because several steps in the lengthy amendment process would be eliminated, but some options included in Alternative 2 are not included here.

DRAFT

2.0 PURPOSE AND NEED

2.1 Purpose Statement

The purpose of this amendment is to revise management reference points and status determination criteria for Caribbean queen conch, snapper, grouper, and parrotfish; specify annual catch limits and accountability measures to prevent overfishing of these species/species groups; establish framework measures to facilitate regulatory modifications; adjust management measures as needed to constrain harvest to specified annual catch limits; and minimize, to the extent practicable, negative socioeconomic impacts that may result from the amendment actions.

2.2 Need for Action

The 2006 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSA) require that each federal fishery management plan (FMP) specify annual catch limits (ACLs) and accountability measures (AMs) for managed fisheries. These amendments require such measures be implemented in 2010 for fisheries determined by the Secretary of Commerce to be subject to overfishing and in 2011 for all other fisheries. These determinations are documented in the National Marine Fisheries Service's (NMFS) quarterly reports to Congress on the status of U.S. fisheries. The most recent of these reports (fourth quarter 2009) is accessible online at: http://www.nmfs.noaa.gov/sfa/statusoffisheries/2009/fouthquarter/q4_2009_fssi_nonfssi_stocks.pdf.

Caribbean queen conch, parrotfish, and several species/species groups within the Caribbean snapper and grouper families are currently classified as subject to overfishing (Table 2.2.1) and are therefore the focus of this proposed action. The status of these species/species groups has not been assessed since the Caribbean Fishery Management Council (Council) and NMFS took action to address overfishing through

Definition of Terms
(from NOAA Fish Glossary 2006 unless otherwise noted).

Status Determination Criteria (SDC): Objective and measurable criteria used to determine if a stock is being overfished or is in an overfished state according to National Standard Guidelines.

Annual Catch Limit (ACL): The amount of fish allowed to be caught in a year. (http://alaskafisheries.noaa.gov/npfmc/current_issues/ACL/ACL.htm)

Accountability Measure (AM): Management controls to prevent ACLs, including sector-ACLs, from being exceeded, and to correct or mitigate overages of the ACL if they occur (74 FR 3180)

Overfishing: Occurs whenever a stock or stock complex is subjected to a rate or level of fishing mortality that jeopardizes the capacity of a stock or stock complex to produce maximum sustainable yield on a continuing basis.

Maximum Sustainable Yield (MSY): The largest average catch or yield that can continuously be taken from a stock under existing environmental conditions.

Optimum Yield (OY): The harvest level for a species that achieves the greatest overall benefits, including economic, social, and biological considerations.

DRAFT

Table 2.2.1. Composition and current status classifications of managed snapper, grouper, and parrotfish species in the U.S. Caribbean.

Species group (included species)	Overfishing?	Overfished?	Approaching Overfished?	Rebuilding Progress
SNAPPER UNIT 1 (silk, black, vermilion, blackfin)	Yes	No	Yes	N/A
SNAPPER UNIT 2 (queen and wenchman)	Unknown	Unknown	Unknown	N/A
SNAPPER UNIT 3 (gray, lane, dog, mutton, schoolmaster, mahogany)	Unknown	Unknown	Unknown	N/A
SNAPPER UNIT 4 (yellowtail)	Unknown	Unknown	Unknown	N/A
GROUPER UNIT 1 (Nassau)	Yes	Yes	N/A	Year 5 of 25-Year Plan
GROUPER UNIT 2 (goliath)	No	Yes	N/A	Year 5 of 30-Year Plan
GROUPER UNIT 3 (red hind, coney, rock hind, graysby, creole-fish)	Unknown	Unknown	Unknown	N/A
GROUPER UNIT 4 (red, yellowedge, misty, tiger, yellowfin)	Yes	Yes	N/A	Year 5 of 10-Year Plan
PARROTFISH UNIT (blue, midnight, princess, queen, rainbow, redfin, redtail, stoplight, redband, striped)	Yes	No	Yes	N/A

the 2005 Comprehensive Sustainable Fisheries Act (SFA) Amendment (CFMC 2005). The MSA requires that fishery management plans be consistent with ten national standards for conservation and management. Primary among those standards is the requirement to prevent overfishing while achieving, on a continuing basis, the optimum yield (OY) from each fishery for the United States fishing industry (MSA, Section 301(a)(1)). To meet this obligation requires establishment of management reference points and status determination criteria that can be used to determine whether each species or species group is overfished, as well as, harvest estimates that are suitable for the determination of rates of harvest relative to maximum sustainable yield (MSY). The harvest activities of all fishing sectors that comprise the commercial and recreational fisheries must be documented to the extent practicable to assure that the goals of the MSA are met. Finally, it is necessary to define actions that will be implemented if harvest levels are exceeded, including a framework for efficient modification of harvest regulations in response to changing conditions and new information.

Achieving requirements of National Environmental Policy Act (NEPA) Sections 101 and 102(1)

This amendment and associated draft environmental impact statement (DEIS) address the environmental consequences of and alternatives to the proposed action, the relationship between short-term effects and long-term costs or benefits, and the effect on the future e.g., irreversible and irretrievable commitments of resources. It was prepared via an interdisciplinary plan team (IPT). In these regards the amendment/DEIS achieve the requirements of NEPA Sections 101 and 102(1), which frame a set of environmental, economic, and social goals.

3.0 INTRODUCTION

3.1 Background

On January 12, 2007, Congress amended the MSA with passage of the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (MSRA). While maintaining the requirement that "conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry," the MSRA added new requirements to end and prevent overfishing including the use of ACLs and AMs.

Specifically, the MSRA requires that FMPs "establish a mechanism for specifying annual catch limits in the plan (including a multiyear plan), implementing regulations, or annual specifications, at a level such that overfishing does not occur in the fishery, including measures to ensure accountability" (MSRA Section 303(a)(15)). Further, the MSRA requires such measures be implemented by 2010 for fisheries determined by the Secretary to be overfished or subject to overfishing and by 2011 for all other fisheries.

Currently, there are five species or species groups classified as undergoing overfishing in the U.S. Caribbean (Table 2.1.1). These groups are: queen conch (*Strombus gigas*), parrotfish, Grouper Unit (GU) 1 (Nassau grouper), GU4 (tiger, yellowfin, red, misty, and yellowedge grouper), and Snapper Unit (SU) 1 (black, blackfin, silk, and vermilion snapper). These determinations are documented in the NMFS quarterly reports to Congress on the status of U.S. fisheries. The most recent of these reports (fourth quarter 2009) is accessible online at:
http://www.nmfs.noaa.gov/sfa/statusoffisheries/2009/fouthquarter/q4_2009_fssi_nonfssi_stocks.pdf.

In an effort to set ACLs for these species and species groups, the Council, based on advice from its Scientific and Statistical Committee (SSC), convened a Technical Monitoring and Compliance Team (TMCT), whose task was to identify available data in the U.S. Caribbean and to recommend the appropriate data set to a second group, the Annual Catch Limit Working Group (ACLG). The ACLG consisted of federal, state, and local managers, scientists, and constituents. The ACLG was tasked to analyze the available data and make recommendations to the SSC regarding how to best comply with the National Standard (NS) 1 Guidelines (74 FR 3178).

Concurrent with the work of these groups, the Southeast Data, Assessment, and Review (SEDAR) panel convened to evaluate all available data in the U.S. Caribbean in support of ACL development, a summary of which is available at:
http://www.sefsc.noaa.gov/sedar/download/CaribData_Final.pdf?id=DOCUMENT. The SEDAR findings, along with those of the ACLG, were presented to the SSC for development of Overfishing Levels (OFL) and Acceptable Biological Catch (ABC) limits, as required by the NS1 guidelines (74 FR 3178). The SSC developed eight scenarios for evaluation of available data (see Appendix 1). Each species or species group was examined via the scenario process and appropriate scientific advice was provided based

on the outcome of the scenario. For the species and species groups listed above, the SSC concluded that no OFL or ABC could be determined. Instead, the SSC followed the catch level recommendations of the ACLG which were derived from average annual landings in recent years (Note: use of the appropriate "recent years" was based on a case by case basis for each of the species and species groups). These catch level recommendations will be examined in Action 2 of the management alternatives section.

In addition to providing recommendations to meet the requirements of the NS1 guidelines, the ACLG and SEDAR groups recommended modifications to stock complexes within the Council's Fishery Management Units (FMU). These recommendations were developed based on the empirical landings data, biological characteristics of the species involved, and discussion with fishermen. Specific reorganization recommendations are evaluated in Action 1 of the management alternatives section.

3.2 History of Federal Fisheries Management

3.2.1 Fishery Management Plan for the Queen Conch Resources of Puerto Rico and the U.S. Virgin Islands

The United States Virgin Islands (USVI) have the longest history of queen conch regulations in the US Caribbean. The following paragraphs describe the chronology of these regulations in the territorial waters of the USVI, in federal waters, and in the state waters of Puerto Rico.

Queen conch, *Strombus gigas*, has been regulated in the territorial waters of the USVI since 1987, when a prohibition on fishing and possession of conch was implemented in St. Thomas/St. John, but not in St. Croix, from February 15, 1988, to December 31, 1992 (Title 12 V.I.C. §304). The recommendation to establish the closure was done by the St. Thomas/St. John Fisherman's Committee of Overseers because of overfishing and was implemented by the Governor (A.A. Farrelly) as an emergency regulatory action.

In St. Croix, a seasonal closure was implemented in 1988 from August to September and every year thereafter from 1 July to 30 September each consecutive year (Title 12, V.I.R.& R., §304 signed by the Governor on 6 July 1988). Additionally, a size limit of 9 inches (22.9 cm) was implemented and the meats of legally landed conch had to weigh at least three to the pound if cleaned or two to the pound if uncleaned. But, conch had to be landed intact. In 1988, personal use fishers had a limit of six conchs per fisher per day.

The USVI government closed the fishery in the territorial waters of St. Thomas/St. John between 1992 and 1995.

Revisions to USVI conch harvest regulations, implemented in 1994, included the seasonal closure (July 1 to September 30 of each consecutive year), a 9" length limit or 3/8" (0.95 cm) lip thickness, a requirement that conch be landed intact, a prohibition on throwing the empty shell back in the water, and a bag limit for personal use of 6 conch per day not to exceed 24 per boat. Also in 1994, the commercial bag limit was established at 150 conch per day. The size and seasonal closure regulations apply to all commercial and

recreational fishers in the USVI. These regulations were implemented under Title 12 VIIR, Chapter 9A, §301- 310 dates July 12 1994. [In regulations dated April 26 1994, the USVI government had established a daily limit of 75 conchs for commercial fishers, along with the regulations mentioned above, which subsequently was amended to 150 conchs in July 12 1994.]

On August 24, 2001, the USVI Department of Planning and Natural Resources (VIDPNR) implemented a moratorium on issuance of new commercial fishing permits. The permit moratorium remains in effect. Commercial fishing licenses and vessel registrations have been required in the USVI since 1972 (Act No. 3330). The regulations of the USVI are provided to the public in Fishers Booklets that have been published since at least 1986. The distribution of these booklets has been done through the VIDPNR at the time of registering for a commercial fishing license.

On July 30, 2007, the USVI government announced that the seasonal closure, which normally runs from July 1st through September 30th, would be extended until January 1, 2008. Additionally, it was announced that once the fishing season began there would be a 50,000 pound quota throughout the territory. These regulations were again revised and approved on June 3, 2008. The size limits for conch (9" or 3/8" lip thickness), the prohibition on the sale of undersized conchs, the limit on personal use (6 per day per fisher not to exceed 24 per boat per day), landing conch intact, no possession of meats less than 2 per pound (un-cleaned) or 3 per pound (cleaned) remained in place. The seasonal closure was changed to include the months of June 1st through October 31st or as soon as the annual landings reached the limit of 50,000 pounds per district. The commercial harvest quota was also limited to 200 conchs per day per registered commercial fishing vessel. A requirement for fishers to submit catch reports by the 15th of the following month was implemented with the regulations.

The open season began on November 1, 2008, and on April 6, 2009, the Commissioner of the VIDPNR announced that the quota had been reached in St. Croix and the conch fishery was to be closed on April 30, 2009. On April 21, 2009, the Commissioner of the VIDPNR requested from the CFMC an emergency closure of federal waters (See Amendment to the Queen Conch FMP and the following section on Federal Management). The season re-opened on November 1, 2009.

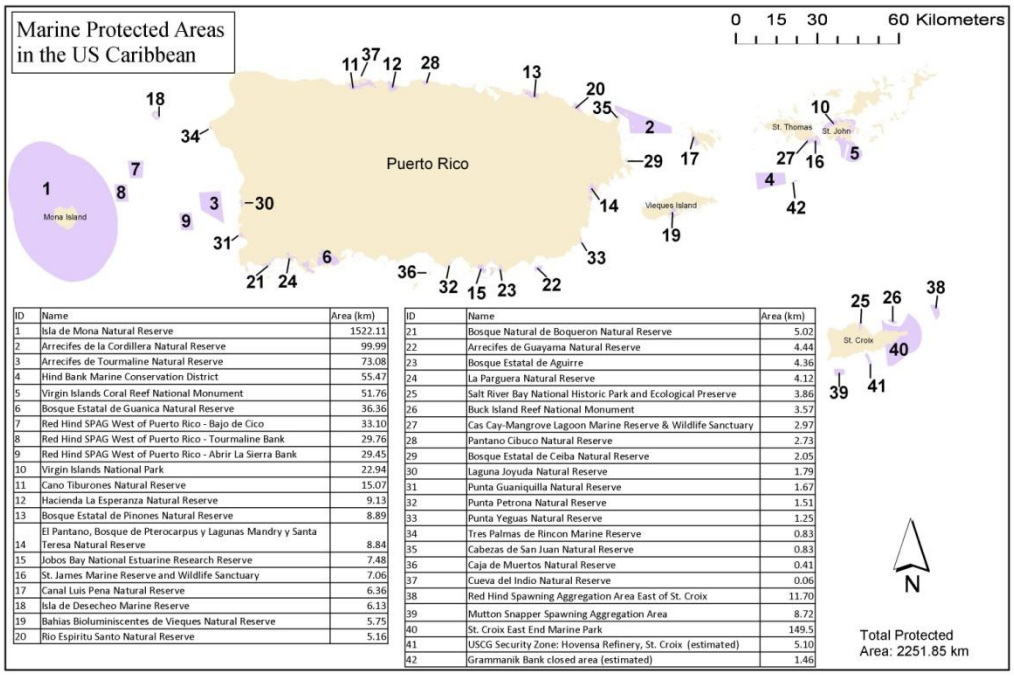
In June 1996, after the USVI revised the territorial regulations for queen conch, the Council proposed a management plan for queen conch to curb overfishing by reducing the mortality on spawning adults and preventing the harvest of immature individuals. That plan accomplished the following: (1) imposed a 9-inch overall minimum size limit or 3/8-inch shell-lip thickness limitation on the possession of queen conch; (2) required that all species in the management unit be landed in the shell and prohibited the sale of undersized queen conch and queen conch shells; (3) established a bag limit of 3 queen conch per day for recreational fishers, not to exceed 12 per boat, and 150 queen conch per day for licensed commercial fishers; (4) closed the harvest season from July 1 through September 30 of each year coincident with the peak spawning period; and, (5) prohibited harvest of queen conch by HOOKAH (breathable air provided by a surface supply apparatus rather

than by tanks mounted to the body) gear in the exclusive economic zone (EEZ) to protect deep-water spawning stocks.

The government of Puerto Rico implemented a seasonal closure in state waters in 1997 to protect the spawning population concurrent with the USVI and the federal regulations (July-September of each year). The bag limits for commercial and recreational conch fishers were also established in state waters but the conch did not have to be brought to shore intact. The bag limits of 150 conch per licensed commercial fisher per day, and three conch per fisher per day to a maximum of 12 conch per boat, were also established in 1997 for the commercial and the recreational sectors, respectively. In 2004, the government established a maximum harvest limit of 450 conch per commercial fishing vessel per day. Commercial fishing licenses have been required in Puerto Rico since 1936, and this regulation was upheld in 1998. Permits for conch were not required until 2004. Although recreational fishing licenses and permits have been required since 1997 (upheld in 1998 and 2004), these requirements have not been implemented.

Additional management measures, implemented for the reef fish fishery, also affected queen conch harvest. Seasonal closures for all fishing on the Tourmaline Bank off the west coast of Puerto Rico (closed from December 1 through the last day of February each year; CFMC 1993), the marine conservation districts (MCD) off St. Thomas (closed between December and February each year since 1990 (CFMC 1990), closed year-round since 1999; Coral FMP Amendment 1 (CMFC 1999)), Lang Bank off St. Croix (closed from December 1 through the last day of February each year; Reef Fish FMP Amendment 2, CFMC 1993) and the mutton snapper area off St. Croix (closed April 1- June 30 each year; Reef Fish FMP Amendment 2, CFMC 1993) resulted in the prohibition of harvest of queen conch in those areas (Figure 3.2.1).

DRAFT



ID	Name	Area (km)
1	Isla de Mona Natural Reserve	1522.11
2	Arrecifes de la Cordillera Natural Reserve	99.99
3	Arrecifes de Tourmaline Natural Reserve	73.08
4	Hind Bank Marine Conservation District	55.47
5	Virgin Islands Coral Reef National Monument	51.76
6	Bosque Estatal de Guanica Natural Reserve	36.36
7	Red Hind SPAG West of Puerto Rico - Bajo de Cico	33.10
8	Red Hind SPAG West of Puerto Rico - Tourmaline Bank	29.76
9	Red Hind SPAG West of Puerto Rico - Abrir La Sierra Bank	29.45
10	Virgin Islands National Park	22.94
11	Cano Tiburones Natural Reserve	15.07
12	Hacienda La Esperanza Natural Reserve	9.13
13	Bosque Estatal de Pinones Natural Reserve	8.89
14	El Pantano, Bosque de Pterocarpus y Lagunas Mandry y Santa Teresa Natural Reserve	8.84
15	Jobos Bay National Estuarine Research Reserve	7.48
16	St. James Marine Reserve and Wildlife Sanctuary	7.06
17	Canal Luis Pena Natural Reserve	6.36
18	Isla de Desecheo Marine Reserve	6.13
19	Bahias Bioluminiscentes de Vieques Natural Reserve	5.75
20	Rio Espiritu Santo Natural Reserve	5.16

ID	Name	Area (km)
21	Bosque Natural de Boqueron Natural Reserve	5.02
22	Arrecifes de Guayama Natural Reserve	4.44
23	Bosque Estatal de Aguirre	4.36
24	La Parguera Natural Reserve	4.12
25	Salt River Bay National Historic Park and Ecological Preserve	3.86
26	Buck Island Reef National Monument	3.57
27	Cas Cay-Mangrove Lagoon Marine Reserve & Wildlife Sanctuary	2.97
28	Pantano Cibuco Natural Reserve	2.73
29	Bosque Estatal de Ceiba Natural Reserve	2.05
30	Laguna Joyuda Natural Reserve	1.79
31	Punta Guaniquilla Natural Reserve	1.67
32	Punta Petrona Natural Reserve	1.51
33	Punta Yeguas Natural Reserve	1.25
34	Tres Palmas de Rincon Marine Reserve	0.83
35	Cabezas de San Juan Natural Reserve	0.83
36	Caja de Muertos Natural Reserve	0.41
37	Cueva del Indio Natural Reserve	0.06
38	Red Hind Spawning Aggregation Area East of St. Croix	11.70
39	Mutton Snapper Spawning Aggregation Area	8.72
40	St. Croix East End Marine Park	149.5
41	USCG Security Zone: Hovensa Refinery, St. Croix (estimated)	5.10
42	Grammanik Bank closed area (estimated)	1.46

Figure 3.2.1. Territorial, state, federal (USFWS, USCG) and EEZ Marine Protected Areas in the U.S. Caribbean.

Further protection was afforded queen conch beginning in 1996 with the establishment of additional seasonal closures for all fishing at Bajo de Sico and Abrir La Sierra (both closed from December 1 through the last day of February each year) off the west coast of Puerto Rico (CFMC 1996). Compatible regulations were implemented for the Bajo de Sico and Tourmaline Bank areas that were contiguous between federal and local jurisdictions.

There are other protected areas in the U.S. Caribbean or areas where fishing is restricted or prohibited (e.g., United States Coast Guard (USCG) Security Zones, DOI Monuments) that provide additional protection to the queen conch resources in the region.

In 2005, the Comprehensive SFA Amendment provided a rebuilding plan for queen conch as Amendment 1 to the Queen Conch FMP. To implement the rebuilding plan, the Council prohibited commercial and recreational harvest and possession of queen conch in federal waters of the U.S. Caribbean, with the exception of Lang Bank near St. Croix. More specifically, the amendment:

- Established a new Fishery Management Unit for the queen conch;

- Prohibits the harvest and possession of queen conch from the EEZ, west of 64°34'W, East of this coordinate, fishing and possession are prohibited between July and September;
- Where fishing is allowed in the EEZ, conch must be maintained intact and all other regulations of bag limits, gear restrictions, and minimum size apply;
- Prohibits all fishing on Grammanik Bank, south of St. Thomas, from February 1 through April 30 of each year, and;
- Specified an MSY proxy, OY, MSST, and MFMT for the FMUs.

The Council is currently developing another regulatory amendment to the Queen Conch FMP to establish a quota and seasonal closures that are compatible with the USVI. Under current regulations, fishing for and possession of queen conch is prohibited in the Caribbean EEZ, with the exception of an area known as Lang Bank east of St. Croix, which is open to harvest of queen conch from October 1 through June 30. The purpose of the proposed regulatory amendment is to implement federal regulations compatible with the USVI territorial regulations to extend the closed season from June 1 through October 31 and to close the queen conch fishery in federal waters once the local government has determined that the quota in St. Croix has been reached.

3.2.2 Fishery Management Plan for the Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands

The Council's Reef Fish FMP (CFMC 1985; 50 FR 34850) was implemented in September 1985. The FMP, which was supported by an environmental impact statement (EIS), defined the reef fish fishery management unit to include shallow water species only, defined various fishing parameters, described objectives for the shallow water reef fish fishery, and established management measures to achieve those objectives.

Amendment 1 to the Reef fish FMP (CFMC 1990; 55 FR 46214) was implemented in December 1990. That amendment was supported by an environmental assessment (EA) with a finding of no significant impact (FONSI). Primary management measures included an increase in mesh size, a prohibition on harvest of Nassau grouper, and establishment of a seasonal closure near St. Thomas, USVI. Amendment 1 also defined overfished and overfishing for shallow water reef fish.

A regulatory amendment to the Reef Fish FMP (CFMC 1991; 56 FR 48755) was implemented October 1991. The primary management measures contained in this amendment, which was supported by an EA with a FONSI, included a modification to the mesh size increase implemented through Amendment 1 and a change in the specifications for degradable panels for fish traps.

Amendment 2 to the Reef Fish FMP (CFMC 1993; 58 FR 53145), implemented in November 1993, was supported by a supplemental EIS (SEIS). That amendment redefined the reef fish fishery management unit to include the major species of deep water reef fish and marine aquarium finfish. Primary management measures implemented through this amendment included gear restrictions, prohibition of harvesting goliath

grouper and other aquarium trade species, and creation of various seasonally closed areas. Amendment 2 also applied existing definitions of MSY and OY to all reef fish within the revised FMU, with the exception of marine aquarium finfish. The MSY and OY of marine aquarium finfish remained undefined.

A technical amendment to the Reef Fish FMP (59 FR 11560), implemented in April 1994, clarified the minimum mesh size allowed for fish traps.

An additional regulatory amendment to the Reef Fish FMP (CFMC 1996; 61 FR 64485) was implemented in January 1997. That action, supported by an EA, reduced the size of the Tourmaline Bank closed area that was originally implemented in 1993, and prohibited fishing in two areas off the west coast of Puerto Rico (Abrir La Sierra Bank and Bajo de Sico).

Amendment 3 to the Reef Fish FMP was implemented in 2005 with the approval of the Comprehensive SFA Amendment, in which the Council redefined the fishery management units and defined rebuilding plans for overfished species (CFMC 2005). Primary management measures implemented through this amendment are as follows:

- Established new Fishery Management Units (FMU) for reef fish;
- Required that fish traps have an 8 inch by 8 inch panel (with mesh not smaller than the mesh of the trap) on one side of the trap (excluding top, bottom and the side of the door) attached with untreated jute twine (diameter less than 1/8 inch);
- Required that individual traps or pots have at least one buoy attached that floats on the surface;
- Required that traps or pots tied together in a trap line have at least one buoy that floats at the surface at each end of the trap line;
- Prohibited the use of gillnets and trammel nets in the EEZ;
- Established a seasonal area closure in the area known as Grammanik Bank south of St. Thomas;
- Prohibited the use of bottom tending gear (traps, pots, gillnets, trammel nets, bottom longlines) in the seasonally closed areas including Grammanik Bank;
- Required an anchor retrieval system for anyone fishing or possessing Caribbean reef fish species;
- Prohibited the filleting of fish at sea;
- Established seasonal closures (no fishing or possession), every year during the specified months, for SU1 (silk, black, blackfin and vermillion snapper) from October 1 through December 31, GU4 (tiger, yellowfin, yellowedge, red and black) from February 1 through April 30, red hind from December 1 through the last day of February, and lane and mutton snapper from April 1 through June 30, and;
- Established MSY, OY, MSST, and MFMT for the FMUs.

The Council is currently developing another regulatory amendment to the Reef Fish FMP to extend the seasonal closure of Bajo de Sico. Bajo de Sico has been identified as an important spawning site, especially for red hind and possibly other resident grouper

including Nassau and yellowfin, as well as an important foraging site for these and other Caribbean reef fish. The Bajo de Sico closed area has been described as a well developed and diverse coral and sponge habitat that provides essential fish habitat (EFH) for Caribbean reef fish. The purpose of the regulatory amendment is to protect red hind spawning aggregations and large snapper and grouper from directed fishing mortality.

Compatible reef fish regulations exist in the U.S. Caribbean for Nassau and goliath grouper; fishing and possession of these species has been prohibited from the shore to the EEZ since 2004 for goliath grouper and since 2006 for Nassau grouper.

Seasonal closures established in the EEZ since 2005 have been also established for some of the same species groups in the territorial and state waters. Fishing for and possession of Grouper Unit 4 (see Appendix 2) is prohibited in the territorial waters of the USVI and in the EEZ from February 1 to April each year; Snapper Unit 3 from April to June in the EEZ and the USVI but only from April to May in Puerto Rico; Grouper Unit 3 from December to February in the EEZ and Puerto Rico but not in the USVI; Snapper Unit 1 from October to December in the EEZ and St. Thomas/St. John, but not in St. Croix and only 2 species within this group (silk and blackfin) are regulated during these months in Puerto Rico.

Size regulations for yellowtail snapper have been implemented in the EEZ and Puerto Rico but not in the USVI.

Gear restrictions (e.g., mesh size in traps) also provide additional protection to the reef fish resources in the U.S. Caribbean. The mesh size for traps in the U.S. Caribbean is 2" (5.1 cm) rectangular and 1.5" (3.8 cm) hexagonal mesh; the same requirements apply for escape panels, and tying materials have been specified across the jurisdictions. Trammel and gillnets are prohibited in the EEZ and in the USVI; Puerto Rico has regulated the mesh size and length of the nets.

3.2.3 Generic FMP Amendments

The Council submitted the Generic Essential Fish Habitat Amendment to the Spiny Lobster, Queen Conch, Reef Fish, and Coral Fishery Management Plans (Generic EFH Amendment with an EA) to NMFS in 1998 to comply with the EFH provisions of the Magnuson-Stevens Act (CFMC 1998). NMFS partially disapproved that amendment on March 29, 1999, finding that it did not evaluate all managed species or all fishing gears with the potential to damage fish habitat (64 FR 14884). The document was subsequently challenged by a coalition of environmental groups and fishing associations on the grounds that it did not comply with the requirements of the Magnuson-Stevens Act and NEPA (American Oceans Campaign et al. v. Daley et al., Civ. No. 99-982 [D.D.C.]). The federal court opinion upheld the plaintiffs' claim that the Generic EFH Amendment with an EA was in violation of NEPA, but determined that the amendment was in accordance with the Magnuson-Stevens Act. The Council completed the final EIS (FEIS) for the Generic EFH Amendment to comply with the September 14, 2000 court order (CFMC 2004). The notice of availability of the draft EFH EIS was published in the Federal Register on August 1, 2003 (68 FR 45237). The comment period on that document ended on October

30, 2003. The notice of availability for the Record of Decision on the EFH FEIS was published in the Federal Register on May 25, 2004 (69 FR 29693). The Generic EFH Amendment was implemented by the Comprehensive SFA Amendment of 2005.

Additional information regarding the management history of the Reef Fish and Queen Conch FMPs can be found in Section 2.2 of the Comprehensive SFA Amendment.

3.3 Overview of Data History

The commercial and recreational fishery data available for conducting assessments in the US Caribbean is limited. The available data, previous U.S. Caribbean assessments, and descriptions of some of the limitations have been thoroughly described in various reports including:
Comprehensive SFA Amendment (CFMC 2005) available at:
http://www.caribbeanfmc.com;
SEDAR (2009) available at:
(http://www.sefsc.noaa.gov/sedar/download/CaribData_Final.pdf?id=DOCUMENT)
SEDAR 04 (2003-2004) available at:
http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=04);
SEDAR 08A (2005) available at:
http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=08%20A);
SEDAR 14 (2007) available at:
http://www.sefsc.noaa.gov/sedar/Sedar_Workshops.jsp?WorkshopNum=14);
reports produced by the Fisheries Research Laboratory of the Puerto Rico Department of Natural and Environmental Resources (PRDNER) and available at:
(http://www.drna.gobierno.pr/oficinas/arn/recursosvivientes/negociado-de-pesca-y-vida-silvestre/laboratorio-de-investigaciones-pesqueras-1/publicaciones);
and, reports by the VIDPNPNR Division of Fish and Wildlife available at:
http://fw.dpnr.gov.vi/fish.index.htm

Among the primary concerns regarding the data are the scarce, missing, or unreliable information on fishing effort, spatial/geographic patterns, and life history parameters. Although some fishery independent data are available, they are spatially and temporally limited and previous assessments have been unable to incorporate a viable time series into the analyses (SEDAR 2009).

3.3.1 Commercial Data History

Commercial fisheries landings data have been collected since 1974 from St. Thomas/St. John, since 1975 from St. Croix, and since 1967 from Puerto Rico (available in electronic format since 1983 for Puerto Rico). However, most of the USVI landings data have not been recorded to species with adequate reliability so species-specific landings information cannot be utilized to document historical trends. Beginning in 1998 (St. Croix) and 2000 (St. Thomas/St. John), finfish landings have been reliably reported to the species group or family level (e.g., snapper, grouper, parrotfish) while queen conch landings have been reliably reported to species. At the time of preparation of this document, complete and verified landings data (to the species group or family level for finfish and to the species

level for conch) were available through 2007 for both the USVI and Puerto Rico. Moreover, at the September 2009 meeting of the Council, a motion was approved to use 1999 as the earliest year for which data would be considered. Thus, year sequences used to calculate average commercial landings estimates for the purpose of setting ACLs include 2000-2007 for St. Thomas/St. John and 1999-2007 for both St. Croix and Puerto Rico.

During the years of record for both St. Croix and St. Thomas/St. John, landings were reported at the level of species group or family. For the purposes of the analyses presented herein, those species complexes include conch, parrotfish, grouper, and snapper. As a result, although various FMUs are extant or are being proposed for management, analyses of USVI landings data cannot be resolved to the level of individual FMU except in the case of conch and parrotfish. Both grouper and snapper are presently divided into several FMUs and modifications to those FMUs are proposed in this document. It is not possible to resolve the landings data from the USVI to a level that allows consideration of those individual FMUs.

Even in Puerto Rico, with its much longer history of landings being reported to individual species, there are complications with those assignments which compromise some analyses and prevent the successful application of others. For example, during 1999-2007 the annual contribution of unclassified (i.e., not reported to species) grouper ranged between 35-53% of the classified landings. These unclassified landings can be redistributed among the individual species based upon proportional representation in the catch, but such redistribution is not straightforward particularly within individual years. Also, due to non-reporting, under-reporting, and misreporting of catch, the reported landings from Puerto Rico reflect actual fishing activity to a variable degree. Puerto Rico DNER staff, working with staff from NOAA's Southeast Fisheries Science Center (SEFSC), has developed adjustment factors to account for the lack of complete reporting. Data collected from Puerto Rico, and used in the present amendment for evaluation of various harvest scenarios, have been adjusted to account for reporting problems (Table 5.3.8) but have not been redistributed to account for unclassified landings. Instead, unclassified landings are accounted for as a separate, unclassified species group within the respective complex.

Additionally, fish that are caught but subsequently released rather than harvested (i.e., bycatch) are not accounted for in the landings data. Reasons for discarding catch include risk of ciguatera (a sickness caused by eating toxin-exposed fish), regulatory restrictions, catch unmarketable, market saturation with a specific species, or (for lobster) individuals in the catch are carrying eggs (Trumble et al. 2006). Discards may represent a substantial proportion of the total catch and may represent an important source of mortality for some species. For example, St. Thomas fishermen discard as much as 20% of their total catch (Figure 2, Trumble et al. 2006). Although some discards survive and 20% in this example represents an upper bound, reported landings represent a lower bound and probably underestimate total catch. No suitable method to account for bycatch mortality is presently available. Appendix 3 provides additional details regarding bycatch.

3.3.2 Recreational Data History

There is no comprehensive landings data-collection program for the recreational sector in the U.S. Caribbean. The only continuous data gathering effort exists in the form of the Marine Recreational Fisheries Statistics Survey (MRFSS) program for Puerto Rico, and only for the years 2000 to 2008. Recreational data for the USVI exist both for the fleet that targets pelagic fish and billfish obtained from recreational fishing tournaments, and in snapshot form for the boat-based reef-based recreational fishery. Neither data set is complete. Furthermore, there are no continuous data being collected on two of the most important fisheries in the area, the queen conch and the spiny lobster. These problems should be rectified to a considerable degree with the implementation of the next-generation Marine Recreational Information Program (MRIP), which is expected to expand both the spatial and species coverage of U.S. Caribbean recreational fishing activities.

3.3.2.1 Puerto Rico

Although recreational and sportfishing activities in Puerto Rico are prominent, data on the recreational catch and effort, species composition of the catch, and biological data on the species targeted and harvested are mostly lacking. The only continuous attempt at gathering these data from the recreational fishing sector dates to 2000, when the MRFSS was implemented in Puerto Rico, and which has continued to collect data to date. Recreational fisheries monitoring through the MRFSS follows the same methodology as on the continental U.S. and is briefly described herein. For information on the MRFSS program (now redefined as MRIP), see:
https://www.countmyfish.noaa.gov/), which can be accessed through:
http://www.st.nmfs.noaa.gov/st1/recreational/overview/overview.html.

In Puerto Rico, the MRFSS program has been conducted through the PRDNER, who generally have provided the intercept and interview personnel although occasionally contracting consultants to carry out the survey. Data are collected on recreational catch and effort targeting reef fish and on coastal and highly migratory pelagic species, but not on invertebrates such as queen conch and spiny lobster (two of the most commercially and recreationally important harvested species). In 2000-2001, the MRFSS program in Puerto Rico included a two-year special survey on conch. This information was used in the development of the 2005 Comprehensive SFA Amendment to the FMPs in the U.S. Caribbean. At the time, with only the availability of two years of data, there was indication that the recreational catch in Puerto Rico was a significant proportion of the total landings, accounting in some instances for more than 50% of the total landings (including SU2 and GU3) in Puerto Rico. The proportional participation was also significant with over 200,000 participants annually.

The MRFSS program collects data, through telephone interviews, on a two-month wave mode, with six waves per year. The information includes shore line, charter, and private boat modes to account for most of the recreational fishing activity. However, the survey does not target SCUBA divers, a potential major activity in the U.S. Caribbean (Garcia-Moliner et al. 2001).

The Coastal Household Telephone Survey (CHTS) collects information from participants at the end of each two-month wave. Households are accessed randomly from numbers obtained from the telephone book. Following a brief screening, the respondents are questioned about fishing effort from shore and from private boats. Anglers are queried regarding fishing trips taken over the last two months and asked to provide information on the details of the trips:
(http://www.st.nmfs.noaa.gov/st1/recreational/documents/MRFSS%20Telephone/SOW_J.1.pdf).
The information requested includes the fishing mode (shore, charter or private boat), the number of trips taken, and the number of people fishing, among other information. The household information is expanded to determine total participation as the number of trips by county and then expanded again for the whole Island. These data are collected for each of the shore and private modes every two months throughout the year.

Expanded estimates of the recreational catch (in numbers) and effort (number of trips and participants) are always accompanied by a calculation of the proportional standard error (PSE). As an example, in 2008 the total number of participants was estimated at 149,544 (with 127,863 resident participants and 21,681 out-of-state participants) with a PSE of 11%. These 149,544 participants in the recreational fishery made a total of 798,551 trips (all included: shore, private and charter) with a PSE of 9% for all modes combined. Landings for 2008 were estimated at 1,910,542 pounds for all finfish species (Table 3.3.1).

The MRFSS includes an at-dock intercept component (Access-Point Angler Intercept Survey), also conducted by PRDNER personnel. The interviews are conducted at fishing access points to identify species landed, individual length-weight, total numbers by species, and effort information. The intercept points are selected following a random stratified design in proportion to the dates, times, and sites of fishing activity. As stated in the MRFSSS overview, funding availability also dictates sampling effort. Intercepts are conducted for each mode separately (private, shore, and charter). Ideally a catch-per-unit-effort (CPUE) estimate could be determined from these interviews. It is the information collected during these interviews that are used for expanding the data to estimate total catch and harvest (Table 5.3.8). This survey in Puerto Rico has met with varying degrees of success due in part to a number of changes in personnel and a lack of adequate personnel to cover areas other than the north coast of the island. This has resulted in very minimal or zero samples, poor species identification, few samples per species for length and weight, and geographical bias of the samples. Attempts have been made to use the catch, effort, and length data in stock assessments for a number of species, including mutton snapper, yellowtail snapper, and yellowfin grouper, and in the determination of ACLs (e.g., SEDAR 2009). Although no complete evaluation of the MRFSS data for Puerto Rico has been conducted to date, both SEDAR (2007) and SEDAR (2009) assessed the MRFSS data and concluded that the data were not sufficient for use in stock assessments.

Among the issues of concern with the recreational data are problems with (1) the accurate identification of species, reflected in the large proportion of landed fish attributed to general (i.e., 'unclassified') categories such as 'groupers' or *Mycteroperca* spp., (2) the minimal number of individuals measured and the minimal information on complete catches, (3) geographic bias of the samples with most coverage on the north coast of Puerto Rico, and (4) minimal validation of the intercept trips (validation is done through follow-up telephone calls on 10% of the interviews). Additionally, there is a need for validating the harvest areas to determine if the catch comes from state waters or from the EEZ. Finally, the primary source of MRFSS information (telephone surveys) reports in numbers of fish harvested and discarded. Weight of the catch is then estimated based on individual weight estimates obtained from the intercept survey.

Table 3.3.1. Recreational landings statistics generated from MRFSS intercept program in Puerto Rico from inception (2000) to the most recent available year.

Year	Mode	Total	Charter	Private	Shore	Participants
2000	Lbs	4,601,741	48,173	4,195,832	357,736	249,868
	Trips	1,332,703	16,899	522,914	792,890	
2001	Lbs	3,301,922	23,281	2,752,165	526,476	222,128
	Trips	1,411,943	10,919	504,349	896,675	
2002	Lbs	2,452,048	22,438	2,236,507	193,103	237,995
	Trips	1,301,059	34,277	572,844	693,938	
2003	Lbs	3,754,963	28,254	3,320,974	405,735	219,910
	Trips	1,111,405	21,764	471,741	617,900	
2004	Lbs	2,145,475	40,435	1,940,892	164,148	163,833
	Trips	1,050,299	22,028	389,469	638,802	
2005	Lbs	1,971,263	41,689	1,835,863	93,711	141,743
	Trips	866,722	17,969	379,910	468,843	
2006	Lbs	955,123	16,823	431,274	507,026	213,005
	Trips	896,582	16,906	386,111	493,565	
2007	Lbs	2,375,687	43,063	2,197,800	134,824	185,429
	Trips	1,080,096	10,734	453,907	615,455	
2008	Lbs	1,910,542	39,974	1,793,360	77,208	149,544
	Trips	798,552	12,623	362,739	423,190	

The MRFSS data do provide a first attempt at accounting for the recreational harvest, which is generally considered to be significant. A summary of all available information for Puerto Rico from the recreational sector, including number of participants, number of trips taken by mode (shore, charter and private boat), and the total catch (all species reported) from 2000 to 2008 is presented in Table 3.3.1. A relatively flat trend in number of fishing trips and pounds landed is present from 2000-2008, except for an as-yet unexplained anomaly in 2006. The percent of trips taken to the shore (53-61%) is always higher than the percent of trips taken in private boats (36-45%), which in turn is always higher than the number of charter trips (1-3%). However, the private boats account for a greater proportion of the landings (45-94% of the total) followed by shore landings (4-

53%) and finally (as expected from much catch and release in the area) by the charters (1-2%). The total catch corresponds to the Type A+B1+B2 (A = fish that are brought back to shore for identification by the interviewer, B1 = filleted or used for bait but identified by angler, B2 = identified but released alive). Between the years 2000 and 2008, the total landings from the recreational sector ranged from 955,123 to 4,601,741 pounds (an average of 2,607,640 pounds per year from all finfish species). The number of participants has also varied annually from a low of 141,743 in 2005 to a maximum of 249,868 in 2000.

The MRFSS program also offers information on the total number of trips by mode and area (≤10 miles being roughly equivalent to state waters and ≥10 miles being roughly equivalent to EEZ waters) from 2000 to 2008 (Figure 3.3.1). Twenty percent of the trips taken to EEZ waters were by recreational fishers in private boats, but most recreational trips occur within state waters. The narrowest PSEs are from the private and shore fishing sectors, ranging from 10 to 16%, while for the charter mode PSEs range from 40 to 91%. The MRFSS sampling was based mostly on the shoreline mode, with limited sampling of private vessels. A specific reporting protocol is being developed for the for-hire sector (G. Rodríguez, PRDNER, pers. comm.).

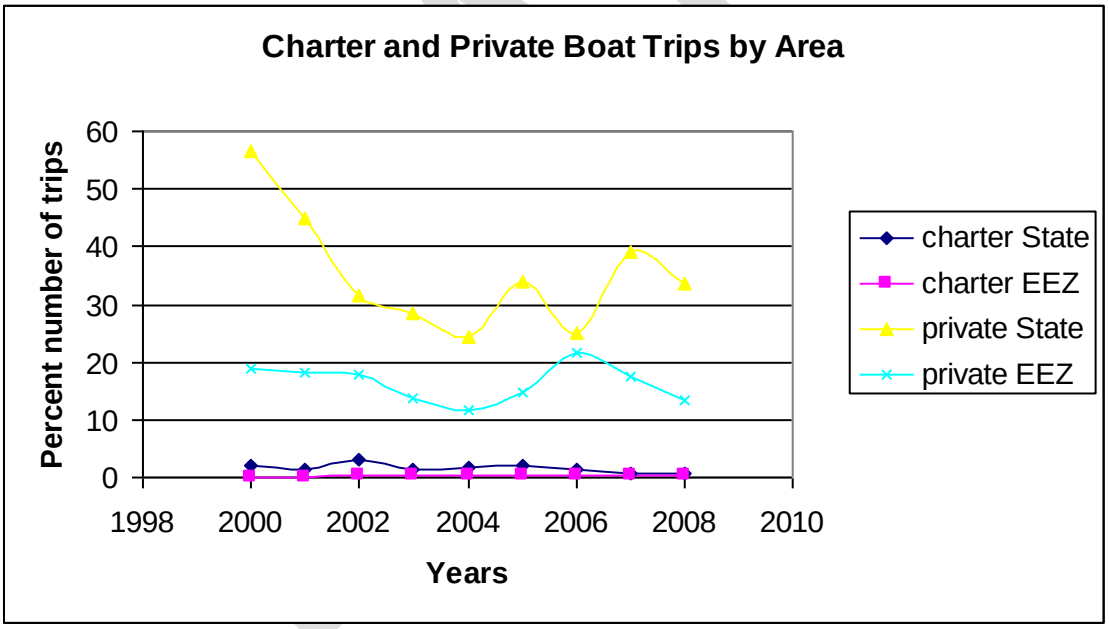


Figure 3.3.1. Charter and private vessel trips occurring within Puerto Rico commonwealth (State) and U.S. Caribbean EEZ waters during 2000-2008.

There is no information on the universe of recreational fishers in the U.S. Caribbean. The National Angler Registry, which began in 2010 as part of the MRIP program, has in its database, as of March 9, 2010, 594 anglers registered as fishing in the EEZ (582 in Puerto Rico and 12 in the USVI) (F. Darby, NMFS/OFS, pers. Comm..). There are no state registries of recreational fishers.

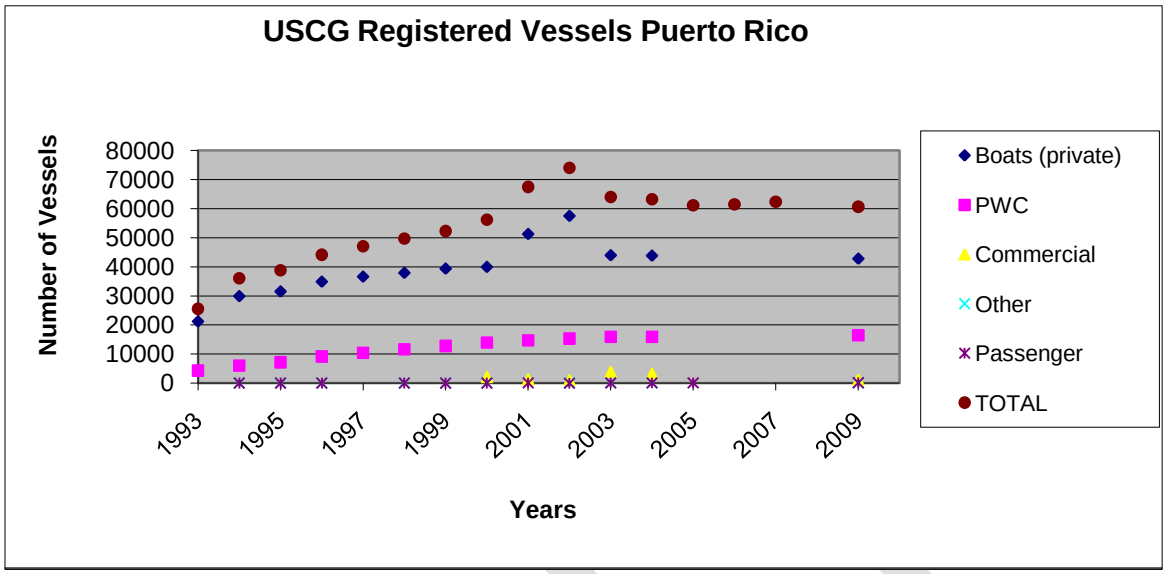


Figure 3.3.2. Recreational and commercial vessel registrations in Puerto Rico as recorded by the United States Coast Guard. PWC = personal watercraft.

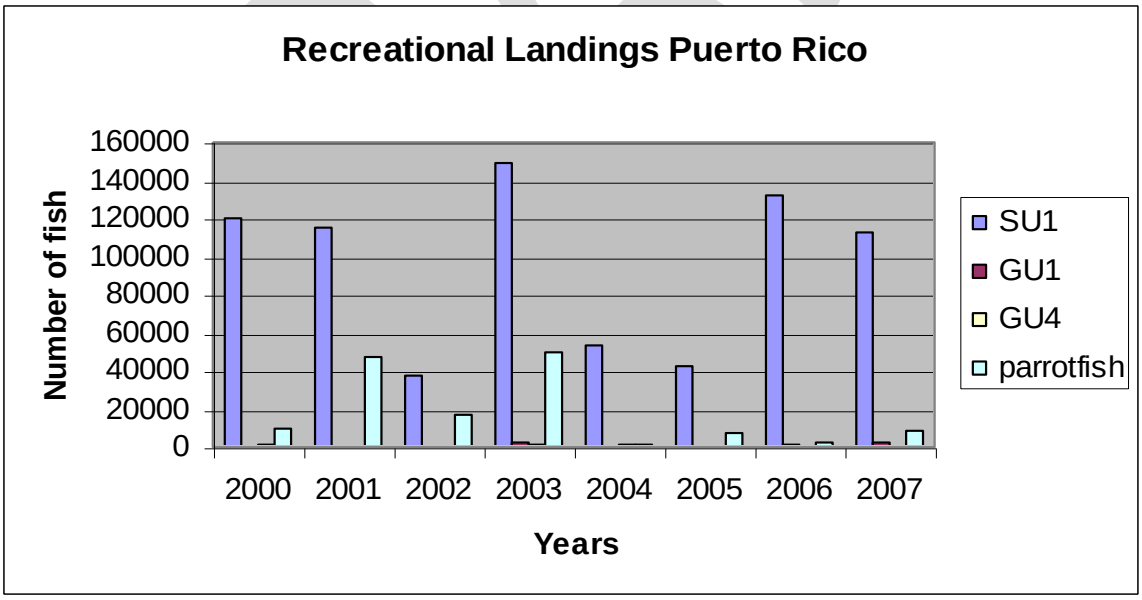


Figure 3.3.3. Estimated number of fish caught each year during 2000-2008 by recreational anglers, reported within each of the SU1, GU1, GU4, and Parrotfish FMUs.

The number of vessels registered with the United States Coast Guard peaked at 60,640 (Figure 3.3.2) including 1,125 boats registered as commercial fishing vessels in Puerto Rico (A. Cruz, PRDNER, pers. comm.). This boat registry can be used as an indicator of the potential number of recreational fishers in Puerto Rico. Furthermore, "saltwater recreational fishing in Puerto Rico is an important industry generating $754.8 million in trip and durable goods expenditures" (B. Gentner and J. Agar, SEFSC, pers. comm.). Regardless of its limitations, MRFSS provides useful information on the potential impact of recreational harvest on the finfish species considered in this amendment (Table 2.2.1).

Species specific data from the recreational harvest is limited but Figure 3.3.3 shows the total number of fish estimated per year since 2000 for SU1, GU1, GU4 and parrotfish. MRFSS data indicates that large numbers of fish are being landed by the recreational sector most significantly within SU1 (silk, blackfin, black and vermillion snapper). However, the total number of fish reported from the intercepts is limited to 172 silk snapper measured between the years 2000 and 2008; and only 52, 36 and 3 vermillion, blackfin and black snapper sampled during the same time period. A total of 43 individual parrotfish were sampled between 2000 and 2008.

3.3.2.2 USVI

The most recent report on recreational fishing activity in USVI waters (Tobias and Dupigny 2009) reviews the information available for the area, including the surveys on the recreational fishing activity in general (reef fish) included in the Comprehensive SFA Amendment to the FMPs (CFMC 2005) and most recently in the Caribbean Fisheries Data Evaluation workshop (SEDAR 2009).

Most of the information on recreational fisheries for the USVI derives from offshore billfish and other pelagic fisheries since the area is well known for gamefish. Tobias and Dupigny (2009) summarize the information on the latest recreational fishing survey targeting the pelagic fleet. None of the reports on the recreational fishing activity in the USVI target the fleet harvesting reef fish, lobster, or conch.

Logbook data identify snapper (yellowtail, mutton, and dog), jacks, and grouper (red hind, coney) as being harvested but accounting for less than 2% of the total fish reported in the logbooks (Tobias and Dupigny 2009).

Telephone surveys targeting boat-based and shore fishers provide an estimate of 10% of the USVI population participating as recreational fishers (Jennings 1992, Mateo 1999). In all cases, pelagic species are the most commonly targeted (Tobias and Dupigny 2009). In St. Thomas/St. John, 7,000 vessels were registered in 20005-2006 and 250 were registered in St. Croix (Tobias and Dupigny 2009), but there is no additional information on the fishing fleet of the USVI targeting reef fish and conch resources.

DRAFT

3.3.2.3 Regulations on licenses and permits

There are no federal licenses or permits issued for the commercial harvest of reef fish and queen conch in the EEZ of the U.S. Caribbean. The Government of Puerto Rico requires commercial fishing licenses for fishing in state waters and an additional permit for harvesting queen conch. In the USVI, a commercial fishing permit is required if fishing with pots, traps, set-nets, or haul seines, and if trading or selling any of the catch. Charter operators, if selling the catch, must have a commercial fishing permit. In the USVI there is a moratorium on new commercial fishing licenses since 2001.

In 2010, all anglers fishing recreationally in the U.S. Caribbean EEZ are required to register through the national registry (https://www.countmyfish.noaa.gov/howtoregister/index.htm) if fishing for species other than highly migratory species (HMS) since there are already permits in place for HMS anglers. There are 582 anglers registered in the National Registry from Puerto Rico (Table 3.3.2). Fishing licenses and permits are a legal mandate for recreational harvesters in Puerto Rico although a licensing program has not yet been implemented. In addition to the license, Puerto Rico recreational fishers must have a permit for catching queen conch. In the USVI there are no licenses or permits required for recreationally fishing in territorial waters. The USVI is currently developing regulations for recreational fishing activity.

Table 3.3.2. Recreational fishing effort estimates for the U.S. Caribbean during 2008-2010

		Puerto Rico	USVI		
Recreational*	1/1 – 3/1/2010 National Registry**	582	12		
HMS Permits	May 2008***		STX	STT	STJ
	Angling Permit	805	26	28	2
	Charter	21	4	10	7
	General Permit	99	13	6	1
MRFSS	Recreational Participants[$]	149,544			
Vessels	Registered Recreational[#]	60,640			

*Forbes Darby (pers. comm. March 9, 2010 from Scott Sauri)
**Only registered if fishing in the EEZ
***Amendment 4 to the Consolidated Atlantic HMS FMP
[$] http://www.st.nmfs.noaa.gov/st1/recreational/queries/effort/effort_time_series.html
[#]A. Cruz, PRDNER

3.3.2.4 Recreational Vessels and Permits

There are 60,640 recreational vessels registered with the United States Coast Guard in Puerto Rico (Table 3.3.2). A downward trend was detected in the number of private power boats registered in 2003. In 2009 all types of recreational vessels showed a decrease in numbers.

Recreational vessels, except for those targeting HMS, are not required to have any additional permits for fishing in the U.S. Caribbean. The HMS open access permits are issued to the vessel while the recreational angler National Registry registers fishermen. The HMS permit applies to both state and federal waters while the registry applies only to fishers fishing in the EEZ. Table 3.3.2 compares the number and types of permits/registry for the recreational sector in the U.S. Caribbean.

DRAFT

4.0 MANAGEMENT ALTERNATIVES

The Council at its 134th Regular Meeting held April 7-8, 2010, in St. Thomas selected the preferred alternatives for most actions in this amendment. These are marked as (**PREFERRED**) for those cases when a preferred alternative was identified. This does not mean that this is the final decision by the Council. Instead, the alternatives including the designated preferred alternatives will be vetted at public hearings and then further discussed at the Council's 135th Regular meeting to be held after public hearings.

4.1 ACTION 1: Amend the Stock Complexes in the Reef Fish Fishery Management Units (FMU)

4.1.1 Action 1(a) Grouper complex

Alternative 1. No action. Do not change the species groupings within the grouper complex.

Alternative 2. **(PREFERRED)** Separate Grouper Unit 4 into Grouper Unit 4 (yellowfin, red, tiger plus black grouper) and Grouper Unit 5 (yellowedge and misty grouper). Move creole-fish from Grouper Unit 3 into the 'data collection only' unit.

Discussion: Action 1(a) proposes several changes to the grouper Fishery Management Units for the U.S. Caribbean, including the removal of creole-fish (*Paranthias furcifer*) from Unit 3, addition of black grouper (*Mycteroperca bonaci*) to Unit 4, and movement of yellowedge grouper (*Epinephelus flavolimbatus*) and misty grouper (*E. mystacinus*) into a Unit of their own (Table 4.1.1).

Alternative 1 is the no action alternative and maintains the present situation. Puerto Rico commercial landings data for both black grouper and creole-fish indicate that they are rarely caught in the commercial fishery. An adjusted average of about 15 pounds of creole-fish and 20 pounds of black grouper were reported to have been landed by commercial fishers between 1983 and 2007. These landings averages are essentially inconsequential and do not justify inclusion of either species in a FMU, although it is unclear whether and to what extent either species is reported in the unclassified category. In contrast to commercial landings, recreational landings of black grouper from Puerto Rico waters are occasionally substantial, with an average of about 500 fish being landed each year during 2000-2007. Creole-fish are absent from the recreational landings during that same period of time. If black grouper are added to the FMU, as proposed by **Preferred Alternative 2**, then it has been recommended that they be added to Grouper Unit 4 based upon similar habitat by depth distribution patterns (SEDAR 2009). Because both misty and yellowedge grouper are found at depths much greater than are the other species in current Grouper Unit 4, it is further proposed in **Preferred Alternative 2** to create a new grouper unit (Grouper Unit 5) that will contain these two species. Public testimony supporting the separation of those grouper into two units has been consistent. The Council selected **Alternative 2** as the preferred alternative since this alternative best represents the landings history and ecology of the affected species. This alternative also

would aid on-going efforts to collect species-specific data by adding a species (black grouper) that is targeted by recreational fishers but has not previously been included as a managed species.

4.1.2 Action 1(b) Snapper complex

Alternative 1. No action. Do not change the species groupings within the snapper complex.

Alternative 2. (PREFERRED) Modify the snapper FMUs by adding cardinal snapper (*Pristipomoides macrophthalmus*) to SU2 and moving wenchman (*Pristipomoides aquilonaris*) into SU1.

Discussion: The wenchman, *Pristipomoides aquilonaris*, is currently included in SU2 along with the queen snapper (*Etelis oculatus*). However, the species commonly captured in the commercial fishery apparently is locally known (particularly in Puerto Rico) as the wenchman although it actually appears to be *Pristipomoides macrophthalmus*. The latter is commonly referred to as the cardinal snapper. The cardinal snapper clusters strongly with queen snapper based upon analyses of landings records and habitat utilization patterns by depth (SEDAR 2009). In contrast, *P. aquilonaris* is most closely associated with those species comprising SU1, again based upon similarities in habitat utilization by depth.

Alternative 1 of Action 1(b) is the no-action alternative. Choosing this alternative would continue a situation in which cardinal snapper are not included in any snapper unit and wenchman are paired with queen snapper in SU2. As noted above, wenchman cluster most closely with members of SU1 based upon patterns of habitat utilization by depth. In the commercial landings records for Puerto Rico dating from 1983 to 2007, no landings of wenchman are specifically recorded although it is unclear whether and to what extent wenchman is reported in the unclassified category. In contrast, cardinal snapper are a common constituent of Puerto Rico commercial landings; cardinal snapper landings have increased considerably in recent years with a peak of 21,482 pounds in 2005. Regardless of any other changes to the snapper FMUs, cardinal snapper (*P. macrophthalmus*) needs to be added to the SU2 in order to account for and properly manage the harvest of this species. The common name in Spanish for both *Pristipomoides* species is "muniama" with the cardinal snapper (*P. macrophthalmus*) referred to as "muniama de afuera" and the wenchman (*P. aquilonaris*) simply referred to as "muniama". The former was never included in the reef fish FMU and thus needs to be added. Wenchman statistically cluster more closely with the members of SU1 than with members of SU2 based upon habitat occupation by depth. For that reason, wenchman could be moved from SU2 to SU1 as proposed by **Preferred Alternative 2**. Also, whereas the cardinal snapper is the only one of these two species that appears in the commercial landings records for Puerto Rico, it is just the opposite for Puerto Rico recreational landings. There, only the wenchman appears and no cardinal snapper landings have been recorded in the 2000-2007 Puerto Rico MRFSS records. Although it may not be entirely clear which species is being harvested by the recreational and commercial fisheries, or if both are being harvested in a manner consistent with the landings information, these species could be included as members of

the managed snapper complex and they could be grouped with those species with which they exhibit the closest ecological alliance. Testimony at the scoping meetings and other Council meetings has been consistent in the proposed changes in **Preferred Alternative 2** to the snapper units. The Council selected **Alternative 2** as the preferred alternative since this alternative best represents the ecologically and managerial most defensible changes to the FMUs. This change also would aid on-going efforts to collect species specific data.

4.1.3 Summary Comparison of Alternatives to Amend the Stock Complexes in the Reef Fish Fishery Management Units (FMU)

For grouper, **Alternative 1** does not account for the contribution of black grouper to harvest, particularly recreational harvest, in Puerto Rico. For snapper, **Alternative 1** does not account for the substantial contribution of cardinal snapper to commercial harvest. It appears valid to include wenchman in the snapper FMU based on recorded landings from the Puerto Rico recreational fishery. In the case of each of the grouper (Action 1(a)) and snapper (Action 1(b)) FMUs, **Preferred Alternative 2** would account for species for which recreational and/or commercial landings have been recorded and provides the basis for managing these harvested species in an ecologically appropriate manner.

Rearranging the grouper FMU has the added advantage of removing yellowedge and misty grouper from membership in Grouper Unit 4, where these two deep-water grouper species were matched with grouper species more characteristic of shallow-water habitats.

Table 4.1.1. Current and proposed FMUs for various species of Caribbean reef fish.

REEF FISH COMPLEX	CURRENT	PROPOSED
Grouper Unit 3	Red hind Coney Rock hind Graysby Creole-fish	Red hind Coney Rock hind Graysby
Grouper Unit 4	Yellowfin Red Tiger Yellowedge Misty	Yellowfin Red Tiger Black
Grouper Unit 5		Yellowedge Misty
Snapper Unit 1	Silk Black Blackfin Vermilion	Silk Black Blackfin Vermilion Wenchman (*Pristipomoides aquilonaris*)
Snapper Unit 2	Queen Wenchman (*Pristipomoides aquilonaris*)	Queen Cardinal (*Pristipomoides macrophthalmus*)

For both of Actions 1(a) and 1(b), no action **Alternative 1** would have no added economic or social impacts. **Preferred Alternative 2** is an administrative action and would not directly affect the economic and social environment. Its indirect economic and social effects are dependent upon subsequent regulatory actions. Testimony at the scoping meetings and other CFMC meetings has been consistent in the proposed separation of the grouper into two units (Action 1(a) **Preferred Alternative 2**) and the changes to the snapper units (Action 1(b) **Preferred Alternative 2**). The Council selected **Alternative 2** as the preferred alternative for both Actions 1(a) and 1(b) because these alternatives best represent the ecological relationships of the subject species and provide for the most efficient management of the various FMUs. These alternatives also aid in the on-going efforts to collect species specific data.

4.2 ACTION 2: MANAGEMENT REFERENCE POINTS

The MSA requires that FMPs specify a number of reference points for managed fish stocks, including:

- Maximum Sustainable Yield (MSY) – The greatest amount or yield that can be sustainably harvested under prevailing environmental conditions.
- Overfishing Threshold – The maximum rate of fishing a stock can withstand (MFMT) or maximum yield a stock can produce (OFL), annually, while still providing MSY on a continuing basis.
- Overfished Threshold (MSST) – The biomass level below which a stock would not be capable of producing MSY.
- Annual Catch Limit (ACL) – The annual level to which catch is limited in order to prevent overfishing from occurring.
- Optimum Yield (OY) – The amount or yield that provides the greatest overall benefit to the Nation, taking into account food production, recreational opportunities and the protection of marine ecosystems.

Together, these parameters are intended to provide the means to measure the status and performance of fisheries relative to established goals. Available data in the U.S. Caribbean are not sufficient to support direct estimation of MSY and other key parameters. In such cases, the National Standard 1 (NS1) guidelines direct regional fishery management councils to adopt other measures of productive capacity, including long-term average catch, which can serve as reasonable proxies.

This section describes current reference points or proxies for species/species groups comprising the snapper, grouper, parrotfish and queen conch complexes, as well as alternative MSY proxies, overfishing thresholds, and ACL and OY definitions, considered by the Council to better comply with new mandates added to the MSA through the 2006 MSRA. None of the parameter estimates considered here represents empirical estimates derived from a comprehensive stock assessment; rather, all are calculated based on landings data averaged over alternative time series. The overfished threshold (MSST) of these species/species groups is currently defined based on the default proxy recommended by Restrepo et al. (1998) and is not being revisited here. That default proxy effectively

defines a more conservative threshold for less productive species, such as snapper, grouper, and conch, which are not capable of recovering to B_{MSY} as quickly as other, more productive species.

The Council at its 133rd meeting reviewed the alternatives taken to scoping meetings (see Appendix 4 for Scoping Meeting information and Appendix 5 for Alternatives Considered and Rejected) and the comments received. Additional information regarding the need to redefine status determination criteria or management reference points (or their proxies) and to evaluate the data on recent catch were presented at the 133rd Council meeting and incorporated into this public hearing draft.

All the reference points considered here are closely interrelated, and the MSA places several key constraints on what can be considered a reasonable suite of alternatives. OY must be less than or equal to MSY. ACL must be less than or equal to the acceptable biological catch (ABC) level recommended by a Council's Scientific and Statistical Committee (SSC) or other established peer-review process. And the ABC recommendation must be less than or equal to the overfishing threshold.

4.2.1 Action 2(a) Snapper, Grouper and Parrotfish Complexes

Action 2(a) proposes to redefine management reference points or proxies for species/species groups within the snapper, grouper, and parrotfish complexes. The composition and classification of these species/species groups in NMFS' report to Congress on the status of U.S. marine fisheries is described in Table 2.2.1. Snapper Unit 1, Grouper Units 1 and 4, and the Parrotfish Unit are classified as undergoing overfishing; however, the status of these species groups has not been assessed since the Council and NMFS implemented measures to address overfishing through the Comprehensive SFA Amendment (CFMC 2005). Grouper Units 1, 2 and 4 are classified as overfished and are entering the sixth year of rebuilding plans designed to rebuild those species/species groups by 2029, 2034 and 2014, respectively.

Alternative 1. No action. Retain current management reference points or proxies for species/species groups within the snapper, grouper and/or parrotfish complexes.

Discussion: This alternative would retain the present MSY proxy, OY, and overfishing threshold definitions specified in the Comprehensive SFA Amendment for species/species groups within the snapper, grouper, and/or parrotfish complexes. These definitions are detailed in Table 4.2.1.

The current MSY proxy is based on average catch (C) and on estimates of where stock biomass and fishing mortality rates are in relation to MSY levels during the period over which catches are averaged. The overfishing threshold (MFMT) is defined as a rate of fishing which exceeds that which would produce MSY. And OY is defined as the amount of fish produced by fishing at a rate equal to 75% of that which would produce MSY. The numerical values associated with these parameters are provided in Table 4.2.2 under the columns titled, "Alternative 1."

Table 4.2.1. Current MSY proxy, OY and overfishing threshold definitions for species/species groups within the snapper, grouper and parrotfish complexes.

REFERENCE POINT	STATUS QUO DEFINITION
Maximum Sustainable Yield	MSY proxy = C / [(F_{CURR}/F_{MSY}) x (B_{CURR}/B_{MSY})]; where C is calculated based on commercial landings for the years 1997-2001 for Puerto Rico and 1994-2002 for the USVI, and on recreational landings for the years 2000-2001.
Overfishing Threshold	MFMT = F_{MSY}
Optimum Yield	OY = average yield associated with fishing on a continuing basis at F_{OY}; where $F_{OY} = 0.75F_{MSY}$

The Comprehensive SFA Amendment in which these reference points were established pre-dated the MSRA provisions requiring FMPs to specify ACLs; consequently, the Comprehensive SFA Amendment did not explicitly specify this parameter for managed species/species groups. However, the ABC estimates derived from the Council's MSY control rule could be considered to represent the ACLs of snapper, grouper, and parrotfish species if no additional action were taken to revise management reference points in this amendment.

The average catch estimate used to calculate the Caribbean-wide MSY proxy for each species/species group was derived from commercial landings data recorded during 1997-2001 for Puerto Rico and during 1994-2002 for the USVI, and recreational landings data recorded during 2000-2001. These time series were considered to represent the longest time periods of consistently reliable data at the time the Comprehensive SFA Amendment was approved. Commercial catch data were derived from trip ticket reports collected by the state governments. Recreational data for Puerto Rico were derived from MRFSS. Recreational data for the USVI were derived by assuming the same commercial-recreational relationship and species composition reported by MRFSS for Puerto Rico. Those data indicated recreational catches averaged about 44% of commercial catch levels during 2000-2001.

DRAFT

Table 4.2.2. Extant and alternative U.S. Caribbean reference points or proxies calculated based on the alternative time series described in Section 4.2.1. Also included are the average landings for the two years (2006-2007) following enactment of the Comprehensive SFA Amendment.

	Maximum Sustainable Yield (MSY) Proxy				**Overfishing Threshold**			
Unit	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 1 (MFMT)**	**Alternative 2 (OFL)**	**Alternative 3 (OFL)**	**Alternative 4 (OFL)**
Queen Conch	452,000	512,718	488,073	525,152	Undefined	512,718	488,073	525,152
Snapper	1,551,000	2,004,003	1,861,538	1,725,798	Undefined	2,004,003	1,861,538	1,725,798
Unit 1	493,000							
Unit 2	151,000							
Unit 3	542,000							
Unit 4	365,000							
Grouper	257,000-289,000	396,483	354,853	337,178	Undefined	396,483	354,853	337,178
Unit 1	2,000-25,000							
Unit 2	2,000-11,000							
Unit 3	158,000							
Unit 4	95,000							
Parrotfish	304,000	507,059	496,656	512,201	Undefined	507,059	496,656	512,201

Table 4.2.2 (continued). Extant and alternative U.S. Caribbean reference points or proxies calculated based on the alternative time series described in Section 4.2.1. Also included are the average landings for the two years (2006-2007) following enactment of the Comprehensive SFA Amendment.

Optimum Yield (OY)/Annual Catch Limit (ACL)										
Unit	**Alt. 1 (OY/ABC)**	**Alt. 2 (c)**	**Alt. 2(d)**	**Alt. 2(e)**	**Alt. 2(f)**	**Alt. 2(g)**	**Alt. 2(h)**	**Alt. 3(c)**	**Alt. 3(d)**	**Alt. 3(e)**
Queen Conch	424,000/ -	107,720	91,562	80,790	53,860	50,000	0	116,899	99,364	87,674
Snapper	1,455,000/1,428,000	2,004,003	1,703,403	1,503,002	1,002,002	-----	N/A	1,861,538	1,582,307	1,396,154
Unit 1	463,000/370,000									
Unit 2	142,000/151,000									
Unit 3	508,000/542,000									
Unit 4	342,000/365,000									
Grouper	237,000/229,000	396,483	337,011	297,362	198,242	-----	N/A	354,853	301,625	266,140
Unit 1	1,880-23,440/ -						0			
Unit 2	1,880-10,310/ -						0			
Unit 3	148,000/158,000									
Unit 4	89,000/71,000									
Parrotfish	285,000/228,000	507,059	431,000	380,294	253,530	430,000	N/A	496,656	422,158	372,492
Unit	**Alt 3(f)**	**Alt 3(g)**	**Alt 3(h)**	**Alt 4(c)**	**Alt 4(d)**	**Alt 4(e)**	**Alt 4(f)**	**Alt 4(g)**	**Alt 4(h)**	**06-07 Avg.**
Queen Conch	58,450	50,000	0	138,587	117,799	103,940	69,294	50,000	0	401,705
Snapper	930,769	-----	N/A	1,725,798	1,466,928	1,294,349	862,899	-----	N/A	1,360,996
Unit 1										
Unit 2										
Unit 3										
Unit 4										
Grouper	177,427	-----	N/A	337,178	286,601	252,884	168,589	-----	N/A	214,118
Unit 1			0						0	
Unit 2			0						0	
Unit 3										
Unit 4										
Parrotfish	248,328	430,000	N/A	512,201	435,371	384,151	256,101	430,000	N/A	464,819

DRAFT

Because data are insufficient to estimate biomass and fishing mortality rates in the U.S. Caribbean, the remaining information needed to calculate MSY proxies was derived from the informed judgment of the SFA Working Group regarding whether each species/species group was at risk of overfishing and/or overfished during the time period when catches were averaged.[1] This approach followed guidance provided by Restrepo et al. (1998), which notes that "in cases of severe data limitations, qualitative approaches [to determining stock status and fishery status] may be necessary, including [the use of] expert opinion and consensus-building methods." The determinations of the SFA Working Group were based on available scientific and anecdotal information (including anecdotal observations of fishermen as reported by fishery managers), life history information, and the status of individual species as evaluated in other regions. ABC estimates were developed using the natural mortality rate of each species/species group as a proxy for F_{MSY}. The actual yield associated with the current OY definition was estimated to equal 93.75% of MSY.

Alternative 2. **(PREFERRED)** Redefine management reference points or proxies for the snapper, grouper and/or parrotfish complexes based on the longest time series of pre-Comprehensive SFA Amendment catch data that is considered to be consistently reliable across all islands.

Discussion: Preferred Alternative 2 would define aggregate management reference points or proxies for the snapper, grouper and/or parrotfish complexes based on what the Council considers to be the longest time series of catch data prior to the implementation of the Comprehensive SFA Amendment that is consistently reliable across all islands. Specific definitions are detailed in Table 4.2.3. The Council chose to omit several years of landings data collected in Puerto Rico prior to 1999 in favor of selecting a more consistent baseline across all islands, noting the inclusion of those earlier landings data would not appreciably alter the various reference point estimates.

The MSY proxy specified by **Preferred Alternative 2** would equate to average catch, calculated using commercial landings data from 1999-2005 for Puerto Rico and St. Croix and from 2000-2005 for St. Thomas/St. John, and recreational landings data from 2000-2005 for Puerto Rico only. Commercial data would be derived from trip ticket reports collected by the state governments. Recreational data would be derived from the MRFSS.

The overfishing threshold (OFL) would be defined as the amount of catch corresponding to the MSY proxy, and overfishing would be determined to occur if annual catches

---

[1] The SFA Working Group was a Council-advisory group, which included staff from the Council, NMFS' Southeast Regional Office and SEFSC, USVI and Puerto Rico fishery management agencies, and several environmental non-governmental organizations. The discussion of biomass and fishing mortality rate estimates took place at the October 23-24, 2002 meeting of the SFA Working Group in Carolina, Puerto Rico. Notice of the meeting location, date, and agenda was provided in the *Federal Register* (67 FR 63622).

exceeded the overfishing threshold (**Alternative 2(a)**) or if annual catches exceeded the overfishing threshold and scientists (in consultation with managers) attributed the overage to increased catches versus improved data collection and monitoring (**Preferred Alternative 2(b)**).

Table 4.2.3. Management reference points or proxies proposed for snapper, grouper and/or parrotfish complexes under **Alternative 2**.

REFERENCE POINT	ALTERNATIVE 2 (PREFERRED)
Maximum Sustainable Yield	MSY proxy = average annual commercial catch from 1999-2005 for Puerto Rico and STX and from 2000-2005 for STT/STJ + average annual recreational catch from MRFSS during 2000-2005 for Puerto Rico
Overfishing Threshold	
Alternative 2(a)	OFL = MSY proxy; overfishing occurs when annual catches exceed the OFL.
Alternative 2(b) (PREFERRED)	OFL = MSY proxy; overfishing occurs when annual catches exceed the OFL, unless NMFS' Southeast Fisheries Science Center (in consultation with the Caribbean Fishery Management Council and its Scientific and Statistical Committee) determines the overage occurred because data collection/monitoring improved, rather than because catches actually increased.
Optimum Yield/Annual Catch Limit	
Alternative 2(c)	OY = ACL = OFL
Alternative 2(d)	OY = ACL = OFL x (0.85)
Alternative 2(e) (PREFERRED)	OY = ACL = OFL x (0.75) (**PREFERRED** for snapper, grouper, and parrotfish)
Alternative 2(f)	OY = ACL = OFL x (0.50)
Alternative 2(g)	OY = ACL = ABC specified by Scientific and Statistical Committee
Alternative 2(h) (PREFERRED)	OY = ACL = 0 (Grouper Units 1 and 2, midnight parrotfish, blue parrotfish, rainbow parrotfish) (**PREFERRED** for GU1 and GU2 and for midnight, blue and rainbow parrotfish)

The OY and ACL would be equal values, and the same socioeconomic and ecological tradeoffs would be considered in the determination of where to set both of these parameters. Most of the alternative ACL definitions considered here are more restrictive than the current OY definition and would prevent the fishery from achieving OY as currently defined.

ACL (= OY) **Alternatives 2(c) through 2(f)** would set those parameters equal to some proportion (100-50%) of the OFL to take into account uncertainty, ecological factors, and

other concerns. **Alternative 2(g)** would set the ACL (= OY) equal to the ABC recommended by the Council's Scientific and Statistical Committee; however, of the complexes considered here, the SSC recommended an ABC only for parrotfish. **Alternative 2(h)** would set the ACL (= OY) equal to zero for Grouper Unit 1 (Nassau grouper) and/or Grouper Unit 2 (goliath grouper), indicating that take of these species should be prohibited to prevent overfishing. The Council chose to include three of the parrotfish (blue, midnight and rainbow) in **Preferred Alternative 2(h)** thereby creating the option to set OY and ACL equal to zero for these species as well.

The specific numerical values associated with the various **Alternative 2** definitions are described in Table 4.2.2 under the columns titled, "Alternative 2."

The CFMC, at its 134th Regular Meeting held in St. Thomas, USVI during April 7-8 2010, chose the following alternatives as preferred alternatives to be taken to public hearings. These are not to be considered final actions by the CFMC. Instead, the Council will convene later in 2010, following the public hearings, to take final action on these alternatives.

In Action 2(a), **Alternative 2** was chosen as the preferred alternative because it includes the longest pre-Comprehensive SFA Amendment data series for the commercial and recreational sectors. In 2005, implementation of the Comprehensive SFA Amendment to the reef fish and conch FMPs included a suite of management measures designed to curb or end overfishing, including for example seasonal and area closures. As a result, the management regime changed drastically in 2005. The Council therefore decided to use the pre-Comprehensive SFA Amendment time series for redefining management reference points because that time series does not include post-2005 years that are influenced by those potentially substantial changes in management and resultant reduction in catch. Moreover, Caribbean coral reefs and their associated community experienced a major bleaching event and an above-normal number of hurricanes and storms in 2005 (Wilkinson and Souter 2008), further complicating the interpretation of post-2005 harvest data.

The CFMC chose **Alternative 2(b)** as a preferred alternative in the public hearing draft document to ensure that AMs are not triggered indiscriminately without considering the effect of improved reporting and data collection efforts. The Council recognized the efforts that the local governments, fishers, and the SEFSC are undertaking to provide the necessary information for stock assessments in the region. In making the determination, the agency will assess the quality of the incoming data on an improved and timely schedule, and monitor along with the local governments the quality of the data. Additional information could be collected to determine if the increase in catches is due to more accurate reporting, including increases in the number of complete catches being sampled.

The Council preferred **Alternatives 2(e)**, a scalar of 0.75, for the snapper complex, the grouper complex, and the parrotfish unit. This precautionary approach was taken in consideration of the combined management and scientific uncertainty inherent in the data,

but also considering the many changes that have taken place in the U.S. Caribbean since 2005. **Alternative 2(h)** was chosen as a preferred alternative for GU1 (Nassau grouper), GU2 (goliath grouper), and for blue, midnight, and rainbow parrotfish. For Nassau and goliath grouper, fishing and possession of these species already is prohibited in all state and territorial waters and in the EEZ.

Table 4.2.4. Management reference points or proxies proposed for snapper, grouper and/or parrotfish complexes under **Alternative 3**.

REFERENCE POINT	ALTERNATIVE 3
Maximum Sustainable Yield	MSY proxy = average annual commercial catch from 1999-2007 for Puerto Rico and STX and from 2000-2007 for STT/STJ + average annual recreational catch from MRFSS during 2000-2007 for Puerto Rico
Overfishing Threshold	
Alternative 3(a)	OFL = MSY proxy; overfishing occurs when annual catches exceed the OFL.
Alternative 3(b)	OFL = MSY proxy; overfishing occurs when annual catches exceed the OFL, unless NMFS' Southeast Fisheries Science Center (in consultation with the Caribbean Fishery Management Council and its Scientific and Statistical Committee) determines the overage occurred because data collection/monitoring improved, rather than because catches actually increased.
Optimum Yield/Annual Catch Limit	
Alternative 3(c)	OY = ACL = OFL
Alternative 3(d)	OY = ACL = OFL x (0.85)
Alternative 3(e)	OY = ACL = OFL x (0.75)
Alternative 3(f)	OY = ACL = OFL x (0.50)
Alternative 3(g)	OY = ACL = ABC specified by Scientific and Statistical Committee
Alternative 3(h)	OY = ACL = 0 (Grouper Units 1 and 2 and/or parrotfish)

This amendment includes, as an alternative, a prohibition on fishing for and possession of midnight, blue, and rainbow parrotfish, as recommended by the SSC. The Council also chose Action 4(a) **Alternative 2** prohibiting fishing for and possession of these parrotfish as the preferred alternative. This alternative, for the three species of parrotfish, responds to the important role these larger parrotfish have on the ecological health of the coral reefs and the testimony at Council public meetings (including scoping meetings on ACLs) on the decrease in numbers of these species on U.S. Caribbean coral reefs.

DRAFT

Alternative 3. Redefine management reference points or proxies for the snapper, grouper and/or parrotfish complexes based on the longest time series of catch data that is considered to be consistently reliable across all islands.

Discussion: Alternative 3 would define aggregate management reference points or proxies for the snapper, grouper and/or parrotfish complexes based on what the Council considers to be the longest time series of catch data that is consistently reliable across all islands. Specific definitions are detailed in Table 4.2.4.

The Council chose to omit several years of landings data collected in Puerto Rico prior to 1999 in favor of selecting a more consistent baseline across all islands, noting the inclusion of those earlier landings data would not appreciably alter the various reference point estimates.

The MSY proxy defined by **Alternative 3** would equate to average catch, calculated using commercial landings data from 1999-2007 for Puerto Rico and St. Croix and from 2000-2007 for St. Thomas/St. John, and recreational landings data from 2000-2007 for Puerto Rico only. Commercial data would be derived from trip ticket reports collected by the state governments. Recreational data would be derived from the MRFSS. Alternative definitions for the overfishing threshold, OY, and ACL parameters are the same as those considered under **Alternative 2**. The specific numerical values associated with the various **Alternative 3** definitions are described in Table 4.2.2 under the columns titled, "Alternative 3."

Alternative 4. Redefine management reference points or proxies for the snapper, grouper and/or parrotfish complexes based on the most recent five years of available catch data.

Discussion: Alternative 4 would define aggregate management reference points or proxies for the snapper, grouper and/or parrotfish complexes based on the most recent five years of available catch data as requested by the Council. Specific definitions are detailed in Table 4.2.5.

The MSY proxy defined by **Alternative 4** would equate to average catch, calculated using commercial landings data from 2003-2007 for Puerto Rico and the USVI, and recreational landings data from 2003-2007 for Puerto Rico only. Commercial data would be derived from trip ticket reports collected by the state governments. Recreational data would be derived from the MRFSS. Alternative definitions for the overfishing threshold, OY and ACL parameter are the same as those considered under **Alternatives 2** and **3**. The specific numerical values associated with the various **Alternative 4** definitions are described in Table 4.2.2 under the columns titled, "Alternative 4."

DRAFT

Table 4.2.5. Management reference points or proxies proposed for snapper, grouper and/or parrotfish complexes under **Alternative 4**.

REFERENCE POINT	ALTERNATIVE 4
Maximum Sustainable Yield	MSY proxy = average annual commercial catch from 2003-2007 for Puerto Rico and the USVI + average annual recreational catch from MRFSS during 2003-2007 for Puerto Rico
Overfishing Threshold	
Alternative 4(a)	OFL = MSY proxy; overfishing occurs when annual catches exceed the OFL.
Alternative 4(b)	OFL = MSY proxy; overfishing occurs when annual catches exceed the OFL, unless NMFS' Southeast Fisheries Science Center (in consultation with the Caribbean Fishery Management Council and its Scientific and Statistical Committee) determines the overage occurred because data collection/monitoring improved, rather than because catches actually increased.
Optimum Yield/Annual Catch Limit	
Alternative 4(c)	OY = ACL = OFL
Alternative 4(d)	OY = ACL = OFL x (0.85)
Alternative 4(e)	OY = ACL = OFL x (0.75)
Alternative 4(f)	OY = ACL = OFL x (0.50)
Alternative 4(g)	OY = ACL = ABC specified by Scientific and Statistical Committee
Alternative 4(h)	OY = ACL = 0 (Grouper Units 1 and 2 and/or parrotfish)

4.2.2 Action 2(b) Queen Conch Complex

Action 2(b) proposes to redefine management reference points or proxies for the queen conch complex. Queen conch is currently classified as overfished and subject to overfishing in NMFS' report to Congress on the status of U.S. marine fisheries. However, the status of this species has not been assessed since the Council and NMFS implemented measures to address overfishing through the Comprehensive SFA Amendment (CFMC 2005). Queen conch is currently entering the sixth year of a rebuilding plan designed to rebuild the stock by 2019.

Alternative 1. No action. Retain current management reference points or proxies for the queen conch complex.

Discussion: This alternative would retain the present MSY proxy, OY, and overfishing threshold definitions specified in the Comprehensive SFA Amendment for queen conch. These definitions are detailed in Table 4.2.6.

Table 4.2.6. Current MSY proxy, OY, and overfishing threshold definitions for queen conch.

REFERENCE POINT	STATUS QUO DEFINITION
Maximum Sustainable Yield	MSY proxy = C / [(F_{CURR}/F_{MSY}) x (B_{CURR}/B_{MSY})]; where C is calculated based on commercial landings for the years 1997-2001 for Puerto Rico and 1994-2002 for the USVI, and on recreational landings for the years 2000-2001.
Overfishing Threshold	MFMT = F_{MSY}
Optimum Yield	OY = average yield associated with fishing on a continuing basis at F_{OY}; where $F_{OY} = 0.75F_{MSY}$

The current MSY proxy is based on C and on estimates of where stock biomass and fishing mortality rates are in relation to MSY levels during the period over which catches are averaged. The overfishing threshold (MFMT) is defined as a rate of fishing which exceeds that which would produce MSY, and OY is defined as the amount of queen conch produced by fishing at a rate equal to 75% of that which would produce MSY. The numerical values associated with these parameters are provided in Table 4.2.2 under the columns titled, "Alternative 1."

The Comprehensive SFA Amendment in which these reference points were established pre-dated the MSRA provisions requiring FMPs to specify ACLs; consequently, the Comprehensive SFA Amendment did not explicitly specify this parameter for managed species/species groups. However, the ABC estimates derived from the Council's MSY control rule could be considered to represent the ACL of queen conch if no additional action were taken to revise management reference points in this amendment.

The average catch estimate used to calculate the MSY proxy was derived from commercial landings data recorded during 1997-2001 for Puerto Rico and during 1994-2002 for the USVI, and recreational landings data recorded during 2000-2001. These time series were considered to represent the longest time periods of relatively reliable data at the time the Comprehensive SFA Amendment was approved. Commercial catch data were derived from trip ticket reports collected by the state governments. Recreational catch data for Puerto Rico were derived from a two-month MRFSS survey specific for queen conch. Recreational catches for the USVI were assumed to equal 50% of USVI commercial landings based on information from Valle-Esquivel (pers. comm.).

Because data are insufficient to estimate biomass and fishing mortality rates in the U.S. Caribbean, the remaining information needed to calculate the MSY proxy was derived from the informed judgment of the SFA Working Group regarding whether queen conch was at risk of overfishing and/or overfished during the time period when catches were averaged. This is the same approach described in Section 4.2.1 for the snapper, grouper, and parrotfish complexes. ABC estimates were developed using the natural mortality rate of queen conch as a proxy for F_{MSY}. The actual yield associated with the current OY definition was estimated to equal 93.75% of MSY.

Alternative 2. **(PREFERRED)** Redefine management reference points or proxies for queen conch based on the longest time series of pre-Comprehensive SFA Amendment catch data that is considered to be consistently reliable across all islands.

Table 4.2.7. Management reference points or proxies proposed for queen conch under **Preferred Alternative 2**.

REFERENCE POINT	ALTERNATIVE 2 (PREFERRED)
Maximum Sustainable Yield	MSY proxy = average annual commercial catch from 1999-2005 for Puerto Rico and STX and from 2000-2005 for STT/STJ.
Overfishing Threshold	
Alternative 2(a)	OFL = MSY proxy; overfishing occurs when annual catches exceed the OFL.
Alternative 2(b) (PREFERRED)	OFL = MSY proxy; overfishing occurs when annual catches exceed the OFL, unless NMFS' Southeast Fisheries Science Center (in consultation with the Caribbean Fishery Management Council and its Scientific and Statistical Committee) determines the overage occurred because data collection/monitoring improved, rather than because catches actually increased. (**PREFERRED**)
Optimum Yield/Annual Catch Limit	
Alternative 2(c)	OY = ACL = average annual landings from 1999-2005 for St. Croix
Alternative 2(d)	OY = ACL = average annual landings from 1999-2005 for St. Croix x (0.85)
Alternative 2(e)	OY = ACL = average annual landings from 1999-2005 for St. Croix x (0.75)
Alternative 2(f)	OY = ACL = average annual landings from 1999-2005 for St. Croix x (0.50)
Alternative 2(g) (PREFERRED)	OY = ACL = ABC specified by Scientific and Statistical Committee (**PREFERRED**)
Alternative 2(h)	OY = ACL = 0

Discussion: Preferred Alternative 2 would redefine management reference points or proxies for queen conch based on what the Council considers to be the longest time series of catch data prior to the implementation of the Comprehensive SFA Amendment that is considered reliable across all islands. Specific definitions are detailed in Table 4.2.7. The Council chose to omit several years of landings data collected in Puerto Rico prior to 1999 in favor of selecting a more consistent baseline across all islands, noting the inclusion of those earlier landings data would not appreciably alter the various reference point estimates.

The MSY proxy specified by **Preferred Alternative 2** would equate to average catch, calculated using commercial landings data from 1999-2005 for Puerto Rico and St. Croix and from 2000-2005 for St. Thomas/St. John. These data would be derived from trip ticket reports collected by the state governments.

The OFL would be defined as the amount of catch corresponding to the MSY proxy, and overfishing would be determined to occur if annual catches exceeded the overfishing threshold (**Alternative 2(a)**) or if annual catches exceeded the overfishing threshold and scientists (in consultation with managers) attributed the overage to increased catches versus improved data collection and monitoring (**Preferred Alternative 2(b)**).

The OY and ACL would be equal values, and the same socioeconomic and ecological tradeoffs would be considered in the determination of where to set both of these parameters. Most of the alternative ACL definitions considered here are more restrictive than the current OY definition and would prevent the fishery from achieving OY as currently defined.

ACL (= OY) **Alternatives 2(c)** through **2(f)** would set those parameters equal to some proportion (100-50%) of the average annual landings from 1999-2005 for St. Croix to take into account uncertainty, ecological factors, and other concerns. **Preferred Alternative 2(g)** would set those parameters equal to the 50,000 pound ABC recommended by the Council's SSC for queen conch. **Alternative 2(h)** would set these parameters equal to zero, indicating that queen conch take should be prohibited to prevent overfishing. Note that the EEZ is closed to queen conch harvest west of 64° 34' W, with only the Lang Bank EEZ area east of St. Croix open to queen conch harvest in federal waters.

The specific numerical values associated with the various **Alternative 2** definitions are described in Table 4.2.2 under the columns titled, "**Alternative 2**".

Alternative 3. Redefine management reference points or proxies for queen conch based on the longest time series of catch data that is considered to be consistently reliable across all islands.

Discussion: Alternative 3 would define aggregate management reference points or proxies for queen conch based on what the Council considers to be the longest time series of catch data that is consistently reliable across all islands. Specific definitions are detailed in Table 4.2.8.

The Council chose to omit several years of landings data collected in Puerto Rico prior to 1999 in favor of selecting a more consistent baseline across all islands, noting the inclusion of those earlier landings data would not appreciably alter the various reference point estimates.

Table 4.2.8. Management reference points or proxies proposed for queen conch under **Alternative 3**.

REFERENCE POINT	ALTERNATIVE 3
Maximum Sustainable Yield	MSY proxy = average annual commercial catch from 1999-2007 for Puerto Rico and STX and from 2000-2007 for STT/STJ.
Overfishing Threshold	
Alternative 3(a)	OFL = MSY proxy; overfishing occurs when annual catches exceed the OFL.
Alternative 3(b)	OFL = MSY proxy; overfishing occurs when annual catches exceed the OFL, unless NMFS' Southeast Fisheries Science Center (in consultation with the Caribbean Fishery Management Council and its Scientific and Statistical Committee) determines the overage occurred because data collection/monitoring improved, rather than because catches actually increased.
Optimum Yield/Annual Catch Limit	
Alternative 3(c)	OY = ACL = average annual landings from 1999-2007 for St. Croix
Alternative 3(d)	OY = ACL = average annual landings from 1999-2007 for St. Croix x (0.85)
Alternative 3(e)	OY = ACL = average annual landings from 1999-2007 for St. Croix x (0.75)
Alternative 3(f)	OY = ACL = average annual landings from 1999-2007 for St. Croix x (0.50)
Alternative 3(g)	OY = ACL = ABC specified by Scientific and Statistical Committee
Alternative 3(h)	OY = ACL = 0

The MSY proxy defined by **Alternative 3** would equate to average catch, calculated using commercial landings data only from 1999-2007 for Puerto Rico and St. Croix and from 2000-2007 for St. Thomas/St. John. These data would be derived from trip ticket reports collected by the state governments. Alternative definitions for the overfishing threshold, OY, and ACL parameters are the same as those considered under **Alternative 2**. The specific numerical values associated with the various **Alternative 3** definitions are described in Table 4.2.2 under the columns titled, "**Alternative 3**".

Alternative 4. Redefine management reference points or proxies for queen conch based on the most recent five years of available catch data.

Discussion: Alternative 4 would define management reference points or proxies for queen conch based on the most recent five years of available catch data, as requested by the Council. Specific definitions are detailed in Table 4.2.9.

Table 4.2.9. Management reference points or proxies proposed for queen conch under **Alternative 4**.

REFERENCE POINT	ALTERNATIVE 4
Maximum Sustainable Yield	MSY proxy = average annual commercial catch from 2003-2007 for Puerto Rico and the USVI.
Overfishing Threshold	
Alternative 4(a)	OFL = MSY proxy; overfishing occurs when annual catches exceed the OFL.
Alternative 4(b)	OFL = MSY; overfishing occurs when annual catches exceed the OFL, unless NMFS' Southeast Fisheries Science Center (in consultation with the Caribbean Fishery Management Council and its Scientific and Statistical Committee) determines the overage occurred because data collection/monitoring improved, rather than because catches actually increased.
Optimum Yield/Annual Catch Limit	
Alternative 4(c)	OY = ACL = average annual landings from 2003-2007 for St. Croix
Alternative 4(d)	OY = ACL = average annual landings from 2003-2007 for St. Croix x (0.85)
Alternative 4(e)	OY = ACL = average annual landings from 2003-2007 for St. Croix x (0.75)
Alternative 4(f)	OY = ACL = average annual landings from 2003-2007 for St. Croix x (0.50)
Alternative 4(g)	OY = ACL = ABC specified by Scientific and Statistical Committee
Alternative 4(h)	OY = ACL = 0

The MSY proxy specified by **Alternative 4** would equate to average catch, calculated using commercial landings data only from 2003-2007 for Puerto Rico and the USVI. These data would be derived from trip ticket reports collected by the state governments. Alternative definitions for the overfishing threshold, OY, and ACL parameters are the same as those considered under **Alternatives 2** and **3**. The specific numerical values associated with the various **Alternative 4** definitions are described in Table 4.2.2 under the columns titled, "**Alternative 4**".

4.2.3 Summary Comparison of Management Reference Point Alternatives

Specifying the MSY, OFL, OY, and ACL of snapper, grouper, parrotfish and queen conch would not have direct environmental impacts because these parameters (or proxies) simply provide fishery managers with targets and thresholds to use in evaluating fishery status and performance. However, this action would indirectly impact the environment by

influencing the development of fishery management actions to prevent overfishing and optimize yield.

The primary differences between the no action (status quo definitions) and action alternatives considered here are: (1) the no action alternative requires estimates of catch, stock biomass, and fishing mortality rates, whereas action alternatives require only catch estimates; and (2) the no action alternative estimates reference points or proxies at a smaller scale/finer resolution for some complexes (i.e., for species or species groups within the snapper and grouper complexes), whereas action alternatives estimate aggregate reference points or proxies at the complex level for snapper, grouper, parrotfish and queen conch.

Theoretically, the biomass and fishing mortality rate-based reference points specified by the no action alternative would be more precise and more effective in preventing overfishing. However, because data are insufficient to estimate biomass and fishing mortality rates in the U.S. Caribbean, these reference points must be calculated based on informed judgment regarding stock status in relation to MSY. Based on extensive feedback from affected fishermen and others regarding the limitations of this approach, and concerns about SFA Working Group determinations of stock status, the action alternatives considered here are based on simpler catch-based proxies, which better reflect the data and are more transparent and operationally useful.

The present practice of defining management reference points at the finest resolution possible could also be considered the ideal approach to monitoring fishery performance. Aggregate reference points would make it more difficult for fishery scientists and managers to monitor the status of individual species/species groups. SU1 (silk, black, vermilion and blackfin snapper) and GU1 (Nassau grouper) and 4 (red, misty, tiger, yellowedge, and yellowfin grouper) are currently classified as subject to overfishing in NMFS' report to Congress on the status of U.S. Fisheries. Grouper Units 1, 2 (goliath grouper) and 4 are classified as overfished and are managed under rebuilding plans. While regulations have been implemented to end overfishing and rebuild these stocks, the response of individual species to these regulations would be less apparent if reference points were redefined at the aggregate level.

However, U.S. Caribbean fishermen continue to report large numbers of unclassified species (unclassified snapper, grouper and parrotfish averaged approximately 6%, 33% and 90% of commercial catches, respectively, during 2006-2007), making it difficult and impractical to monitor fishery performance at the species/species group level. The Council can choose to implement species-specific regulations, such as the current harvest prohibitions on Nassau and goliath grouper, regardless of whether reference points are defined at the individual or aggregate level. Consequently, the action alternatives considered here aim to redefine reference points for species complexes in aggregate rather than for individual species/species groups within complexes; an approach that is supported by the NS1 guidelines in situations where data do not support stock-specific monitoring, management, and assessment.

The primary difference between the action alternatives is the time series of catch data on which they are based. The NS1 guidelines caution it is generally best to average catches over as long a time series as possible when using average catch as an MSY proxy to capture the fishery's response to changing conditions. But equally important is the need to base the average on years for which a stable fishery and reliable catch data exist.

The reliability of catch data collected in the early years of the state trip ticket programs has been compromised by a series of periodic lapses in the programs over the years, as well as significant under- and/or mis-reporting and changes in the type of data collected (Valle-Esquivel 2002). Landings in the USVI were historically reported by gear group (e.g., pot fish, net fish), while those in Puerto Rico were reported by species or species groups (e.g., Nassau grouper, grouper).

Maximum Sustainable Yield (MSY)

The MSY proxy defined by no action **Alternative 1** averages catches over the longest time period during which data were considered to be relatively stable at the time the Council approved the Comprehensive SFA Amendment. Because the Council had fewer years of catch data to work with at that time, that proxy incorporated Puerto Rico and USVI catch data prior to 1999. The MSY proxies evaluated in **Alternatives 2-4** do not use pre-1999 data in average catch calculations because those data were collected by gear type rather than by family group. The Council instead prefers to use data from more recent years, when the data were collected by family group and therefore provide a relatively consistent baseline among all of the islands.

Additionally, in contrast to the no action **Alternative 1**, **Alternatives 2-4** do not attempt to incorporate information on recreational catches of snapper, grouper, and parrotfish in the USVI or on recreational catches of queen conch in Puerto Rico and the USVI because the MRFSS does not provide this information and no alternative data are available to reliably estimate these landings. As a result, the MSYs specified by these alternative proxies are expected to be underestimated to some unknown degree; this is particularly true for the queen conch proxies, which are based solely on commercial landings data. According to MRFSS, recreational fisheries landed about 35%, 42%, and 2% of the total snapper, grouper and parrotfish catch in Puerto Rico, on average, during 2006-2007, the two years for which data are available following implementation of current management controls to end overfishing.

Preferred Alternative 2 would set the MSY proxy equal to average catches over what the Council considers to be the longest time period prior to the implementation of current management controls for which data are consistently reliable among all islands. **Alternative 3** would set the MSY proxy equal to average catches over what they consider to be the longest time period during which landings data are consistently reliable among all islands, including recent years in which harvest was further constrained by management controls. **Alternative 4** would set the MSY proxy equal to catches averaged over just the last five years for which data are available, two of which are characterized by the more restrictive management controls in place today.

The MSY values specified by **Alternatives 2-4** are greater than those specified by no action **Alternative 1** for each of the snapper, grouper, and parrotfish complexes in aggregate and for queen conch (Table 4.2.2). Of the action alternatives, **Preferred Alternative 2** would specify the highest MSY for the snapper and grouper complexes (1,986,351 lbs and 388,124 lbs, respectively), followed by **Alternative 3** (1,840,200 lbs and 342,515 lbs, respectively), then **Alternative 4** (1,706,132 lbs and 327,370 lbs, respectively). **Alternative 4** would specify the highest MSY for the parrotfish and queen conch complexes (505,306 lbs and 525,152 lbs, respectively), followed by **Preferred Alternative 2** (494,600 lbs and 512,718 lbs, respectively), then **Alternative 3** (485,869 lbs and 488,073 lbs, respectively).

In general, underestimating MSY can result in foregone yield, whereas overestimating MSY can lead to overfishing. However, the MSY values specified by **Alternatives 2-4** for each complex are remarkably similar, differing by only 16% at most (grouper complex). This indicates that landings were relatively stable over the years in which the Council considers data to be consistently reliable across islands and the choice of MSY proxy is not likely to have a substantial impact on current management controls or long-term yield.

Overfishing Threshold (MFMT/OFL)

The overfishing threshold defined by no action **Alternative 1** is a maximum fishing mortality threshold (MFMT) equal to the fishing mortality rate at MSY. Because this fishing mortality rate is unknown for U.S. Caribbean species, the Comprehensive SFA Amendment adopted natural mortality rate as a proxy for this parameter. However, data are insufficient to evaluate the sustainability of current fishing mortality rates relative to this proxy and make a determination as to whether overfishing is or is not occurring. To remedy this, **Preferred Alternative 2** and **Alternatives 3** and **4** propose to specify a catch-based, rather than fishing mortality-based, overfishing threshold, called the overfishing limit (OFL). Annual catches would be evaluated relative to the OFL to determine whether overfishing is or is not occurring. This approach is consistent with the NS1 guidelines, which provide fishery managers the flexibility to determine if overfishing occurs based on either fishing mortality rates or actual annual catch.

Preferred Alternative 2 and **Alternatives 3** and **4** would essentially maintain the same relationship as the no action alternative between the overfishing threshold and MSY. MSY represents the maximum yield a species complex can provide in the long term, while OFL estimates the amount of annual catch above which overfishing is occurring. In theory, the annual OFL would vary above and below the MSY level depending on fluctuations in stock size. Since both MSY and OFL are related to the highest fishing mortality rate that will not result in overfishing, the long-term average of OFLs would be expected to equate to MSY, provided that stock abundance is high enough to support MSY. But, in practice, the annual OFLs proposed in **Preferred Alternative 2** and **Alternatives 3** and **4** would remain constant at the MSY level until stock biomass can be estimated.

DRAFT

Sub-alternative (a) would result in an automatic overfishing determination if annual catches exceeded the OFL in any given year, whereas **Preferred Sub-alternative (b)** would provide scientists (in consultation with managers) the flexibility to evaluate the cause of the reported catch increase prior to making a determination that a species complex is undergoing overfishing. Specifically, they would consider whether the reported increase represents an actual increase in landings or just improved data collection and monitoring. The intent of this sub-alternative is to eliminate any incentive for fishermen to under-report or misreport catches to avoid exceeding ACLs and triggering associated AMs.

Both the ranking and range of the OFL values specified by the action alternatives is equal to that described for MSY values as these alternatives would set OFL equal to MSY. Landings in 2006-2007 (the most recent years for which data are available) were below the OFLs proposed by **Preferred Alternative 2** and **Alternatives 3** and **4** and below the status quo MSYs for all complexes with the exception of parrotfish (Table 4.2.2). This could indicate that actions taken through the Comprehensive SFA Amendment to end overfishing, and compatible regulations implemented in state and territorial waters, are working in most cases. Alternatively, the recent decline in landings may be attributed to a decline in stock abundance. The cause of the higher than expected parrotfish landings has not been determined but may be attributed to the delayed implementation of the gillnet prohibition in state waters, increased reporting, or other factors.

Underestimating OFL can result in stricter management controls than needed to prevent overfishing. This would be expected to benefit the physical, biological, and ecological environments but to reduce socioeconomic benefits especially in the short run. Conversely, overestimating OFL can lead to habitual overfishing, triggering resource-intensive administrative requirements and, ultimately, threatening the long-term sustainability of fish stocks and reducing the long term net socioeconomic benefits to fishers, their families, and fishing communities.

Optimum Yield (OY) and Annual Catch Limits (ACLs)

The current OY defined by no action **Alternative 1** is derived from the technical guidance provided by Restrepo et al. (1998), which recommends the target fishing mortality rate be set equal to the average yield available on a continuing basis from fishing at 75% of the fishing mortality rate that would produce MSY. The authors of that guidance indicate that fishing at this level adds precaution and maintains stocks at higher biomass levels, while sacrificing only a small amount (~ 6.25%) of catch. Because data are insufficient to estimate the fishing mortality rate that would produce MSY, the Comprehensive SFA Amendment estimated the OY of each species/species group to equal 93.75% of MSY (Table 4.2.2).

While the no action **Alternative 1** does not explicitly define ACLs for snapper, grouper, parrotfish, or queen conch, the ABC estimates specified by the Council's MSY control rule could be considered to represent the ACLs of these species/species groups if no

additional action were taken through this amendment to revise management reference points (Table 4.2.2). However, these ABC values are very uncertain as they were calculated using natural mortality rate as a proxy for the fishing mortality rate that would produce MSY and informed judgment regarding stock biomass. And, because these values were set well below MSY values to address SFA Working Group determinations regarding overfishing, they would prevent the fishery from achieving OY; even though recent landings data indicate that, in most cases, management controls appear to have effectively reduced catch rates below the overfishing threshold (Table 4.2.2).

To remedy this, **Preferred Alternative 2** and **Alternatives 3** and **4** would set the OY and ACL as equal values, requiring the Council to consider the socioeconomic and ecological components of OY when determining how far ACLs should be reduced below the overfishing threshold to account for scientific uncertainty in estimating the OFL and management uncertainty in effectively constraining harvest over time. This approach leads to OY estimates for the snapper and queen conch complexes that are below those estimated in the Comprehensive SFA Amendment, regardless of the OY (= ACL) alternative selected. In contrast, most of the OY alternatives would result in larger OY estimates for the grouper and parrotfish complexes relative to the no action alternative.

Preferred Alternative 2 and **Alternatives 3** and **4** propose essentially the same suite of OY and ACL) sub-alternatives for snapper, grouper, parrotfish, and queen conch; however, the queen conch alternatives differ in that they would set the OY equal to average catches landed in St. Croix only, rather than to average catches Caribbean-wide. **Sub-alternative (c)** is the most risk prone, proposing to set the OY equal to the OFL. **Sub-alternatives (d)** through **(f)** are progressively more precautionary, incorporating increasingly larger buffers between the OY and OFL, which are recommended in fisheries characterized by scientific and management uncertainty. **Preferred Sub-alternative (g)** would set OY equal to the ABC recommended by the Council's SSC for parrotfish and/or queen conch, and **Preferred Sub-alternative (h)** would set ACL equal to zero for those species that are currently managed under a total harvest prohibition. (i.e., Nassau grouper and goliath grouper) or near total harvest prohibition (i.e., queen conch) and/or for those species that perform a critical ecological function (e.g., large parrotfish).

The NS1 guidelines suggest that OY and ACL should generally be reduced from the overfishing threshold and MSY, respectively, to effectively prevent overfishing. This precautionary buffer is more important for species like snapper, grouper, parrotfish, and queen conch, which are considered to be more vulnerable to overfishing because of life history characteristics (e.g., long-lived, late to mature, etc.) and/or greater susceptibility to the fishery (e.g., easily harvested).

The relative ranking of the OY and ACL values specified by **Alternatives 2-4** is equal to that described for the MSY alternatives as most of the OY and ACL values are derived in part from the MSY proxy (Table 4.2.2). Excluding consideration of sub-alternatives, **Alternative 2** would specify the highest OY/ACL values for the snapper and grouper complexes, followed by **Alternative 3**, then **Alternative 4**. **Alternative 4** would specify the highest OY/ACL values for the parrotfish and queen conch complexes, followed by

Preferred Alternative 2 and **Alternative 3** (parrotfish) and **Alternative 3** and **Preferred Alternative 2** (queen conch). The OY/ACL values specified for all complexes by **Sub-alternatives (c)** through **(f)** become progressively smaller as the precautionary buffers they propose become increasingly larger, whereas the values associated with **Sub-alternatives (g)** and **(h)** are the same across all alternatives.

ACLs effectively limit the total catch of a species, species group, or complex that may be taken in any given year without requiring fishery managers to impose additional management controls. As a result, larger ACLs are likely to support less restrictive management controls than will smaller ACLs, and support higher levels of landings and socioeconomic benefits that derive from those landings. However, larger ACLs also increase the risk of overfishing relative to smaller ACLs and risk smaller net socioeconomic benefits over time, which could lead to more restrictive management that substantially reduces socioeconomic benefits to fishers, their families, and fishing communities because the ACL was incorrectly set too high.

Sub-alternative (f) would be expected to best benefit most snapper and grouper species, as well as their surrounding physical and ecological environment, because it would support the lowest catch level and largest precautionary buffer (50%) relative to the other sub-alternatives. The ecological benefits of a large precautionary buffer include protecting the critical functions parrotfish perform in coral reef ecosystems. **Sub-alternative (h)** would best benefit Nassau grouper, goliath grouper, and parrotfish by specifying an OY and ACL of zero for those species. **Sub-alternatives (e)** through **(c)** would progressively reduce the precautionary buffer between the OY and ACL and the overfishing threshold, as well as associated environmental benefits, with **Sub-alternative (c)** being the least conservative of those considered. The environmental benefits of parrotfish **Sub-alternative (g)** are generally intermediate to those associated with **Sub-alternatives (c)** and **(d)**.

Preferred Sub-alternative (h) would be expected to best benefit queen conch and its surrounding physical and ecological environment because it would require fishery managers to prohibit all harvest of that species in federal waters. **Sub-alternative (g)** would be the next most conservative option for queen conch because it would support the lowest catch level and largest precautionary buffer relative to the remaining sub-alternatives. **Sub-alternatives (f)** through **(c)** would progressively reduce this safety margin and associated environmental benefits, with **Sub-alternative (c)** being the least conservative of those considered.

In general, more conservative OY and ACL values would be expected to be more administratively burdensome than less conservative values because they would trigger management review and action more frequently. However, defining the OY (= ACL) as zero for Grouper Units 1 & 2 (Nassau and goliath grouper, respectively) would benefit the administrative environment by supporting the current catch prohibitions. And defining the OY and ACL as zero for queen conch would reduce the administrative burden of implementing compatible in-season closures each year. Additionally, insufficiently

precautionary OY and ACL values would have adverse administrative effects if they led stocks to become overfished, triggering resource-intensive MSA rebuilding provisions.

The unavoidable adverse socioeconomic tradeoff that must be considered in determining the degree of precaution to incorporate in the OY and ACL definition is foregone socioeconomic benefits that derive from yield. The more precautionary the OY and ACL, the greater the risk of needlessly reducing fishery yield and associated socioeconomic benefits. Table 4.2.2 compares alternative OY (= ACL) values with 2006-2007 landings data recorded following the implementation of current management controls to end overfishing. Based on this comparison, OY and ACL **Sub-alternatives (e)** and **(f)** could require additional measures to further reduce snapper, grouper, and parrotfish catches depending on the MSY proxy selected by the Council as a continuation of current management controls for those species. While post-SFA catches of parrotfish and queen conch exceed the values specified by OY (= ACL) alternatives under most scenarios, higher than expected landings of these species could be attributed to the delayed implementation of compatible harvest restrictions in state waters.

Due to data limitations, it is not possible to calculate the probability of the various OY and ACL alternatives considered here in successfully preventing overfishing and, thus, maximizing long-term benefits to the physical, biological, ecological, socioeconomic, and administrative environments. Recognizing this will be the case in some fisheries, the NS1 guidelines suggest fishery managers implement the best ACLs possible with existing data, but also look for opportunities to improve data collection in the future so ACL measures prevent overfishing without being overly restrictive.

Alternative 1 is the no action alternative, and it would be incompatible with **Preferred Alternative 2** of Action 1(a) and **Preferred Alternative 2** of Action 1(b). **Alternative 1** would also be incompatible with the present regulatory environment because it would specify ACLs for Nassau and goliath grouper that contradict present regulations.

With regard to Action 2(a), **Preferred Alternatives 2** and **Alternatives 3** and **4** would have no direct economic or social impact. **Preferred Alternative 2** and **Alternatives 3** and **4** would indirectly affect the economic and social environments by fostering regulatory changes that could have short-term adverse economic and social impacts on fishers, their families, and fishing communities, but larger net positive socioeconomic impacts in the long run. The actual impacts, however, are dependent upon the allocation (Action 3), AMs (Action 5), regulations that trigger the AMs (Action 5), other regulations that combine to rationalize the fishery, and other environmental factors.

Alternative 2c of Action 2(a) would specify the highest ACL for each of the Snapper and Grouper FMUs, and **Alternative 4c** would specify the highest ACL for the Parrotfish FMU. **Alternative 2c** and **Alternative 4c** could indirectly result in greater economic and social benefits that derive from fishing for the Snapper, Grouper, and Parrotfish FMUs; however, actual impacts are dependent upon the allocation (Action 3), AMs (Action 4), regulations that trigger the AMs (Action 5), other regulations that combine to rationalize the fishery, and other environmental factors.

Preferred Alternatives 2h and **Alternatives 3h,** and **4h** of Action 2(a) would set the ACL for Grouper Unit 1 at zero and for Grouper Unit 2 at zero and would be consistent with the present regulation that closes these fisheries.

Among the sub-alternatives of **Preferred Alternative 2 of Action 2(a), Preferred Sub-alternative e** would establish the third largest ACL for snapper, grouper, and parrotfish. Consequently, the short-run economic and social benefits that derive from annual catches of snapper, grouper, and parrotfish could be smaller under a regulatory regime supported by **Preferred Sub-alternative 2e** than by **Sub-alternatives 2c** and **2d**. However, the long-run economic and social benefits that indirectly derive from **Preferred Sub-alternative 2e** could be larger.

Alternatives 1 through **4** of Action 2(b) would have no direct economic or social impact. However, **Preferred Alternative 2** and **Alternatives 3** and **4** could indirectly affect the economic and social environments by fostering regulatory changes that could have short-term adverse economic and social impacts on fishers, their families, and fishing communities, but larger long term net benefits. The actual impacts, however, are dependent upon the allocation (Action 3), AMs (Action 5), regulations that trigger the AMs (Action 5), other regulations such as Action 4 that combine to rationalize the fishery, and other environmental factors.

Alternative 1 of Action 2(b) is the no action alternative, and it would be incompatible with the present regulatory environment because it would specify an ACL for queen conch that would be incompatible with present federal regulations that limit queen conch fishing and possession to an area of the EEZ off St. Croix, and with St. Croix's annual limit of 50,000 pounds per year. **Preferred Alternative 2g** and **Alternatives 3g** and **4g** would be consistent with the 50,000-pound limit and Amendment 1 restrictions. **Alternative 2h, 3h,** or **4h** would set the ACL at zero pounds, which could have the largest indirect adverse economic and social impacts on St. Croix's queen conch fishers, their families, and fishing communities. It is expected that **Preferred Alternative 2g** would not indirectly affect St. Croix queen conch fishers because the ACL is equal to St. Croix's 50,000-pound landings limit.

4.3 ACTION 3: Annual Catch Limit Allocation/Management

4.3.1 Action 3(a) Snapper and grouper unit allocation/management

Alternative 1. No action. Define reference points for sub-units within the snapper and grouper units.

Alternative 2. Define aggregate reference points for the snapper and grouper units:

A. Puerto Rico only
B. USVI only
C. Both Puerto Rico and the USVI

Alternative 3. Define aggregate reference points for the grouper unit:

A. Puerto Rico only
B. USVI only
C. Both Puerto Rico and the USVI

Alternative 4. (**PREFERRED**) Define aggregate reference points for snapper and grouper in the USVI and define aggregate reference points for grouper but not snapper in Puerto Rico.

Discussion: Commercial harvest data have been collected from Puerto Rico and USVI waters for many decades, but as explained in Section 3.3 the USVI landings data were generally reported by gear rather than species until the late 1990s. As a result of those data limitations, USVI commercial landings data only allow analysis to the family-group (snapper, grouper, parrotfish) level since calendar year (CY) 1998 for St. Croix (STX) and since CY 2000 for St. Thomas and St. John (STT/STJ). Moreover, at the September 2009 meeting of the Council a motion to include only data acquired since CY 1999 was presented and passed. Thus, the start date for any analyses included in this amendment is CY 1999 or later. The rationale for this was because family-level data were not available for STT/STJ until CY 2000, so that year represents the earliest start date for STT/STJ. The Council also requested that landings data for Puerto Rico adhere to this start year limitation despite the fact that Puerto Rico data have been reported to species for a longer period of time than family level data have been reported for USVI landings. For all three island groups, commercial landings data were available only through CY 2007 at the time of preparation of this document. Thus, the data record for STX and Puerto Rico is 1999-2007 and for STT/STJ it is 2000-2007. Consequently, reference points for snapper and grouper will be based on similar time periods for all islands.

A tangible goal of fisheries management in U.S. Caribbean waters is to manage at the level of individual species. Considering the large number of species being harvested in U.S. Caribbean waters, and given the data limitations discussed above, adequate data with which to conduct stock assessments and to set reference points for individual species are generally not available for the U.S. Caribbean (SEDAR 2009). Thus, although it is a worthwhile goal to manage at the level of the individual species, in practice this is difficult for many U.S. Caribbean species due to data limitations.

Alternative 1 in Action 3(a) would require that landings data be available for each of the species (or at least the species groups) comprising each FMU, with an immediate focus on those species designated as undergoing overfishing. The species or species-groups presently designated as undergoing overfishing include queen conch, parrotfish, Grouper Unit 1 (Nassau grouper), Snapper Unit 1 (silk, black, blackfin, vermilion), and Grouper Unit 4 (yellowfin, red, tiger, yellowedge, misty): (http://www.nmfs.noaa.gov/sfa/statusoffisheries/2009/fouthquarter/q4_2009_fssi_nonfssi_stocks.pdf). For the USVI, reference points for individual sub-units within the current snapper and grouper units cannot be confidently derived. Similar considerations apply for the proposed sub-units (Table 4.1.1). Although species-specific commercial landings

records are available for Puerto Rico, variable proportions of the landings of any species within each of the snapper and grouper complexes are reported to an unclassified category rather than to an identified species category. For grouper, the contribution of unclassified fish ranges from 35-53% of the classified landings during the pertinent 1999-2007 period. Determining average catch levels as a proxy for MSY therefore requires either that landings included in the unclassified category be redistributed among identified species or that those unclassified landings not be included in the determination of the MSY proxy. The former is replete with complications, as no reliable method of redistributing the unclassified catch is available. An approach that was considered involved distributing the unclassified catch among the identified species in direct proportion to the amount of landings recorded each year for each species. However, that approach increases the average annual catch level for those species that are most frequently caught and that therefore would be expected to be most frequently and successfully identified. The result would be to increase harvest pressure on those species that are already experiencing the greatest harvest pressure, while simultaneously reducing harvest opportunities for many species that are less effectively identified but that may serve an essential role in dispersing harvest pressure. The latter method of handling unclassified landings, to ignore them completely, reduces the estimated average annual catch by excluding legitimate and viable harvest, thereby operating in contradiction to NS1 of the MSA. The same considerations apply for snapper although the situation is better because only about 6% of the Puerto Rico landings are being reported to an unclassified category. Of course, that still constitutes roughly one of every 20 fish.

Alternative 2 requires defining aggregate reference points for both snapper and grouper. This alternative would support MSY proxy analyses at the level of the complex because those data are available for both the USVI and for Puerto Rico. If this alternative is chosen, landings for all managed species and for the unclassified portion of the landings would be combined within each complex. No redistribution of unclassified landings would be required and the ACL derived from this approach would be based upon all recorded landings within each complex. Because the ACL is comprehensive within each complex, changes in the pattern of identification of the species that comprise the complex would have no effect on the tracking of regulated harvest. Additionally, no burden would be added to the fishermen, managers, or enforcement officers due to biases associated with species-specific identification that would be required in some but not other areas and for some but not other species. Sub-alternatives provide for aggregating data only for Puerto Rico, only for the USVI, or for both island groups. As noted above, if data are aggregated for both snapper and grouper, then aggregation can be accomplished for either island group or for both island groups although the most consistent approach would be to aggregate individually within both of the island groups. Additionally, limitations in the presently available commercial landings data make it very difficult to not aggregate the USVI data (**Sub-alternative A**).

Alternative 3 requires defining aggregate reference points for grouper but not for snapper. Thus, commercially landed snapper would be identified to species and the resultant landings data assigned to sub-units as appropriate. Annual catch of grouper would also be identified to species but would be managed as a complex. As discussed above, the option

would exist to redistribute (or not) the landings of those snapper that are unclassified, but because the unclassified landings equal only about 6% of the classified landings of snapper, the consequences resulting from the choice of redistribution strategies (including not redistributing the unclassified landings) would be considerably less than for grouper. However, there is a risk with this approach that fishermen could circumvent the ACL assigned to Snapper Unit 1 by assigning fish to the unclassified category. If effected, that outcome would potentially compromise catch restrictions for Snapper Unit 1 and could render management of that unit ineffective. However, for snapper in Puerto Rico, the ratio of unclassified to classified commercial landings has remained stable at about 5-7% since 1999 and has not exceeded 10% since 1983 (Figure 4.3.1). Continuous monitoring of that ratio would provide an early warning that fewer snapper are being identified to species relative to those that are unclassified and would suggest that the cause needs to be investigated.

Considerations regarding the sub-alternatives contained within **Alternative 3** are similar to those for the sub-alternatives contained within **Alternative 2**. Again for the USVI, the available data are not conducive to estimating an MSY proxy for the FMUs that comprise each of the snapper and grouper family-complexes because species-level data do not exist. Species-level data are available for Puerto Rico and are particularly viable for the snapper FMUs because (as noted previously) roughly 94% of commercial snapper landings in Puerto Rico are reported to species. **Sub-alternative 3A** is therefore not easily accomplished although **Sub-alternatives 3B** and **3C** would be.

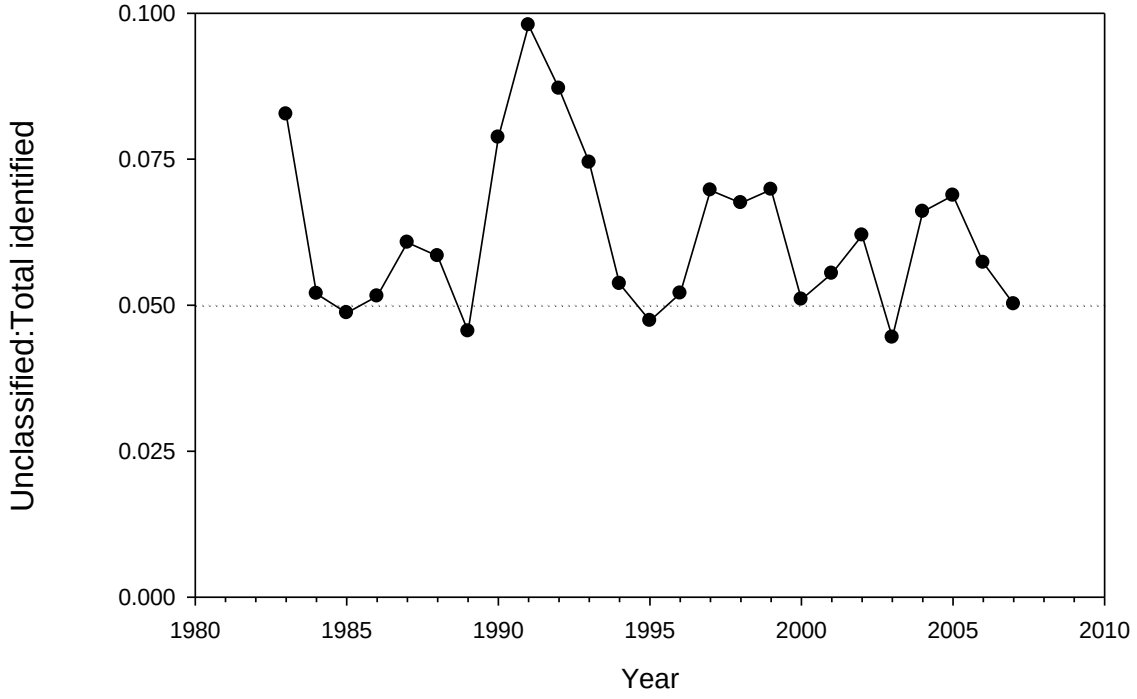


Figure 4.3.1. Ratio of unclassified to total classified (i.e., identified to species) commercial snapper landings in Puerto Rico.

Preferred Alternative 4 was added at the request of the Council and adopted as the preferred alternative in Action 3(a). In the USVI, the commercial data for snapper and grouper are in aggregate form only, thereby essentially requiring that aggregate reference points be defined for snapper and grouper units in the USVI. This alternative also requires defining aggregate reference points for grouper in Puerto Rico, reflecting a concern by the Council for the large proportion of unclassified landings inherent in the Puerto Rico grouper data. However, based on the availability of species-specific data for snapper in Puerto Rico and on the relatively small proportion of unclassified landings within the snapper category, the Council's preferred option is to define unit-specific reference points for snapper in Puerto Rico. Less than 10% of the reported commercial landings of snapper in Puerto Rico are not reported to species. Commercial fishers have been reporting by species in Puerto Rico, and increased reporting to species is a goal of ongoing efforts by the local governments, the SEFSC, and the NMFS in cooperation with the commercial fishers of the U.S. Caribbean. NS1 also directs the use of species-specific data when available.

4.3.2 Action 3(b) Commercial and recreational sector allocation/management (Puerto Rico only)

Alternative 1. No action. Do not specify sector-specific annual catch limits.

Alternative 2. (**PREFERRED**) Specify separate commercial and recreational annual catch limits based on the preferred management reference point time series.

Discussion: Action 3(b) applies only to Puerto Rico waters because recreational harvest data are not available for the USVI. In Puerto Rico, the MRFSS program has been underway since 2000. That program obtains estimates of recreational harvest from statistically based telephone surveys and face-to-face intercepts of recreational fishers, for finfish species including snapper, grouper, and parrotfish. Queen conch is not included in the program.

The no action alternative (**Alternative 1**) would result in a conglomerate annual catch limit for the recreational and commercial sectors. A single annual catch limit would be established, and when that annual catch is achieved both the recreational and commercial harvest for the specified species or species-group would be subject to application of appropriate in-season AMs, assuming that efforts to improve data collection for both the recreational and commercial fisheries are successful to the point of allowing in-season management. If data collection programs are not sufficient to support in-season management, AMs would be applied in following seasons to account for overages. Concern has been expressed by recreational and particularly charter boat interests regarding this approach. Specifically, it is argued that impacting recreational fisheries when a single annual quota is reached is unfair and economically untenable because the catch and rate of catch would be set by commercial harvesters. Preferred **Alternative 2** avoids that problem by completely separating the commercial and recreational harvest quotas. Each fishery would be assigned an ACL, and as each sector achieves their quota

either fishing activity by that sector would end or sector-specific AMs would apply, with no implications for the other sector. This alternative would function within the constraints of present data collection efforts via AMs applied in subsequent harvest seasons, with fulfillment of the commercial harvest quota being monitored via commercial catch records and fulfillment of the recreational harvest quota being monitored via MRFSS (or MRIP). However, because there is presently no complimentary data being acquired for the USVI recreational fishery, a similar approach will not work there. Instead, at least until a recreational harvest monitoring program is installed in the USVI, a single quota based upon commercial catch records would have to be established for the USVI.

The Council chose **Alternative 2** as preferred in Action 3(b) since the data for the recreational sector are available from 2000 to 2007 for Puerto Rico. The recreational harvest in Puerto Rico is significant and each sector should be allocated ACLs accordingly. The recreational harvest in the USVI appears not to be as significant (based on limited surveys) and efforts are underway by the local government to regulate this sector.

4.3.3 Action 3(c) Geographic allocation/management

Alternative 1. No Action. Maintain U.S. Caribbean-wide reference points.

Alternative 2. **(PREFERRED)** Divide and manage annual catch limits by island group (i.e., Puerto Rico, STT/STJ, STX) based on the preferred management reference point time series (Table 4.3.1 and Action 2).

A. (**PREFERRED**) Use a mid-point or equidistant method for dividing the EEZ among islands.
B. Use a straight line approach for dividing the EEZ among islands.
C. Use the St. Thomas Fishermen's Association line.

Discussion: Action 3(c) addresses the opportunity to partition the EEZ consistent with the allocation of fishing regulations among the islands (Puerto Rico and STX) or island groups (STT/STJ). Partitioning management among the described islands or island groups has been expressed as a desire of local fishers, the fishing community, and the local governments. Those entities emphasize differences among the islands in terms of culture, markets, gear preferences, and seafood preferences as the basis for such a management regime.

Alternative 1 would maintain the presently extant situation. In that scenario, the U.S. Caribbean would continue to be managed as a single unit. Resource harvested anywhere within the EEZ could be landed on any of the islands or island groups, as long as the fishers are properly permitted, and would therefore count towards the ACL for that resource. Consequently, one island could have negative impacts on the availability of a target stock on another island by impacting present or future harvest of a particular resource.

Table 4.3.1. Average annual landings in pounds of conch, parrotfish, snapper, and grouper from each of Puerto Rico, St. Thomas/St. John, and St. Croix for each of the year-sequence (1999-2005, 1999-2007, 2003-2007) alternatives discussed in Action 2 of this amendment. Snapper and grouper FMUs are based upon the proposed species composition as described in Table 4.1.1. Also included are averages for 2006-2007, the two available post-Comprehensive SFA Amendment years, for comparison with the year-sequence alternatives. Table A summarizes Puerto Rico commercial landings, Table B summarizes Puerto Rico recreational landings in pounds (numbers of fish reported are in parentheses), Table C summarizes St. Thomas/St. John commercial landings, Table D summarizes St. Croix commercial landings, and Table E provides the summary totals.

A) Puerto Rico average commercial landings

FMU/Year Sequence	1999-2005	1999-2007	2003-2007	2006-2007
Conch	403,349	369,298	384,584	250,122
Parrotfish	127,980	111,614	101,084	54,332
Snapper				
Unit 1	334,923	294,118	240,463	151,300
Unit 2	171,666	167,075	192,721	151,007
Unit 3	406,794	357,281	321,952	183,987
Unit 4	439,171	394,787	351,629	239,445
Unclassified	80,114	71,001	64,930	39,104
Total	1,432,668	1,284,262	1,171,695	764,843
Grouper				
Unit 1	17,469	14,066	7,423	2,152
Unit 2	735	572	995	0
Unit 3	112,875	95,626	79,201	35,254
Unit 4	5,720	5,035	4,710	2,641
Unit 5	9,477	9,356	10,138	8,929
Unclassified	62,563	54,138	44,474	24,649
Total	208,839	178,793	146,941	73,625

B) Puerto Rico average recreational landings

FMU/Year Sequence	1999-2005	1999-2007	2003-2007	2006-2007
Conch	N/A	N/A	N/A	N/A
Parrotfish	37,042 (22,128)	29,464 (17,853)	25,650 (13,726)	6,730 (5,027)
Snapper				
Unit 1	112,384 (97,879)	135,565 (112,851)	133,829 (120,137)	205,109 (157,768)
Unit 2	40,953 (9,250)	32,846 (7,860)	16,477 (6,027)	8,528 (3,690)
Unit 3	97,833 (91,793)	90,649 (92,272)	83,372 (80,233)	69,097 (93,711)
Unit 4	33,540 (32,783)	29,307 (32,071)	29,587 (34,226)	16,607 (29,935)
Unclassified	8,130 (6,336)	6,098 (4,752)	0 (0)	0 (0)
Total	292,840 (238,041)	294,465 (249,806)	263,265 (240,623)	299,341 (285,104)
Grouper				
Unit 1	6,172 (574)	7,975 (915)	11,251 (1,289)	13,383 (1,937)
Unit 2	6,501 (716)	4,875 (537)	0 (0)	0 (0)
Unit 3	72,063 (108,149)	62,994 (91,529)	69,430 (98,691)	35,788 (41,671)
Unit 4	4,581 (306)	4,945 (367)	6,162 (437)	6,035 (548)
Unit 5	1,522 (349)	1,142 (262)	1,361 (330)	0 (0)
Unclassified	0	0	0	0
Total	90,839 (110,094)	81,931 (93,610)	88,204 (100,747)	55,206 (44,156)

DRAFT

Table 4.3.1 (continued). Average annual landings in pounds of conch, parrotfish, snapper, and grouper from each of Puerto Rico, St. Thomas/St. John, and St. Croix for each of the year-sequence (1999-2005, 1999-2007, 2003-2007) alternatives discussed in Action 2 of this amendment. Snapper and grouper FMUs are based upon the proposed species composition as described in Table 4.1.1. Also included are averages for 2006-2007, the two available post-Comprehensive SFA Amendment years, for comparison with the year-sequence alternatives. Table A summarizes Puerto Rico commercial landings, Table B summarizes Puerto Rico recreational landings in pounds (numbers of fish reported are in parentheses), Table C summarizes St. Thomas/St. John commercial landings, Table D summarizes St. Croix commercial landings, and Table E provides the summary totals.

C) St. Thomas/St. John average commercial landings

FMU/Year Sequence	1999-2005	1999-2007	2003-2007	2006-2007
Conch	1,649	1,876	1,981	2,557
Parrotfish	48,818	47,245	49,353	42,528
Snapper	157,382	159,594	156,792	166,231
Grouper	60,999	59,952	64,201	56,812

D) St Croix average commercial landings

FMU/Year Sequence	1999-2005	1999-2007	2003-2007	2006-2007
Conch	107,720	116,899	138,587	149,026
Parrotfish	293,219	308,333	336,114	361,229
Snapper	121,113	123,217	134,046	130,581
Grouper	35,806	34,177	37,832	28,475

E) Summary U.S. Caribbean average commercial and recreational landings

FMU/Year Sequence	1999-2005	1999-2007	2003-2007	2006-2007
Conch	512,718	488,073	525,152	401,705
Parrotfish	507,059	496,656	512,201	464,819
Snapper	2,004,003	1,861,538	1,725,798	1,360,996
Grouper	396,483	354,853	337,178	214,118

Preferred Alternative 2 establishes separate ACLs for the individual U.S. Caribbean islands, based upon the combined territorial and EEZ landings for that island (Table 4.3.1). The applicable year-sequence used to determine ACLs are established by the alternatives included within Actions 2(a) and 2(b). Action 3(c) **Preferred Alternative 2** also establishes the boundaries that define the EEZ waters for each island or island group (Figure 4.3.2).

Three alternative EEZ boundary approaches are included for **Preferred Alternative 2** of Action 3(c) and are illustrated in Figure 4.3.2. **Preferred Sub-alternative A** uses an equidistant method to partition the EEZ among islands. For this approach, start with the USVI and choose several points equidistant from sections of the southern edge of the territorial boundary of St. Thomas/St. John and the northern edge of the territorial boundary of St. Croix to establish a line separating the two island masses. Draw the line from east, starting at the U.S. Caribbean EEZ boundary, to west toward the Puerto Rico

territorial sea boundary. Next, establish several points equidistant from the southeastern edge of the Puerto Rico territorial boundary and the northwestern territorial boundary of St. Croix. Draw the line northeast to southwest. Terminate the line in the northeast where it intersects the previously drawn line separating St. Thomas/St. John and St. Croix. Terminate the line in the southwest upon reaching the 65^0 20' meridian. From that point, extend the line due south to the edge of the U.S. Caribbean EEZ. This described boundary represents the St. Croix portion of the U.S. Caribbean EEZ and the southern portion of the allocated St. Thomas/St. John EEZ.

At the northeastern portion of the Puerto Rico territorial boundary where it intersects with the northwestern potion of the St. Thomas/St. John territorial boundary, establish a line northward parallel with the extreme northeastern boundary of the U.S. Caribbean EEZ and terminate the line where it intersects the edge of the U.S. Caribbean EEZ. This described boundary represents the northern portion of the St. Thomas/St. John EEZ.

The remainder of the EEZ that is not part of the allocated St. Thomas/St. John or St. Croix EEZs will define the allocated Puerto Rico EEZ.

Sub-alternative B uses a straight line method to allocate the U.S. Caribbean EEZ among islands. From the east-west portion of the U.S. Caribbean EEZ boundary south of St. Thomas/St. John, extend a line westward to the Puerto Rico territorial boundary. From that point extend a line south to the southern edge of the U.S. Caribbean EEZ. This described boundary represents the St. Croix EEZ and the southern portion of the St. Thomas/St. John EEZ.

From the intersection of the northeastern Puerto Rico territorial boundary and the northwestern St. Thomas/St. John territorial boundary extend a line due north until it intersects with the U.S. Caribbean EEZ boundary. This described boundary represents the northern portion of the St. Thomas/St. John EEZ.

The remainder of the EEZ that is not part of the allocated St. Thomas/St. John or St. Croix EEZs will define the allocated Puerto Rico EEZ.

The layout of the boundaries for **Sub-alternative C** are identical to those for **Sub-alternative B**, except that the north-south line delineating the boundary between Puerto Rico and St. Thomas follows the 65° 10' line of longitude and is therefore shifted slightly to the west relative to **Sub-alternative B**. The horizontal line defining the boundary between the STT and Puerto Rico EEZs is parallel to that same line in **Sub-alternative B**, except that the **Sub-alternative C** line is shifted 3.9 nm (7.2 km) to the west of the **Sub-alternative B** line on the north side of those two islands and 1.9 nm (3.5 km) to the west of the **Sub-alternative B** line on the south side of those two islands.

The Council chose **Alternative 2**, **Sub-alternative A** in Action 3(c) as the preferred alternative in the public hearing draft document. The fish will be assigned where they are landed to be counted against the ACL for each island. This alternative reflects the need to monitor landings to determine when ACLs are reached in each of the geographic areas,

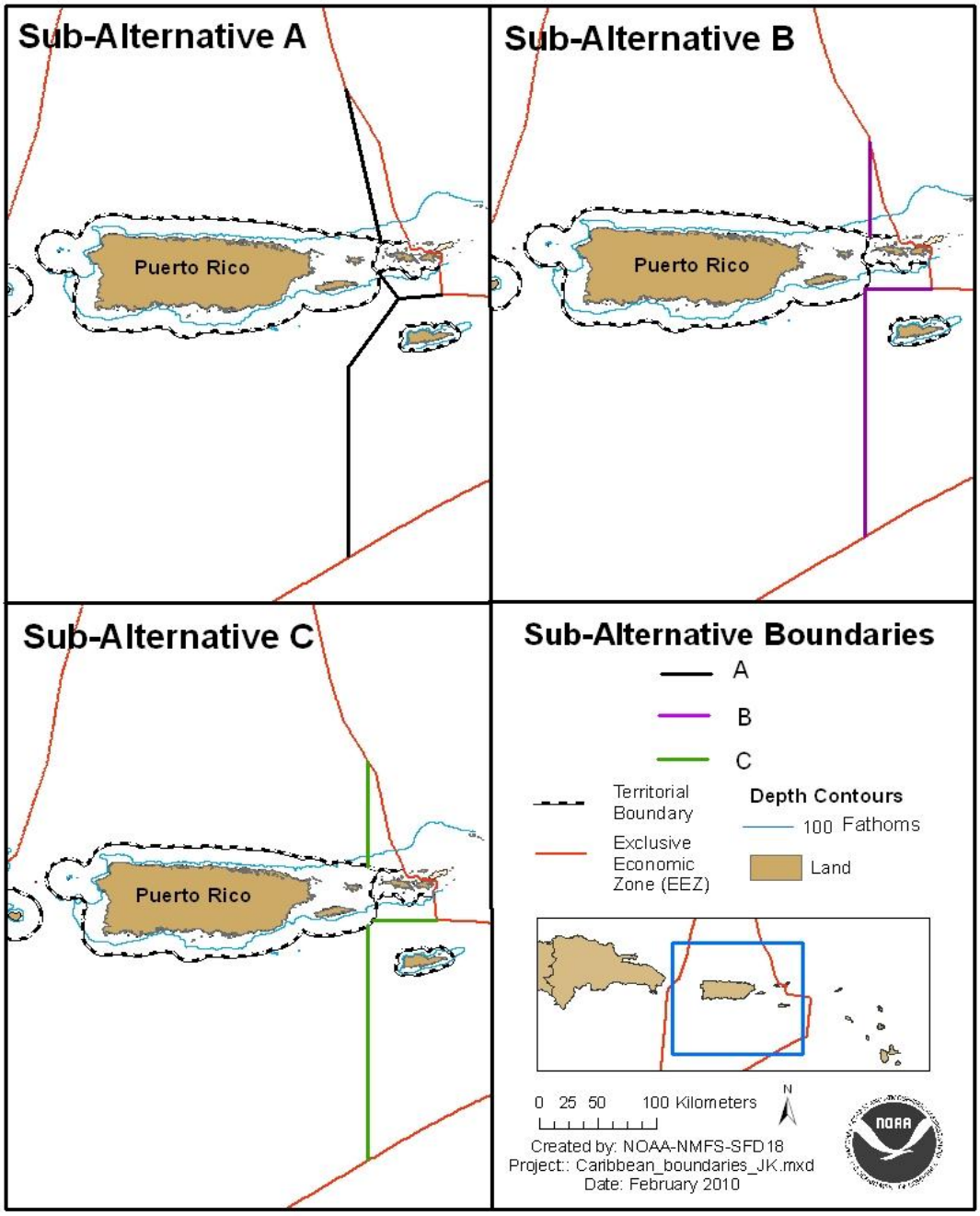


Figure 4.3.2. Alternative proposed boundaries for subdividing the U.S. Caribbean Exclusive Economic Zone by island group. **Alternative 1** is the equidistant approach, **Alternative 2** is the straight line approach, and **Alternative 3** is the St. Thomas Fisherman's Association approach.

since AMs will be triggered if the ACLs are surpassed. None of the alternatives are dramatically different but the equidistant alternative chosen by the Council is the most objective alternative.

4.3.4 Summary Comparison of Annual Catch Limit Allocation/Management Alternatives

Action 3(a) provides options to either adhere to the FMUs described in Table 4.1.1 or to aggregate within either or both the snapper and grouper complexes, within either or both of the USVI and Puerto Rico. The no action alternative (**Alternative 1**) provides the highest resolution of data so would best resolve management if adequate data were available with which to determine FMU-specific ACLs. Unfortunately, as described in Section 3.3, this is not the case. Species-specific landings data are not available for the USVI. Puerto Rico landings ostensibly are collected at the level of species, but in practice that goal is achieved to a variable degree. Snapper data are adequate for consideration at the species level, at least for determination of ACLs, because unclassified landings equate to roughly 6% of the classified landings. In contrast, grouper data are less suitable for analysis at the species level because unclassified landings range between 35-53% of the classified landings for the period of interest (1999-2007). **Alternative 2** requires that recorded landings be aggregated within each of the snapper and grouper complexes, and this can be accomplished for each of the three proposed sub-alternatives. This alternative does not take full advantage of the available data because species-specific data are available for Puerto Rico. **Alternative 3** appears to take best advantage of the available data to establish ACLs and to thereby manage interrelated stocks of fish as a unit to the greatest extent practicable. Data are aggregated for the grouper family-complex, for which species-level data are unavailable to a substantial degree. Data are analyzed at the level of the FMU for snapper, for which apparently reliable species-level data are available (with a roughly 6% error) from Puerto Rico. However, this alternative requires that snapper be managed as individual units in both Puerto Rico and the USVI. Unfortunately, USVI snapper data are not reported to species and therefore unit-level management of snapper in the USVI is not presently possible. **Preferred Alternative 4** specifically addresses the type of data available for each of the snapper and grouper units from each of the islands in the U.S. Caribbean. It considers the species-specific data available for snapper in Puerto Rico as well as the aggregate snapper for the USVI and the aggregate grouper for both Puerto Rico and the USVI.

Action 3(b) provides options to allocate ACLs between the commercial and recreational sectors. This action is specific to Puerto Rico because adequate recreational harvest data are not available for the USVI. However, recreational landings data are available for Puerto Rico for the years 2000-2007 and commercial landings data are also available for that time period. **Alternative 1** is the no action alternative; no sector-specific ACLs would be specified. This alternative provides the least precise management of the commercial and recreational fisheries. **Alternative 1** does not assure that management measures are based upon the best available science because, although sector-specific harvest data are collected by Puerto Rico, those data would be blended to develop a single ACL. **Alternative 1** also does not fully align with NS4 by ensuring that management measures are carried out in such manner that no particular individual, corporation, or other

entity acquires an excessive share. By blending the commercial and recreational data and setting a single ACL for both sectors, it is likely that one sector will exceed what would have been their sector-specific ACL, thereby usurping resource that would otherwise have been assigned to the ACL of the other sector. **Preferred Alternative 2** would result in the setting of separate ACLs for the recreational and commercial sectors. This alternative best responds to the obligations of the MSA National Standards. This approach has the added advantage of utilizing the data as they are reported. Whereas commercial landings are reported in pounds, recreational landings are reported as number of fish (Table 4.3.1). Numbers can be converted to pounds, and those converted weight estimates have been included in Table 4.3.1 as provided by the SEFSC. There is considerable concern among recreational fishers that establishing a single ACL to be shared by the commercial and recreational sectors may simply act to increase the commercial ACL. Concomitant with that would be an increase in commercial effort to take advantage of that increased opportunity. Upon fulfillment of the quota, which may occur relatively early in the calendar year, both the commercial and recreational sectors of the fishery would be subject to AMs dependent upon data availability as noted above.

Action 3(c) addresses the conflict between insular-specific management regimes in territorial waters versus a U.S. Caribbean-wide EEZ. This situation creates problems with properly attributing harvest from the EEZ to the appropriate island or island group. **Alternative 1** maintains the present situation, allowing harvest from throughout the U.S. Caribbean EEZ with resultant landings being counted against a cumulative quota rather than against a quota that is specific to an island or island group. **Preferred Alternative 2** links island-specific quotas with a predefined area, such that upon satisfying an individual species' quota for a particular island or island group, the fishery within that predefined area of the EEZ would be subject to AMs.

Preferred Alternative 4 and **Alternatives 1 through 3** of Action 3(a) would have no direct economic or social impact. However, **Preferred Alternative 4** and **Alternatives 1** through **3** could indirectly affect the economic and social environments by fostering regulatory changes that could have short-term adverse economic and social impacts on fishers, their families, and fishing communities but could have long- term net benefits. The actual impacts, however, are dependent upon the chosen alternatives of the previous proposed actions (Actions 1 and 2), AMs (Action 5), regulations that trigger the AMs (Action 5), other regulations (including Action 6) that combine to rationalize the fishery, and other environmental factors.

Alternative 1, Alternative 2A and **Alternative 3A** would not be consistent with USVI reporting requirements that have not specified landings of snapper and grouper by species. **Alternatives 2B, 2C, 3B**, **3C**, and **Preferred 4** are consistent with USVI and Puerto Rico reporting requirements and would base ACLs on the data as they are reported. Because of this consistency, any one of these five alternatives would support better management of the fishery(ies) and indirectly yield larger long-term net economic and social benefits than **Alternative 1, 2A** or **3A**; however, actual benefits are dependent upon the chosen alternatives of the previous proposed actions (Actions 1 and 2), AMs (Action 5),

regulations that trigger the AMs (Action 5), other regulations (including Action 6) that combine to rationalize the fishery, and other environmental factors.

Because **Alternative 2A** of Action 3(a) would define aggregate reference points for the snapper and grouper units for Puerto Rico only, it follows that this alternative would, by default, define the targets and thresholds for the Snapper and Grouper Sub-units for the USVI only. That is problematic, however, because the USVI has not required commercial fishers to report landings of snapper or grouper by species.

Alternative 2B of Action 3(a) would define aggregate reference points for the Snapper and Grouper FMUs for the USVI only, which is consistent with reporting practices in the USVI. When coupled with **Alternative 4c** of Action 2(a), **Alternative 2B** would specify the largest ACL for each of the two FMUs in the USVI and would allow for the largest annual aggregate catches which could yield the largest economic and social benefits from the two fisheries. However, the actual impacts would be dependent upon the AMs, the regulations that implement the measures, other regulations, and other environmental factors.

Because **Alternative 2B** of Action 3(a) would establish aggregate reference points for the Snapper and Grouper FMUs for the USVI only, by default, it would also establish reference points for the snapper and grouper Sub-units for Puerto Rico only. When coupled with **Alternative 2c** of Action 2(a), **Alternative 2B** of this action would allow for the largest annual catch of each Snapper sub-unit in Puerto Rico and could indirectly yield the largest economic and social benefits that derive from harvesting these resources. When coupled with **Alternative 2c** of Action 2(a), **Alternative 2B** would allow for the largest annual catch of Grouper Units 1, 2 and 3 in Puerto Rico, and could indirectly yield the largest economic and social benefits that derive from harvesting these resources. **Alternative 2B** of Action 3(a) coupled with **Alternative 4c** of Action 2(a) would allow for the largest annual catch of Grouper Units 4 and 5 in Puerto Rico and could indirectly yield the largest economic and social benefits that derive from harvesting these resources. However, the actual outcomes and rankings are dependent upon the specification of the AMs, regulations that implement those measures, other regulations that rationalize the fishery, and other environmental factors.

When combined with **Alternative 2c** of Action 2(a), **Alternative 2C** of this action would allow for the largest annual catches of Snapper and Grouper in Puerto Rico, which could indirectly yield the largest economic and social benefits that derive from harvesting the FMUs. **Alternative 2C** of this action in combination with **Alternative 4c** of Action 2A would allow for the largest annual catches of snapper and grouper in the USVI, which could indirectly yield the largest economic and social benefits that derive from harvesting the FMUs. However, the actual outcomes and rankings are dependent upon the specification of the AMs, regulations that implement those measures, other regulations that rationalize the fishery, and other environmental factors.

When coupled with **Alternative 2c** of Action 2(a), **Alternative 3A** of this action would allow for the largest catch of grouper, which could indirectly yield the largest economic

and social benefits that derive from the exploitation of the resource. However, the actual benefits and ranking of the alternatives are dependent upon the AMs, regulations that implement the measures, other regulations, and other environmental factors. Because **Alternative 3A** of Action 3(a) would define aggregate reference points for the Grouper FMU for Puerto Rico only, it would not change the part of **Alternative 1** of Action 3(a) that would define reference points for sub-units within the Snapper FMU either for the U.S. Caribbean as a whole or by territory and reference points for sub-units of the Grouper FMU in the USVI.

When coupled with **Alternative 4c** of Action 2(a), **Alternative 3B** of this action would allow for the largest annual catch of grouper in the USVI, which could indirectly generate the largest economic and social benefits from harvesting the resource. However, the actual benefits are dependent upon the specification of the AMs, regulations that implement those measures, other regulations, and other environmental factors.

When coupled with **Alternative 2a** of Action 2(a), **Alternative 3C** of this action would allow for the largest annual catch of grouper in Puerto Rico and could indirectly result in the largest economic and social benefits that derive from harvesting the resources. When **Alternative 3C** is combined with **Alternative 4c** of Action 2(a), **Alternative 3C** would allow for the largest annual catch of grouper in the USVI and could indirectly result in the largest economic and social benefits that derive from harvesting the resources. However, actual benefits and ranking of the benefits are dependent upon AMs, regulations that implement those measures, other regulations, and other environmental factors.

Preferred Alternative 4 of Action 3(a) applies **Alternative 2B** to the USVI, which is consistent with reporting practices in the USVI. **Preferred Alternative 4** of Action 3(a) applies **Alternative 3A** to Puerto Rico, which would define aggregate reference points for the Grouper FMU for Puerto Rico only, which is consistent with Puerto Rico's reporting practices. When coupled with **Preferred Alternative 2e** of Action 2(a), **Preferred Alternative 4** of Action 3(a) would allow for the third largest annual catch of each snapper sub-unit in Puerto Rico. However, the actual impacts would be dependent upon the accountability measures, the regulations that implement the measures, other regulations, and other environmental factors.

With regard to Action 3(b), **Alternative 1** and **Preferred Alternative 2** would not have a direct economic or social impact. **Alternative 1**, the no action alternative, would not specify sector-specific reference points, which could cause commercial and recreational fishers to compete for a single ACL. Commercial fishers with larger vessels and gears capable of catching more of the fish in the same or a shorter period of time would be favored over Puerto Rico's recreational and subsistence fishers if there was a race for a single ACL and overcapacity was allowed. **Preferred Alternative 2**, however, would specify separate commercial and recreational annual catch limits in Puerto Rico that are based on the specifications of the MSY, OFL, and OY that are chosen from combining alternatives of Actions 1, 2 and 3a. However, commercial fishers with larger vessels and gears capable of catching more of the fish in the same or a shorter period of time would be favored over Puerto Rico's historic artisanal fishers if there was a race for a commercial

ACL and overcapacity was allowed. Such an environment could result in lower long-term benefits that derive from the resource and the ecosystem of which it is part, and a transfer of economic and social benefits from artisanal to industrial fishers. The actual indirect economic and social impacts, however, would be dependent on if the regulatory and economic environments support such competition for an ACL.

Alternative 1 and **Preferred Alternative 2** of Action 3(c) would not have a direct economic or social impact. **Alternative 1**, the no action alternative, would maintain Caribbean-wide reference points and could create territorial and/or sector competition in the EEZ. This alternative also would be in contradiction to present federal regulations that restrict queen conch fishing and possession. If combined with **Alternative 1** of Action 3(b), **Alternative 1** would establish a single ACL for a unit or sub-unit for which commercial and recreational fishers of Puerto Rico and the USVI would compete. If **Alternative 1** of Action 3(c) is combined with **Preferred Alternative 2** of Action 3(b), recreational fishers of Puerto Rico would be in competition with recreational fishers of the USVI for the U.S. Caribbean-wide recreational ACL and commercial fishers of Puerto Rico would be in competition with commercial fishers of the USVI for the U.S. Caribbean-wide commercial ACL. Fishers with larger vessels and gears capable of catching more of the fish in the same or a shorter period of time would be favored over other fishers if there was a race for the catch and overcapacity was allowed.

Preferred Alternative 2 of Action 3(c) would divide the Caribbean EEZ into three parts. It would not prevent fishers from each island group (Puerto Rico, St. Thomas/St. John, and St. Croix) from fishing in the EEZ of the other island groups, but their catch would be charged to the island upon which it is landed. Once the ACL for a species or species group is reached on an island, the fishery in the EEZ off that island would be subject to appropriate AMs. **Preferred Alternative 2** would not prevent fishermen from fishing for that species or species group elsewhere in the EEZ and landing their catch where the ACL has not been reached, if they are appropriately licensed to do so. It is expected that most fishermen who fish in federal waters do so in the federal waters closest to their home island. It is possible that **Preferred Alternative 2** could have a greater beneficial economic and social impact on St. Thomas/St. John and St. Croix fishers than fishers from Puerto Rico because a larger percent of fishable habitat is found in federal waters off St. Thomas/St. John and St. Croix than in federal waters off Puerto Rico. It is also possible that **Preferred Alternative 2** of Action 3(c) may have a larger adverse economic and social impact on Puerto Rico fishermen than USVI fishermen because Puerto Rico does not limit the number of commercial fishing licenses and the USVI does. USVI fishermen could buy a Puerto Rico commercial fishing license and land their catches in Puerto Rico after the ACL is met in their USVI island areas, but Puerto Rico's commercial fishermen could not similarly buy a USVI commercial license to land their catches in the USVI because of a moratorium on commercial fishing license in the USVI.

DRAFT

4.4 ACTION 4: Management Measures

4.4.1 Action 4(a) Species-specific parrotfish prohibitions

Alternative 1. No action. Do not establish species-specific prohibitions on parrotfish harvest.

Alternative 2. (**PREFERRED**) Prohibit fishing for or possessing in the EEZ:

A. Midnight parrotfish
B. Blue parrotfish
C. Rainbow parrotfish

Discussion: Action 4(a) addresses concerns regarding the harvest of parrotfish, particularly the three largest species of parrotfish (midnight, blue, rainbow) that occur in U.S. Caribbean waters. Regarding those three large parrotfish, concern relates to the potential overharvest of these species due to their combination of large body size, a high susceptibility to spear gear and fish traps (Mumby et al. 2006), resultant relatively low resilience, and lack of abundance compared with most parrotfish occupying U.S. Caribbean waters (Table 4.4.1).

Table 4.4.1. Biological characteristics of common U.S. Caribbean parrotfish.

Common Name	Genus/species	Max size (cm)	Depth range (m)	Population doubling time	Resilience	Abundance
Blue parrotfish	*Scarus coeruleus*	120	3-25	1.4-4.4 yrs	medium	occasional
Midnight parrotfish	*Scarus coelestinus*	77	5-75	1.4-4.4 yrs	medium	occasional
Rainbow parrotfish	*Scarus guacamaia*	120	3-25	1.4-4.4 yrs	medium	occasional
Queen parrotfish	*Scarus vetula*	61	3-25	<15 months	high	common
Princess parrotfish	*Scarus taeniopterus*	35	2-25	<15 months	high	common
Striped parrotfish	*Scarus iseri*	35	3-25	<15 months	high	common
Redband parrotfish	*Sparisoma aurofrenatum*	28	2-20	1.4-4.4 years	medium	common
Redfin parrotfish	*Sparisoma rubripinne*	48	1-15	<15 months	high	common
Redtail parrotfish	*Sparisoma chrysopterum*	*46*	1-15	<15 months	high	common
Stoplight parrotfish	*Sparisoma viride*	64	3-50	1.4-4.4 years	medium	common

Source: Humann 1994 and www.fishbase.com.

DRAFT

Regarding parrotfish in general, these fish provide an essential ecological service to coral reef ecosystems and therefore can be classified as Valued Ecosystem Components (VEC; Beanlands and Duinker 1983, Volety et al. 2009) of U.S. Caribbean coral reefs (which also function as a VEC (Mumby 2006)). Parrotfish are grazers, and since the Caribbean-wide decline of the urchin *Diadema antillarum* in the early 1980s they have become the predominant grazer on many Caribbean reefs (Mumby et al. 2006). The grazing activities of parrotfish act to control the growth of non-calcareous algae and thereby enhance successful settlement and survival of coral propagules (Brock 1979, Steneck 1997). Moreover, as coral cover declines, reversing the decline becomes more difficult and the level of grazing required to reverse the decline increases (Mumby et al. 2007). Parrotfish are therefore an integral and essential component of the coral reef ecosystem.

A variety of parrotfish species inhabit U.S. Caribbean coral reefs. Ten species are presently included in the reef-fish FMU (Table 4.4.1, Appendix 2), but at least two other species (greenblotch, *Sparisoma atomarium*, and emerald, *Nicholsina usta*) have been occasionally reported as recreational catch although some doubt remains as to the validity of these reports. Greenblotch parrotfish are considered to be large if they reach a size of 3.5 in (7.0 cm) and emerald parrotfish may achieve a size of 7.0 in (15 cm). It is therefore unlikely that either species would be of interest to recreational spear fishers, the gear typically used by recreational fishers to harvest parrotfish because parrotfish generally are not susceptible to hook-and-line fishing. More likely, catch reports involving these two species are in reference to the rainbow parrotfish (*Scarus guacamaia*), which may grow to 3 ft (1 m) and may have a green blotch or emerald color pattern.

Of the ten species included in the FMU, the three largest (blue, midnight, rainbow) are of greatest conservation concern because of their relatively long population doubling time, low resilience, susceptibility to spear gear, hermaphroditism, and low abundance on Caribbean reefs (Table 4.4.1). Moreover, these three species are territorial and haremic (Robertson and Warner 1978), resulting in bias towards terminal phase males and a female-oriented sex ratio (Streelman et al. 2002). Those traits tend to reduce effective population size (the number of males that successfully contribute gametes to the next generation), further exacerbating reductions in overall population size. Thus, although healthy populations of all parrotfish species contribute to healthy coral reef communities, biological characteristics of the three largest species dictate that they be managed with particular caution.

The SSC recommended to the Council that the take of blue, midnight and rainbow parrotfish be prohibited. The conclusion of the SSC was based on the testimony of local fishers regarding an apparently significant decrease in the presence of these fish on shallow water reefs, information from the literature, and the scientists' personal observations and research. Thus, the Council chose the SSC's recommendation (**Alternative 2** in Action 4(a)) as the preferred alternative, including all three sub-alternatives.

4.4.2 Action 4(b) Recreational bag limits

Alternative 1. No action. Do not establish bag limit restrictions on recreational reef fish harvest.

Alternative 2. Specify a 10-fish aggregate bag limit per person (would not apply to a fisherman who has a valid commercial fishing license issued by Puerto Rico or the USVI) for:

A. Species in the Snapper FMU
B. Species in the Grouper FMU
C. Species in the Parrotfish FMU

Alternative 3. Specify a 5-fish aggregate bag limit per person (would not apply to a fisherman who has a valid commercial fishing license issued by Puerto Rico or the USVI) for:

A. Species in the Snapper FMU
B. Species in the Grouper FMU
C. Species in the Parrotfish FMU

Alternative 4. Specify a 2-fish aggregate bag limit per person (would not apply to a fisherman who has a valid commercial fishing license issued by Puerto Rico or the USVI) for:

A. Species in the Snapper FMU
B. Species in the Grouper FMU
C. Species in the Parrotfish FMU

Alternative 5. Establish a 0-fish aggregate bag limit per person (would not apply to a fisherman who has a valid commercial fishing license issued by Puerto Rico or the USVI) for species in the Parrotfish FMU.

Alternative 6. Establish a vessel limit (would not apply to a fisherman who has a valid commercial fishing license issued by Puerto Rico or the USVI) equivalent to the combined bag limit of:

A. Two fishers
B. Three fishers
C. Four fishers

Alternative 7. (**PREFERRED**) Establish an aggregate bag limit for snapper, grouper and parrotfish FMUs of: 10 per fisher including not more than two parrotfish per fisher or six parrotfish per boat, and 30 aggregate snapper, grouper, and parrotfish per boat on a fishing day (would not apply to a fisherman who has a valid commercial fishing license issued by Puerto Rico or the USVI).

DRAFT

Discussion: As noted in Action 3(b) above, there is concern on the part of recreational fishing interests in the U.S. Caribbean that a conglomerate annual catch limit for the recreational and commercial sectors could create an unfair and economically untenable situation for the recreational fishers, particularly charter boat interests. The concern of the recreational fisher is that, in the race for a single quota, the commercial sector would dominate and there would be substantial losses of socioeconomic benefits to the recreational sector because the combined fishery would become subjest to appropriate AMs, possibly before recreational fishers could achieve their historic average annual landings. It was therefore suggested at the December 2009 meeting of the Council, and a motion passed, to establish recreational bag limits for the U.S. Caribbean EEZ. Action 4(b) addresses the establishment of recreational bag limits. The goal of implementing bag limits would be to, when coupled with sector-specific (i.e., recreational and commercial) ACLs, ensure that the recreational ACL for each complex is not exceeded until as near as possible to the end of the calendar year.

Bag limits are a common approach to managing harvest in recreational fisheries. Typically, bag limit regulations are promulgated to extend the length of the recreational fishing season. The ideal outcome is that overfishing is avoided, using this management strategy, while the fishery resource is available to the recreational angler for the entire year. As catch rates per angler change, the bag limit can be adjusted to constrain harvest to the quota while ensuring near year-round fishing. Bag limits may be applied on an individual species basis, as an aggregate of a species group, or for an entire fishery.

Deciding at which of those levels the bag limit should be applied depends upon the management objective, the commonalities among species, and the ability of the recreational fisherman to distinguish among species. Choosing an individual versus an aggregate bag limit also may reflect data availability. If data are sufficient only to allow monitoring at a group level, then establishing bag limits at a more resolved level is pointless.

Action 4(b) proposes aggregate bag limits within each of the snapper, grouper, and parrotfish components of the recreational reef fish fishery of the U.S. Caribbean EEZ. In addition to the no action alternative, three alternatives are proposed that specify an individual bag limit, from a relatively restrictive 2-fish bag limit (A**lternative 4**) through an intermediate 5-fish bag limit (**Alternative 3**) to the most liberal 10-fish limit in **Alternative 2**. Estimates of percent reduction in harvest for each of the snapper, grouper, and parrotfish complexes depend upon the year sequence chosen (Figure 4.4.1). These year sequences correspond to those presented in Actions 2 and 3 for the recreational fishery.

Alternative 5 proposes to establish a zero-fish recreational bag limit for all species of parrotfish in the U.S. Caribbean. This alternative relates directly to Action 4(a) but focuses specifically on recreational harvest of parrotfish due to their essential role in the maintenance of a healthy coral reef ecosystem.

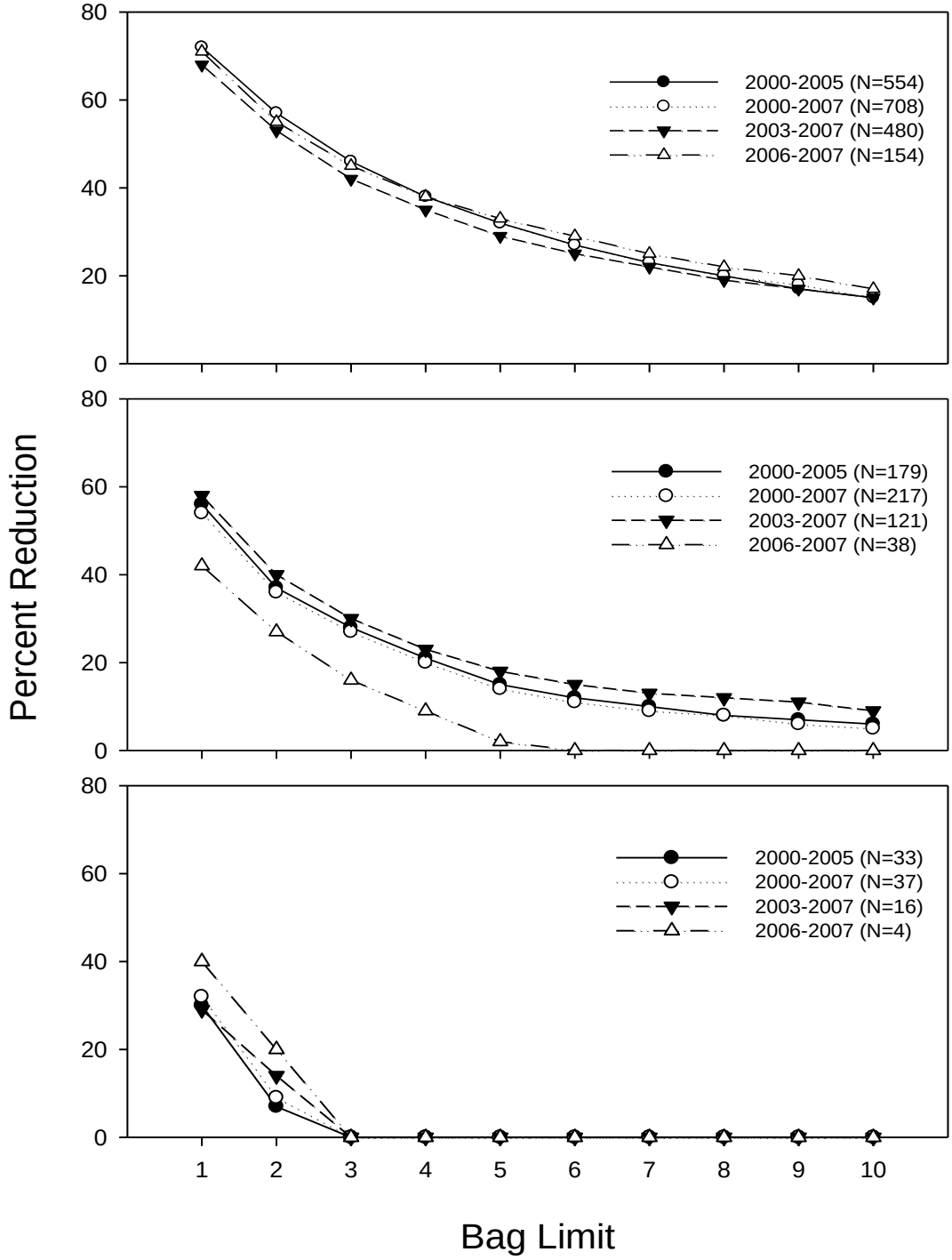


Figure 4.4.1. Estimated percent reduction in harvest of recreational reef fish including snapper (top), grouper (middle) and parrotfish (bottom) for Puerto Rico waters in response to implementation of various bag limits. Each legend references the four year- number of sequences and, parenthetically, the number of intercepts with at least one member of the pertinent group.

Alternative 6 establishes a vessel limit in addition to the individual harvester's bag limit. For the vessel limit, each individual fisherman on a vessel is allowed to harvest their bag limit, but only to the point at which the vessel limit is achieved. If the vessel limit is equivalent to the bag limit for three fishers, then even if there are more than three fishers on the vessel they will only be able to harvest until that three fisher equivalent is reached. For example, if the individual bag limit is 10 fish and the vessel limit is 30 fish, then even if there are more than three people on the vessel they can harvest no more than the 30 fish vessel limit.

Preferred Alternative 7 establishes a vessel limit of 30 fish total per fishing day of aggregate snapper, grouper, and parrotfish but limits the total number of parrotfish to two per fisher up to a maximum of six parrotfish per boat independent of the number of fishers onboard. Each fisher on board a recreational fishing vessel is allowed up to 10 fish per fishing day on a combined catch of grouper and snapper, but that catch can include no more than two parrotfish within that 10 fish bag limit. The maximum number of parrotfish on board any recreational vessel is six. The maximum number of fish per boat on a fishing day is 30 of a combined bag limit of snapper, grouper, and parrotfish. The individual bag limit is an aggregate of 10 fish (of which no more than two can be parrotfish) but the vessel limit cannot exceed 30 fish total and within the 30 fish limit (aggregate snapper, grouper and parrotfish) there can be no more than six parrotfish.

4.4.3 Summary Comparison of Management Measures Alternatives

Action 4(a) addresses the risk of overharvest and resultant disruption of populations of blue (*Scarus coeruleus*), midnight (*Scarus coelestinus*), and rainbow (*Scarus guacamaia*) parrotfish by providing an option to prohibit fishing for these species in the U.S. Caribbean EEZ. **Alternative 1** maintains the status quo, allowing the harvest of the three largest species of parrotfish to continue unabated, subject to the aggregate ACL limitations. **Preferred Alternative 2** prohibits the harvest of various combination of these three species depending upon the sub-alternative or combination of sub-alternatives chosen. Benefits would accrue from regulating against harvest of any of the three species, but the greatest benefit to coral reef health will accrue if commercial and recreational harvest of all three species is eliminated. The reason for this can best be illustrated by a brief discussion of the relationship between parrotfish and corals.

All parrotfish are herbivores, roaming over the bottom and scraping algae off rocks and coral with their stout, fused-teeth beaks. Grazing performs several critical functions in the coral reef ecosystem, including the conversion of primary production to finfish accessible trophic pathways (Mumby et al. 2006). Parrotfish grazing positively conditions substrate for new coral settlement and mediates competition between corals and macroalgae (Brock 1979, Steneck 1997). Such attributes, whether describing a particular species or a familial group, are considered keystone in the operation of ecosystems including coral reef ecosystems (Connell 1978). Consequently, the success and health of corals within the coral reef ecosystem may be partially attributable to parrotfish and other herbivores (e.g., surgeonfish, damselfish, sea urchins).

Alternative 1 of Action 4(a) is the no action alternative and would not have any added short-term economic or social impacts. **Preferred Alternative 2** of Action 4(a) follows logically from **Preferred Alternative 2h** of Action 2(a) for rainbow, blue, and midnight parrotfish and would have direct adverse short-term economic and social impacts on the U.S. Caribbean fishers who take midnight, rainbow, and/or blue parrotfish in the EEZ. It is expected that they could mitigate for loss of harvest of these species from the EEZ, if there is any, by either increasing effort in territorial waters or by targeting other parrotfish or nonparrotfish species in federal waters, subject to any ACL limitations on those species.

None of Puerto Rico's recreational fishers interviewed for MRFSS in 2006 or 2007 reported catching parrotfish in the EEZ. According to a scoping-meeting comment, commercial and recreational fishers in Puerto Rico catch the same kind of parrotfish and in the same areas. That comment suggests **Preferred Alternative 2 (A, B,** and **C)** of Action 4(a) would have little to no economic or social impact on commercial fishers, their families, and fishing communities of Puerto Rico. Testimony at the scoping meetings (see Appendix 4) indicated that the larger parrotfish are considered trophy fish and are hunted to establish spearfishing records.

MRFSS is not conducted in the USVI, so there are no data regarding annual recreational landings of parrotfish or any other species. Hence, the economic and social impacts of **Preferred Alternative 2 (A, B,** and **C)** on recreational fishers of the USVI are unknown.

The economic and social impacts of **Preferred Alternative 2 (A, B,** and **C)** of Action 4(a) on USVI commercial fishers are unknown; however, it is likely that St. Croix fishers and their families could experience larger adverse impacts than their counterparts in St. Thomas/St. John, and possibly significantly larger adverse impacts than their counterparts in Puerto Rico, because of the much larger landings of parrotfish in St. Croix relative to other U.S. Caribbean islands (Table 4.3.1). It is expected that they could mitigate for losses of landings of midnight, blue, or rainbow parrotfish by either increasing effort for other parrotfish or other species and/or relocating to territorial waters when or if they are targeting these species; however, the ability to mitigate is conditional upon any ACLs and corresponding regulations that restrict harvest of other species.

There are presently no bag limit restrictions for recreational harvest of snapper, grouper, and parrotfish from Puerto Rico territorial or contiguous U.S. Caribbean EEZ waters. **Alternative 1** of Action 4(b) would maintain this situation. In contrast, implementation of the remaining alternatives would, to various degrees, result in reductions to the daily recreational take of the target species, and the extent of this reduction would depend upon the sub-alternative(s) chosen. For example, implementing a 10-fish aggregate snapper bag limit (**Alternative 2A**) would result in a roughly 15-17% reduction in recreational harvest of snapper, depending on the baseline considered (Figure 4.4.1, top panel). Further restricting the bag limit, to a maximum of five snapper per recreational fisher (**Alternative 3A**) or to a maximum of two snapper per recreational fisher (**Alternative 4A**), would further decrease recreational harvest of snapper by roughly 30% (range 29-33% depending on year sequence) or roughly 55% (range 53-57%), respectively. Note

that these estimates should be considered with caution, keeping in mind several caveats including a relatively low number of intercepts upon which the estimate is based (range of intercepts = 46-121), the possible occurrence of rare events and sampling biases that may influence overall results, that most intercepts are from private rather than charter vessels, and that these estimates are based upon the proposed rather than current FMUs (Table 4.1.1).

A similar outcome was predicted for grouper but with a generally less substantial reduction in harvest. For the 10-fish bag limit scenario (**Alternative 2B**), the estimated reduction in harvest is approximately 5%, but the range of variation resulting from the choice of year sequence (0-9%) is wider compared with the outcome for snapper (Figure 4.4.1, middle panel). Outcomes for the **Alternative 3B** five-fish scenario (roughly 12% reduction, range = 2-18% depending upon year sequence) and the **Alternative 4B** two-fish scenario (roughly 35% reduction, range = 27-40% depending upon year sequence) follow a pattern similar to that for snapper. Note that the same caveats apply for the grouper estimates as were described above for snapper.

It is rare for a recreational fisher in Puerto Rico to harvest more than two parrotfish during a fishing trip, and there are no records of fishers harvesting five or more parrotfish during a single trip during 2000-2007. Thus, the **Alternative 2C** 10-fish aggregate bag limit and the **Alternative 3C** 5-fish aggregate bag limit likely would have no effect on recreational parrotfish harvest. Implementation of the **Alternative 4C** two-fish recreational bag limit would reduce harvest by roughly 12% (range = 7-20%) each year. Again, note that the same caveats apply for the parrotfish estimates as were described above for snapper.

Action 4(b) **Alternative 1** is the no action alternative, which would not establish a recreational bag limit in the EEZ. It would not have an economic or social impact beyond the baseline, although it may result in more frequent ACL overages and resultant implementation of AMs.

Alternative 2 of Action 4(b) would allow larger recreational catches per person than **Alternative 3**, and **Alternative 3** would allow larger recreational catches per person than **Alternative 4**. Hence, among these three alternatives, **Alternative 4** would likely have the largest adverse economic and social impacts and **Alternative 2** would likely have the lowest if recreational fishing of snapper, grouper and parrotfish species occurs in federal waters. However, **Alternative 5** would essentially prohibit recreational fishing of parrotfish in federal waters, and would have the largest adverse economic impact among Alternatives 2 through 5 for parrotfish. **Alternative 5** could be especially harmful to subsistence fishers of the USVI, especially St. Croix, because ethnographic evidence suggests they are more dependent upon parrotfish than their Puerto Rican counterparts.

The largest adverse economic and social impacts of **Preferred Alternative 7** and **Alternatives 2 through 6** of Action 4(b) could be on recreational fishers of St. Croix and St. Thomas/St. John because more fishable habitat is in the EEZ off St. Thomas/St. John and St. Croix than in the EEZ off Puerto Rico. **Alternative 6** and **Preferred Alternative 7** boat limits could adversely affect charter vessel operations because their catch of

parrotfish and combined catch of snapper, grouper, and parrotfish would be limited, which could discourage anglers from buying their services.

Preferred Alternative 7 of Action 4(b) is a combination of a daily personal limit and a daily vessel limit. Specifically, it combines personal daily limits of 2 parrotfish per person (**Alternative 4C** of 2 parrotfish per person) and 10 snapper, grouper, and parrotfish combined per person with vessel limits of 6 parrotfish per boat and 30 snapper, grouper, and parrotfish combined per boat. The vessel limits are three times the personal limits, which is equivalent to **Alternative 6B**, which is smaller than **Alternative 6C**. Consequently, the adverse economic and social impact on charter vessel operations could be larger with **Preferred Alternative 7** than **Alternative 6C**.

Preferred Alternative 7 is the alternative being considered in the USVI and is recommended by the Fisheries Advisory Committees (FACs). Puerto Rico already has in place bag limits for the recreational harvest of individual species (dolphin fish, wahoo, and mackerels) and for a mixed bag of those species, so the **Preferred Alternative 7** approach is not unprecedented. Both governments prohibit the sale of fish by recreational fishers.

If the economic and social cost of **Preferred Alternative 7** is greater than the economic and social cost of obtaining a commercial fishing license, the least cost option for a charter fishing operation or recreational fisher would be to purchase a Puerto Rico commercial license. The cost of a Puerto Rico commercial license for a nonresident is $250, which is good for four years and can be renewed. The cost for a Puerto Rico resident is $10, which may be good for only one year because it is a beginner license. A resident must show sales of catch to get a non-beginner license. The most likely least cost option for the average charter fishing operation or recreational fisher would be to substitute fishing in territorial waters for federal waters when it is intended that landings of the species would exceed the recreational bag limit(s) or vessel limit.

4.5 ACTION 5: Accountability Measures

Accountability Measures (AMs) are defined as management controls to prevent ACLs, including sector-specific ACLs, from being exceeded, and to correct or mitigate overages of the ACL if they occur (74 FR 3180).

4.5.1 Action 5(a) Triggering accountability measures

Action 3 includes alternatives to establish and allocate ACLs. If an ACL is exceeded, AM alternatives are provided to redress overages. Action 5 alternatives are presented in two parts, the first of which addresses the triggering of AMs and the second of which addresses the actual actions needed to redress overages.

Alternative 1. No Action. Do not trigger AMs.

Discussion: This alternative would maintain present status and no trigger to put into place corrective action would be set. Consequently, **Alternative 1** would not achieve MSA compliance.

Alternative 2. Trigger AMs if the annual catch limit is exceeded based upon:

A. A single year of landings beginning with landings from 2010.

B. A single year of landings beginning with landings from 2010, then a 2-year running average of landings in 2011 (average of 2010+2011) and thereafter (i.e., 2010, 2010-2011, 2011-2012, etc.).

C. A single year of landings beginning with landings from 2010, a 2-year average of landings in 2011 (average of 2010+2011), then a 3-year running average of landings in 2012 (average of 2010+2011+2012) and thereafter (i.e., 2010, 2010-2011, 2010-2012, 2011-2013, etc.).

Discussion: Alternative 2A would trigger AMs based on a single year of landings beginning in 2010. By adopting this alternative, the decision as to whether the ACL has been exceeded would be based on one year of landings data. Currently, the process used to consolidate or summarize landings data (i.e., available for use) takes approximately two years. The landings data is initially acquired from fishers through each local government's fishery statistics program (often referred to as trip tickets in Puerto Rico and Commercial Catch Reports in the USVI), is proofed by the local government, and electronically transferred to the SEFSC. The DPNER and the VIDPNR require commercial fishers to report landings or trip tickets monthly. Upon receipt, the SEFSC formats and stores landings data files and provides them to scientists and managers upon request for analysis or decision making. There may be as much as a two-year lag between the time catches are recorded and the data are released for management applications. For **Alternative 2A**, when landings data become available, they represent a single point of comparison to the established ACL. Consequently, the first one-year comparison to the originally established ACL should occur in 2012 or 2013. After that point in time, annual single-point comparisons can be made to existing ACLs.

In order to overcome the challenges of monitoring highly variable landings , **Alternative 2B** would trigger AMs based on a single year of landings beginning in 2010, and then a 2-year running average of landings in 2011 (average of 2010+2011) and thereafter (2010, 2010-2011, 2011-2012, etc.). Using the process described for **Alternative 2A**, the information might not be available for consideration until 2013 or 2014. By adopting this alternative, the decision as to whether the ACL has been exceeded would initially be based on landings from a single year but subsequent year comparisons would be based on two-year landing sets. Landings data can be highly variable; therefore, comparing average landings with the ACL can buffer peaks in landings, which may be a function of sampling or reporting rather than true estimation of actual harvest. While such a

comparison is more robust than **Alternatives 1**and **2A**, a two-year average provides little information with regard to precision of the comparison.

Similar to **Alternative 2B, Alternative 2C** would trigger AMs based on a single year of landings beginning in 2010, then a 2-year average of landings in 2011 (average of 2010+2011), then a 3-year average of landings effective 2012 and thereafter (i.e., 2010, 2010-2011, 2010-2012, 2011-2013, etc.). Using the process described for **Alternative 2A**, the information might not be available for consideration until 2013 or 2014. By adopting this alternative, the decision as to whether the ACL for each species/species group has been exceeded would initially be based on landings from a single year but in 2011 the comparison would be based on a two-year landing set (2010-2011), and subsequent comparisons would be based on 3-year landing sets (2010-2012, 2011-2013, etc.). Such a comparison is more robust than **Alternatives 2A** and **2B** because it provides more information than a 1- or 2-year landings average with regard to precision of the comparison. **Alternatives 2B** and **2C** prescribe a sound method for dealing with data uncertainty and provide a means by which any ACL overages may be accounted for in subsequent fishing years.

Alternative 3. (**PREFERRED**) Trigger AMs if the annual catch limit is exceeded as defined below and NMFS' SEFSC (in consultation with the Caribbean Fishery Management Council and its Scientific and Statistical Committee) determines the overage occurred because catches increased versus data collection/monitoring improved:

A. A single year of landings effective beginning 2010.

B. A single year of landings effective beginning 2010, then a 2-year running average of landings effective 2011 and thereafter (i.e., 2010, 2010-2011, 2011-2012, etc.).

C. (**PREFERRED**) A single year of landings effective beginning 2010, a 2-year running average of landings effective 2011, then a 3-year running average of landings effective 2012 and thereafter (i.e., 2010, 2010-2011, 2010-2012, 2011-2013, etc.).

Discussion: The explanation of **Preferred Alternative 3** is similar to that for **Alternative 2** above with the addition of a consultation between the SEFSC, the SSC, and Council prior to the decision to determine whether an overage occurred. A data collection improvement program is under development by the SEFSC and is focused to provide more precise and accurate fishery landings information for the U.S. Caribbean, and there is a real possibility that more accurate and comprehensive landings data will be collected for each island mass. For **Alternatives 3A-C** a determination will have to be made to examine whether an overrun of the ACL was due to increased catches by fishers or to improved data collection/monitoring efforts. The SEFSC and the SSC will provide an analysis of the information and consult with the Council before any determination is

made. A single year of landings beginning in 2010 will be the basis for the initial consultation and subsequent determination regarding the cause of any ACL overage.

Alternative 3B is similar to **Alternative 3A** except that after the initial single-year comparison (2010 information with established ACLs), then a 2-year running average of landings will begin in 2011 and thereafter (i.e., 2010, 2010-2011, 2011-2012, etc.).

Preferred Alternative 3C is similar to **Alternative 3B** except that after the initial single-year comparison (2010 information with established ACLs), and a 2-year running average of landings comparison will be made in 2011 (i.e., 2010, 2010-2011), after which a 3-year running average of landings will begin in 2012 and thereafter (i.e., 2010, 2010-2011, 2010-2012, 2011-2013, etc.). Using two or three year running averages of landings (**Alternative 3B** and **Preferred Alternative 3C**) would provide a mechanism to deal with data uncertainty that may be due to reporting errors, under reporting, and highly variable landings.

4.5.2 Action 5(b) Applying accountability measures

Alternative 1. No Action. Do not apply AMs.

Alternative 2. (**PREFERRED**) If AMs are triggered, then reduce the length of the fishing season for that species or species group the year following the trigger determination by the amount needed to prevent such an overage from occurring again. The needed changes will remain in effect until modified.

Alternative 3. If AMs are triggered, then reduce the length of the fishing season for that species or species group the year following the trigger determination by the amount needed to prevent such an overage from occurring again and to pay back the overage. The needed changes will remain in effect until modified.

Discussion: Alternative 1 would not apply AMs when the ACL is exceeded and, consequently, would not comply with MSA provisions. Therefore, this is not a viable option when considering AMs. Reducing the length of the fishing season by the amount needed to pay back the overage in addition to shortening the season length to prevent a future overage (**Alternative 3**) would likely have a greater biological benefit than only reducing the length of the fishing season as specified in **Preferred Alternative 2**. However, AMs that shorten the fishing season can increase the magnitude of regulatory discards and may not be as effective as AMs that lower the target level but still allow some catch.

4.5.3 Summary comparisons of accountability measures alternatives

Action 5 alternatives are in two parts: Action 5(a) addresses triggering of AMs; Action 5(b) addresses the actual actions needed to redress overages. For Action 5(a), three alternatives are presented for triggering AMs. **Alternative 1** is the no action alternative,

which would retain the status quo and no trigger to put into place corrective action (i.e., AMs) would be set. Consequently, MSA compliance would not be achieved by **Alternative 1**.

Alternatives 2A, 2B, and **2C** would trigger AMs based on a single year, a 2-year running average, and a 3-year running average of landings, respectively. **Alternative 2A**, the single-year-based trigger would be the quickest to way to trigger AMs but would be based on the least amount of information and would be susceptible to the largest level of uncertainty. If landings were extremely high one year because of resource abundance, while effort remained constant, the AM might be triggered although resource health was not in jeopardy. On the other hand, if landings remained constant in the light of very high fishing effort, resource availability may decrease to dangerously low levels and no AMs would be triggered. Consequently, management based on a single year of information may have a high degree of error and may suffer the consequence of triggering AMs prematurely or not at all. Such an approach may not be reliable and could result in significant resource shortage or exacerbate overfishing conditions.

Alternative 2B represents a trigger based on a 2-year running average of landings rather than a single-year, so uncertainty, while still high, would be better than in **Alternative 2A**. **Alternative 2C** relies on 3-years of information rather than a single-year or only 2-years and would therefore be expected to provide the most reliable indicator that AMs need to be applied.

Alternatives 3A and **3B**, and **Preferred Alternative 3C**, are similar to **Alternatives 2A-C** but prior to triggering an AM based on a single-, 2-, or 3-year average of landings, scientific advice (from the SEFSC and the Council SSC) would be needed to determine whether the ACL was exceeded due to increased catches versus an improved data collection/monitoring effort. The addition of such a scientific review would result in a more reliable and defensible decision by the Council to take further management action by triggering an AM to redress ACL overages.

Action 5(b) **Alternative 1** would not apply AMs when the ACL is exceeded and, consequently, would not comply with MSA provisions. Therefore, the no action alternative is not a viable option when considering AMs. Reducing the length of the fishing season by the amount needed to pay back the overage, in addition to shortening the season length to prevent a future overage (**Alternative 3**), would likely have a greater biological benefit than only reducing the length of fishing season as specified in **Preferred Alternative 2**. However, AMs that shorten the fishing season can increase the magnitude of regulatory discards and may not be as effective as AMs that lower the target level but still allow some catch.

Alternative 1 of Action 5(a) is the no action alternative, and would not have an economic or social impact beyond the baseline. Without regulations that implement the AMs, **Alternative 2** and **Preferred Alternative 3** would have no added economic or social impacts. However, **Preferred Alternative 3** could have a smaller indirect adverse economic and social impact than **Alternative 2** because it would include considerations

for improvements in reported landings that suggest larger landings but are not actually larger. Among the sub-alternatives of **Preferred Alternative 3**, **Preferred Sub-Alternative C** could have the smallest indirect adverse economic and social impact because it would require inclusion of a 3-year average of landings as opposed to a two-year average (**Sub-Alternative B**) or single year of landings (**SUB-Alternative A**).

Alternative 1 of Action 5(b) would not apply the AMs and would have no economic or social impact. **Alternative 3** would likely have a larger adverse economic and social impact on fishers, their families and fishing communities than **Preferred Alternative 2** because it would reduce the fishing season by a longer length of time. However, the actual economic and social impacts of either **Preferred Alternative 2** or **Alternative 3** are greatly dependent upon the percent of landings that derive from fishing in the EEZ and the chosen ACLs relative to current landings. With more fishable habitat in their territorial waters, Puerto Rican fishers would be most able to mitigate for any losses of landings due to a shortened federal fishing season by shifting into territorial waters, if the territorial season were to remain open. With the least amount of fishable habitat in territorial waters off St. Thomas/St. John, it is expected that St. Thomas/St. John fishers would be least able to mitigate for lost landings due to a shortened federal fishing season.

Neither **Preferred Alternative 3** of Action 5(a) nor **Preferred Alternative 2** of Action 5(b) would have an economic or social impact on queen conch fishers in Puerto Rico or St. Thomas/St. John because there is no fishing for queen conch in the EEZ off Puerto Rico or St. Thomas/St. John, nor can fishers take conch from the EEZ off St. Croix and transport it through the EEZ for landing in either Puerto Rico or St. Thomas/St. John. Neither **Preferred Alternative 3C** of Action 5(a) nor **Preferred Alternative 2** of Action 5(b) would have an economic or social impact on St. Croix queen conch fishers because **Preferred Alternative 2g** of Action 2(b) would set the ACL for queen conch at 50,000 pounds, which is consistent with the current St. Croix limit set by the USVI.

4.6 Action 6: Framework Measures

4.6.1 Action 6(a): Establish Framework Measures for Reef Fish FMP

Alternative 1: No Action. Do not amend the framework measures for the Reef Fish FMP

Alternative 2: Amend the framework procedures for the Reef Fish FMP to provide a mechanism to expeditiously adjust the following reference points and management measures through framework action:

a. Quota Requirements
b. Seasonal Closures
c. Area Closures
d. Fishing Year
e. Trip/Bag Limit
f. Size Limits
g. Gear Restrictions or Prohibitions

h. . Fishery Management Units (FMUs)
i. Total Allowable Catch (TAC)
j. Annual Catch Limits (ACLs)
k. Accountability Measures (AMs)
l. Annual Catch Targets (ACTs)
m. Maximum Sustainable Yield (MSY)
n. Optimum Yield (OY)
o. Minimum Stock Size Threshold (MSST)
p. Maximum Fishing Mortality Threshold (MFMT)
q. Overfishing Limit (OFL)
r. Acceptable Biological Catch (ABC) control rules
s. Actions to Minimize the Interaction of Fishing Gear with Endangered Species or Marine Mammals

Alternative 3: Amend the framework procedures for the Reef Fish FMP to provide the Council with a mechanism to expeditiously adjust a subset of management measures outlined in **Alternative 2**.

4.6.2 Action 6(b): Establish Framework Measures for Queen Conch FMP

Alternative 1: No Action. Do not amend the framework measures for the Queen Conch FMP

Alternative 2: Amend the framework procedures for the Queen Conch FMP to provide a mechanism to expeditiously adjust the following reference points and management measures through framework action:

a. Quota Requirements
b. Seasonal Closures
c. Area Closures
d. Fishing Year
e. Trip/Bag Limit
f. Size Limits
g. Gear Restrictions or Prohibitions
h. Total Allowable Catch (TAC)
i. Annual Catch Limits (ACLs)
j. Accountability Measures (AMs)
k. Annual Catch Targets (ACTs)
l. Maximum Sustainable Yield (MSY)
m. Optimum Yield (OY)
n. Minimum Stock Size Threshold (MSST)
o. Maximum Fishing Mortality Threshold (MFMT)
p. Overfishing Limit (OFL)
q. Acceptable Biological Catch (ABC) control rules
r. Actions to Minimize the Interaction of Fishing Gear with Endangered Species or Marine Mammals

DRAFT

Alternative 3: Amend the framework procedures for the Queen Conch FMP to provide the Council with a mechanism to expeditiously adjust a subset of management measures outlined in **Alternative 2**.

Discussion: In order to modify regulations, the Council generally must follow the FMP amendment procedure which takes longer to implement than if the Council had the availability of a framework process. The current process for amending a FMP is not the most expedient possible for making timely preseason, inseason, or other adjustments (see the above list) to management measures. However, this amendment establishes a process to make changes in a more expeditious manner via a regulatory amendment. Regulatory amendments can be implemented in a shorter period of time than plan amendments because the level of public participation is not as extensive as for the full plan amendment process. In order to complete a regulatory amendment, a framework section must be established for each FMP to which changes will be made.

Action 6 lists the framework measures which may be adjusted under regulatory amendment. This discussion section describes a framework procedure and how each might be achieved. Such a procedure will provide the Council with a mechanism to make management changes in the queen conch or reef fish fisheries in a more timely fashion than provided through the FMP amendment process.

Establish an assessment group and adjustments:

The following discussion outlines the procedure by which the Council may make management changes through regulatory amendment. As previously discussed, the purpose of frameworks and regulatory amendments is to provide the most responsive and efficient modifications to management measures. If an additional review process was included, there could be substantial delays, thus resulting in a longer lag time between identification of a problem and implementation of a response.

1. When the Council determines that management measures require modification, the Council will appoint an assessment group (Group) that will assess the condition of species in the reef fish or queen conch management units (including periodic economic and sociological assessments as needed). The Group will present a report of its assessment and recommendations to the Council.

2. The Council will consider the report and recommendations of the Group and hold public hearings at a time and place of the Council's choosing to discuss the Group's report. The Council may convene its Scientific and Statistical Committee to provide advice prior to taking final action. After receiving public input, the Council will make decisions on the need for change.

3. If changes to management regulations are needed, the Council will advise the Regional Administrator (RA) in writing of its recommendations accompanied by the Group's report (where appropriate), relevant background material, draft regulations, Regulatory Impact Review, and public comments.

4. The RA will review the Council's recommendations, supporting rationale, public comments, and other relevant information. If the RA concurs that the Council's recommendations are consistent with the goals and objectives of the fishery management plan, the national standards, and other applicable laws, the RA will recommend that the Secretary take appropriate regulatory action for the reef fish or queen conch fisheries on such date as may be agreed upon with the Council.

5. Should the RA reject the recommendations, the RA will provide written reasons to the Council for the rejection, and existing measures will remain in effect until the issue is resolved.

6. Appropriate adjustments that may be implemented by the Secretary include:

   a. Specification of Maximum Sustainable Yield (MSY) or MSY proxy and subsequent adjustment where this information is available;

   b. Specification of an Acceptable Biological Catch (ABC) control rule and subsequent adjustment where this information is available;

   c. Specification of TAC and subsequent adjustment where this information is available;

   d. Specification of Annual Catch Limits (ACLs) and subsequent adjustment;

   e. Specification of AMs and subsequent adjustment;

   f. Specification of Optimum Yield (OY) and subsequent adjustment where this information is available;

   g. Specification of Minimum Stock Size Threshold (MSST) and subsequent adjustment;

   h. Specification of Maximum Fishing Mortality Threshold (MFMT) or Overfishing Level (OFL) and subsequent adjustment;

   i. Specification (or modification) of quotas (including zero quotas), trip limits, bag limits (including zero bag limits), minimum size limits, gear restrictions (ranging from modifying current regulations to a complete prohibition), season/area closures (including spawning closures), and fishing year;

   j. Initial specification and subsequent adjustment of biomass levels and age structured analyses.

DRAFT

Authority is granted to the RA to close any fishery, i.e. revert any bag limit to zero and close any commercial fishery, once a quota has been established through the procedure described above and such quota has been filled.

If the NMFS decides not to publish the proposed rule of the recommended management measures, or to otherwise hold the measures in abeyance, then the RA must notify the Council of its intended action and the reasons for NMFS's concern, along with suggested changes to the proposed management measures that would alleviate the concerns. Such notice shall specify: 1) The applicable law with which the amendment is inconsistent; 2) the nature of such inconsistencies; and 3) recommendations concerning the action that could be taken by the Council to conform the amendment to the requirements of applicable law.

4.6.3 Summary Comparison of Framework Measures Alternatives

Alternative 1 (No Action) would not establish framework procedures for the Reef Fish or Queen Conch FMPs. This would maintain the current procedure for modifying each FMP, potentially extending the time to achieve necessary changes relative to that provided for via a regulatory amendment.

Under **Alternative 2**, adjustments to everything listed within this alternative could be made with relative ease as new fishery and stock assessment information becomes available. **Alternative 2** would likely be biologically beneficial for reef fish and queen conch. By establishing framework procedures to allow for periodic adjustments to various management measures, modifications could be effected in a timely manner to implement necessary changes in response to stock assessment results.

Alternative 3 would also provide a framework procedure but would not encompass as comprehensive a list of management measures which may be implemented through regulatory amendment. Under **Alternative 3**, the Council may choose which management measures they want to allow modified through regulatory amendment. This list may include one management measure or multiple measures, depending on what the Council deems appropriate.

Alternative 1 would not support more efficient and effective management of the reef fish or queen conch fisheries. **Alternatives 2** and **3** would be expected to increase the efficiency and effectiveness of management change, potentially allowing less severe corrective action when necessary, or the quicker receipt of social and economic benefits associated with less restrictive and more responsive management. **Alternative 2** would provide a more complete framework than **Alternative 3** with which the Council can implement regulatory changes. However, under both **Alternatives 2** and **3**, positive social and economic effects would be expected in the long term, relative to the no action alternative, from more timely management adjustments.

Alternative 1 is the no action alternative and would have no direct economic and social impacts. It would not establish a framework to authorize setting, adjusting, and implementing ACLs and AMs that could be deemed necessary to improve management of

the resource, and hence, could indirectly result in lower long-term net economic and social benefits that derive from exploitation of the resources.

Because **Alternatives 2 and 3** would establish such a framework, it is expected that the indirect long-term net economic and social benefits of **Alternatives 2 and 3** would be larger than those of **Alternative 1**. The benefits of **Alternative 3** relative to **Alternative 2** would depend upon the subset of measures within **Alternative 3** that were chosen by the Council.

DRAFT

5.0 AFFECTED ENVIRONMENT

5.1 Physical Environment

The U.S. Caribbean is located in the eastern extreme of the Caribbean archipelago, about 1,100 mi east-southeast of Miami, Florida (Olcott 1999). It comprises the Commonwealth of Puerto Rico in the Greater Antilles and the Territory of the USVI in the Lesser Antilles island chain (Figure 5.1.1), both of which separate the Caribbean Sea from the western central Atlantic Ocean.

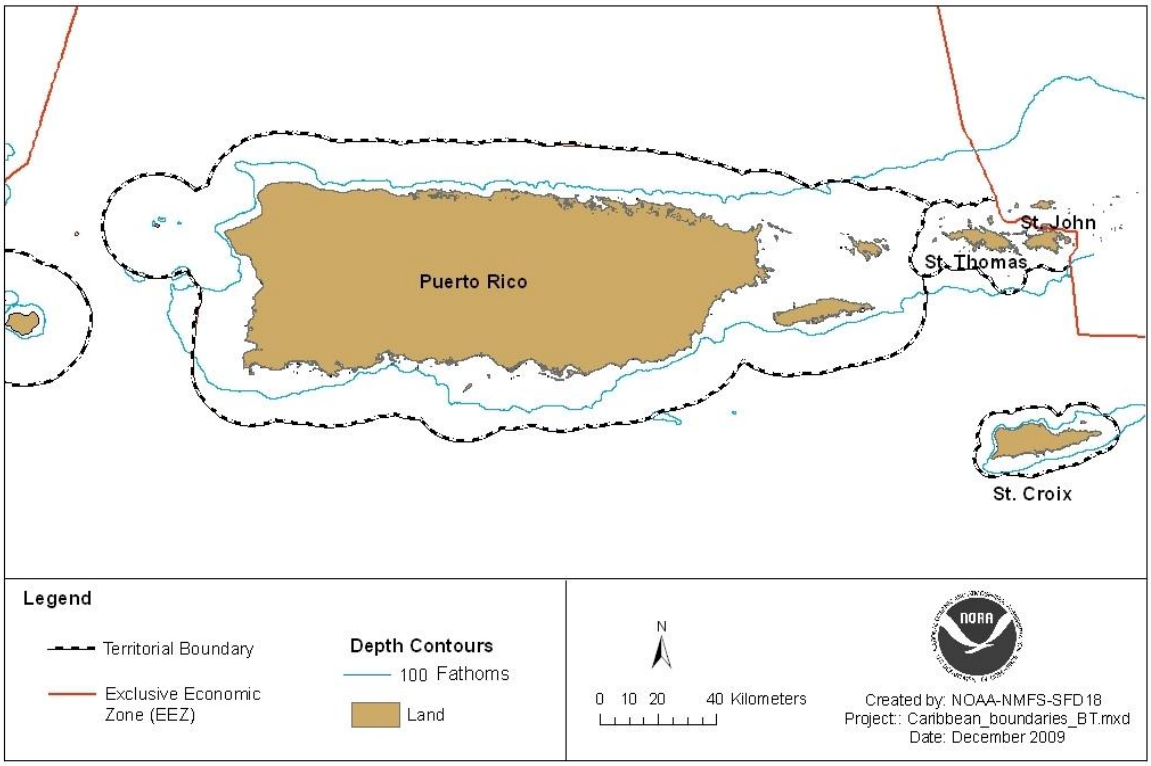


Figure 5.1.1: Map of the U.S. Caribbean.

The USVI are part of the Virgin Islands chain, which lies about 50 mi (80 km) east of Puerto Rico and consist of about 80 islands and cays (Olcott 1999). The USVI include the largest and most important islands of the Virgin Islands chain: St. Croix, St. Thomas, and St. John. Together, their coastlines extend about 175 mi (282 km). St. Croix is located about 40 nm (74 km) south of St. Thomas and St. John (CFMC 2004). Covering about 84 mi^2 (218 km^2), that island is entirely surrounded by the Caribbean Sea. The islands of St. Thomas and St. John are bordered by the Atlantic Ocean to the north and the Caribbean Sea to the south. Their respective areas are about 32 mi^2 (83 km^2) and 19 mi^2 (49 km^2) (Olcott 1999).

The island of Puerto Rico is almost rectangular in shape, about 35 by 110 mi, and is the smallest and the most eastern island of the Greater Antilles (CFMC 1998, Morelock et al. 2001). Its coast measures approximately 700 mi and includes the adjacent islands of Vieques and Culebra. In addition, the Commonwealth includes the islands of Mona, Monito, and various other isolated islands. Deep ocean waters fringe Puerto Rico. The Mona Passage, which separates the island from Hispaniola to the west, is about 75 mi (120 km) wide and more than 3,300 ft (1,000 m) deep. Off the northern coast is the 28,000 ft (8,500 m) deep Puerto Rico Trench, and to the south the sea bottom descends to the 16,400 ft (5,000 m) deep Venezuelan Basin of the Caribbean.

More detailed information on the physical environment can be found in Section 3.1 of the EFH FSEIS (CFMC 2004).

5.1.1 Geology

The shelf shared by the islands of St. Thomas and St. John is about 7.0 nm (12.9 km) wide on the south and 17.4 nm (32.2 km) wide on the north (Goenaga and Boulon 1991). St. Croix, which lies on a different geological platform, is separated from the other islands by a 13,124 ft (4,000 m) -deep trench (CFMC 2004). The St. Croix shelf is much narrower and shallower than that of the northern islands (Goenaga and Boulon 1991), extending only 2.2 nm (4 km) wide in the south, less than 0.1 nm (0.2 km) wide on the northwest, and up to several nautical miles wide in the northeast and on Lang Bank (CFMC 2004).

Puerto Rico shares the same shelf platform as St. Thomas and St. John, and that shelf extends along an east-west axis to the British Virgin Islands (BVI). The St. Croix platform connects through a deep submerged mountain range (including Grappler Bank and Investigador, among other banks in the EEZ) to the southeast platform of Puerto Rico. Section 3 of the EFH-FEIS (CFMC 2004) summarizes the available information on the geology of the U.S. Caribbean.

5.1.2 Oceanography and climate

The North Equatorial Current is the predominant hydrological driving force in the Caribbean region. It flows from east to west along the northern boundary of the Caribbean plateau and splits at the Lesser Antilles. To the north, the current flows westward along the north coasts of the U.S. Caribbean islands, splitting north of the Mona Channel. The north branch flows north of Silver and Navidad Banks, past the Turks and Caicos, to form the Bahama Current. The south branch parallels the north coast of Hispaniola about 16 nm (30 km) offshore. A small gyre has been documented off the northwest corner of Puerto Rico resulting in an easterly flow nearshore in this area (CFMC 2004). To the south, the current enters the Caribbean Sea through the passages between the Lesser Antilles (Chakalall et al. 1998). The water then continues northwestward as the Caribbean Current, the main surface circulation in the Caribbean Sea.

The Caribbean Current flows about 54 nm (100 km) south of the U.S. Caribbean islands at an average speed of 0.5 to 1 knots (0.9 to 1.9 km^{-hr}) (CFMC 2004). The current is

characterized by large cyclonic and anticyclonic gyres. Its flow exits the Caribbean through the Yucatan Strait into the Gulf of Mexico and, to the northwest, into the North Atlantic (Kjerfve 1981). Its strength is influenced by changes in the position of the Inter-tropical Convergence Zone (ITCZ). It increases in strength during the winter when the thermal equator is farthest south. It decreases in strength during the summer when the thermal equator shifts north, and surface waters in the Caribbean are influenced by increasing precipitation. This is the time of year when the North Equatorial Counter Current is established and surface waters of the equatorial Atlantic are displaced to the east (Kjerfve 1981). Fluctuations in the water mass transport of the Gulf Stream are influenced by seasonal changes in Caribbean surface salinity transport and to wind speed changes in the tropical-subtropical trade wind zone (Kjerfve 1981). Westerly trade wind circulations to the north are responsible for the major wind and wave patterns. High winds occur in the winter; hurricanes in the autumn (CFMC 2004).

The zonal shift of the ITCZ is also responsible for the seasonal change in precipitation in the Caribbean. The dry season occurs when the ITCZ is near the equator (Kjerfve 1981), generally in the late winter to spring (Olcott 1999). The wet season occurs when the ITCZ is at its most northerly position in the Caribbean, generally in the late summer into late fall (Olcott 1999); about 50 % of the annual rainfall occurs during this wet season. Average annual precipitation ranges from less than 30 in (76.2 cm) to greater than 55 in (139.7 cm) in the USVI.

Most of the precipitation in this region is returned to the atmosphere by evapotranspiration – evaporation from the land and water surfaces and transpiration by plants (Olcott 1999). Surface water salinity changes along with the seasonal change in precipitation, but precipitation affects salinity only indirectly. The discharge from the Amazon, Orinoco, and Magdalena rivers is the main contribution to buoyancy in the Caribbean, increasing silica concentrations, decreasing salinity and increasing chlorophyll and pigments, as well as increasing the input of terrestrial materials (Kjerfve 1981). The plume of the Orinoco River, as tracked by satellite imagery, seasonally penetrates across the Caribbean Basin, potentially exerting a region-wide influence (Kjerfve 1981; Muller Karger et al. 1989). It could be responsible for events of high turbidity and algal blooms that often occur in the Caribbean Basin in October (CFMC 2004). Other oceanographic phenomena influencing the Caribbean Basin include the passage of cyclonic and anti-cyclonic eddies (Corredor et al. 2004).

The USVI has no permanent streams, and outflows only occur during periods of heavy rainfall. But these are sometimes sufficient to muddy coastal surface waters up to 0.5 nm (0.9 km) from shore (CFMC 1985).

Sea surface temperature ranges from a minimum of 77° F (25° C) in February-March to a maximum of about 83° F (28.5^{o} C) in August-September. Inshore temperatures may be higher (e.g., 86° F or 30° C) due to shallower depths or, in some cases, to thermal plumes from generator plants (CFMC 2004).

Tidal regimes differ between the north and south coasts. The fluctuations range from a diurnal tide of about 3.9 in (10 cm) in the south coast to a semi-diurnal regime of between 24-40 in (60-100 cm) along the north coast, where waves are larger (CFMC 2004). But the astronomical tidal range is slight (8-12 in or 20-30 cm) (Kjerfve 1981).

5.1.3 Major habitat types

The coastal-marine environment of the USVI is characterized by a wide variety of habitat types. NOAA's National Ocean Service has mapped 21 distinct benthic nearshore habitat types using aerial photographs acquired in 1999. Those maps document 9 mi^2 (24 km^2) of unconsolidated sediment, 62 mi^2 (161 km^2) of submerged vegetation, 0.8 mi^2 (2 km^2) of mangroves, and 116 mi^2 (300 km^2) of coral reef and hard bottom over an area of 189 mi^2 (490 km^2) in the USVI. Coral reefs, seagrass beds, and mangrove wetlands are the most productive marine habitat areas (CFMC 2004). CFMC (2004) provides an in-depth description of the distribution of these habitats, along with information on their ecological functions and condition.

A general description of the marine environments of the USVI is provided in Island Resources Foundation (1977). The fringing reefs on St. John are said to be poorly developed (Randall 1963). Outside this area, in Coral Bay, a more-mature reef profile is found at Lagoon Point. St. Croix has the most extensive reefs, with many miles of bank-barrier reefs, often with algal ridges, extending in an almost unbroken line from Coakley Bay on the north coast, around the eastern tip to Great Pond Bay on the south coast. There are also numerous fringing and patch reefs. On the north coast, the eastern shelf is up to several miles wide and is rimmed by emergent Holocene reefs, considered to be the best developed on the island. The western portion is less than 0.1 nm (0.2 km) wide and is traversed by two small submarine canyons; in the Salt River and Cane Bay areas, the edge of the shelf drops precipitously into great depths and the reefs form a vertical wall supporting abundant growths of black coral. The south shore has a shelf up to 2.2 nm (4.0 km) wide (Hubbard et al. 1981). The reef zonation of the entire island has been mapped from aerial photographs for the Bureau of Land Management.

These environments are threatened by human activities, such as coastal development and fishing activities, but also by natural factors, such as El Niño Southern Oscillation events and hurricanes, which leave habitats more vulnerable to human disturbance. Climate changes resulting from global warming are also a threat. Bryant et al. (1998) reports that almost two-thirds of the mapped coral reefs in the Caribbean are at risk and one-third are at high risk of impact resulting from increasing water temperatures.

In Puerto Rico, 49 km^2 of unconsolidated sediment, 721 km^2 of submerged vegetation, 73 km^2 of mangroves, and 756 km^2 of coral reef and colonized hard bottom were mapped (Kendall et al. 2001). About eighty different bottom types are found around Puerto Rico and the USVI (CFMC 1984, CFMC 1994). The bottom types vary with depth and consist of combinations of gravel, rock, sand, mud, and clay. The bottom types greatly influence which organisms are found in each habitat.

All of these habitats are described in as much detail as available in Section 3.2 (3.2.1 through 3.2.11) of the EFH-FEIS (CFMC 2004) and any additional information will be included in the 5-year review of the Generic EFH Amendment to the FMPs under development at the present time. The 5-year EFH-FEIS review will incorporate all new and recently acquired information on the description of the 30 to 50 m depth marine environments of Puerto Rico and the USVI (e.g. Garcia-Sais et al. 2003 (http://www.caribbeanfmc.com)).

Additional information on regional habitat types can be found in Section 3.2 of the EFH FSEIS (CFMC 2004).

5.2 Biological Environment

5.2.1 Conch

5.2.1.1 Queen conch (*Strombus gigas*)

The term "conch" usually refers to gastropods of the family Strombidae (Genus *Strombus*), but is often applied to large, usually edible, gastropods in other families as well. As defined by the Caribbean Council's Queen Conch FMP, the Caribbean conch resource is composed of 13 species of gastropods within the families Strombidae, Cymatiidae, Cassidae, Turbinellidae, Fasciolariidae, and Trochidae. But only one species, the queen conch (*Strombus gigas*), has been the focus of fishery management measures defined in that FMP (CFMC 1996, 2005). Its scientific name *Strombus gigas* means "giant spiral shell."

The queen conch occurs in semi-tropical and tropical waters of the Atlantic Ocean, ranging from south Florida (USA) and Bermuda to northern South America, including the Caribbean Sea (Rhines 2000). This species is taken in both commercial and recreational fisheries. The conch is an invertebrate with a hard shell and a soft body, which consists of the black speckled foot, the visceral mass within which resides the thoracic and abdominal organs, two slender tentacles, a "head" with bright yellow eyes perched on the end of two protruding stalks, and a snout-like mouth (proboscis) which the conch extends to graze on algae. Enclosing the foot and head is a snug, orange or yellow fleshy covering called the mantle, which secretes the shell and also houses the feathery gills that allow the conch to extract oxygen from the water. The queen conch's shell is its most striking feature. Adults have a heavy shell with a broad, flared lip that is a glossy pink, orange, or yellow on the interior. The outside of the shell is marked by a blunt crown of spines that project from each whorl of the spiral. Queen conchs are "right-handed," meaning that as the observer looks at the pointed crown, the spiral coils to the right. A brown, papery layer called the periostracum covers the shell and collects silt, bacteria, and algae, which help to disguise the animal. The periostracum flakes off when the shell is removed from the water and dried. A queen conch shell can be as long as 12 inches and weigh as much as 5 pounds. (FWC FWRI 2006)

The Queen Conch FMP (CFMC 1996) and the CITES (2003) report provide detailed descriptions of the biology and life history of the queen conch. To summarize this

information, this species generally occurs on expanses of shelf to about 250 ft (76 m) depth. It is commonly found on sandy bottoms that support the growth of seagrasses, primarily turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), shoal grass (*Halodule wrightii*), and epiphytic algae upon which it feeds (Randall 1964; Stoner and Waite 1990). Queen conch also occur on gravel, coral rubble, smooth hard coral or beach rock bottoms, and sandy algal beds (CFMC 1996). Additional information on queen conch habitat in deeper water (30-50 m) indicates that the species occurs on rhodolith reefs, a habitat that functions as a foraging ground for conch (Garcia-Sais et al. 2010). Sandt and Stoner (1993) have shown that queen conch actively select among their habitats, with juveniles being more selective than adults, and are dependent on certain habitat requirements. The most productive nurseries occur in shallow (5-6 m deep) seagrass meadows (Stoner 1997). Juveniles exhibit a strong preference for intermediate densities of seagrasses, whereas adults show less habitat specificity (Stoner and Waite 1990).

Adult queen conch grow to 6-12 in (15-30.5 cm) in length (CFMC 1996), weigh about 4.4 lb (2 kg) on average, and generally live 6 to 7 years; although they may survive as many as 26 (Rhines 2000) or even 40 (CFMC 1996) years in deep water habitats. Growth in shell length generally ceases at the time of sexual maturity, after which growth occurs primarily through the thickening of the shell, especially at the lip (CFMC CFRAMP 1999). The shell length of an adult queen conch can progressively decrease with age due to bioerosion of the shell. The flaring of the lip starts at an age of approximately two to four years and lasts for approximately seven to ten months, or longer (Glazer and Berg 1992). While Rhines (2000) reports age at maturation as 3.5 - 4 years, the average age of maturation for both sexes of queen conch off Puerto Rico is reached at approximately five years (Appeldoorn 1994) whereas off St. John it is 3 years (CFMC 1996).

Sexes are separate and fertilization is internal. Copulation can precede spawning events by several weeks (CFMC 1996). Research indicates the lack of reproduction in low-density populations is related primarily to the lack of encounters between females and males. In the Bahamas, Stoner and Ray-Culp (2000) found that reproduction increased proportionally with density levels (due to increased likeliness of encounters) and remained stable near densities of 200 individuals^{-ha}. This highlights the importance of maintaining stock density above a critical level to prevent recruitment failure. In Puerto Rico, surveys undertaken in 1996 found densities of 7.4 individuals^{-ha} on the East Coast and 8.5 individuals^{-ha} on the West Coast (Mateo et al. 1998). For St Thomas, juvenile density of 1.9 individuals^{-ha} was observed in 2001, while adult density in St Croix waters was around 26-27 individuals^{-ha} (Gordon 2002). Recent fishery independent surveys show a marked increase in both juvenile and adult densities in Puerto Rico and the USVI (N. Jimenez, PRDNER, pers. comm.; S. Gordon, VIDPNR, pers. comm.). Rhines (2000) reports the peak reproductive season extends from April to August. Peak spawning activity in the U.S. Caribbean appears to occur from May through September, corresponding to the highest water temperatures (CFMC 1996). Spawning occurs in aggregations (CFMC 1996). Egg masses are composed of a number of gelatinous egg strings, usually deposited in clean coral sand with low organic content but sometimes also in seagrass habitat (CFMC 1996). Fecundity is highly variable: individual strings may contain as many as

185,000 - 460,000 eggs (Rhines 2000); egg masses, from 310,000 - 750,000 eggs. Females commonly spawn 6-8 times per season and produce 1-25 egg masses per season (CFMC 1996).

Embryos hatch into planktonic larvae (Colin 1978, Rhines 2000) after a period of about 5 days. Larvae spend between 18 and 40 days in the water column before settling and metamorphosing into adults. Little is known about recruitment patterns. Some studies have concluded that the majority of larvae are retained locally (e.g., within the area where they are spawned); others, that larvae could be transported 26 mi (43 km) per day, or 540 mi (900 km) during the 3-week larval period depending upon current patterns. Eggs hatched off Puerto Rico and the USVI may supply conch to areas located downstream, such as Haiti, the Dominican Republic, and Cuba. Conversely, islands situated upstream in the Caribbean arc may provide conch that settle in Puerto Rico and the USVI (CFMC 1996). However, evidence of local entrainment of larvae suggests that it is important to focus primarily on management of the local conch stock.

Juveniles settle in shallow subtidal habitats where they spend much of their first year buried in the sediment (CFMC 1996, CFMC CFRAMP 1999, Rhines 2000). At shell lengths ranging from 2.0-3.0 in (5-7.5 cm), young juveniles begin to emerge and take up an epibenthic existence. Some studies have documented a habitat shift at the time of emergence, from the area of settlement into nearby seagrass beds. Queen conch exhibit two general patterns of migration. The first is an ontogenetic migration into deeper water, a pattern which generally becomes more pronounced in large juveniles (CFMC CFRAMP 1999). Aggregations of over 100,000 juveniles have been reported in the Bahamas (CFMC 1996). The second migration is related to spawning. Conch generally move inshore to spawn as temperature begins to increase in March, and return to deeper water in October. This migration is manifested as a general shift in the distribution of conch, with conch in deep water migrating but still remaining deep relative to conch in shallow water areas (CFMC CFRAMP 1999).

Queen conch larvae feed on plankton (Rhines 2000). Juvenile and adults graze on algae and seagrasses (Rhines 2000; Sefton and Webster 1986). Foraminiferans, bryozoans, and small bivalves and gastropods have also been found in conch stomachs but were probably ingested accidentally while grazing (Rhines 2000). Feeding has been observed in sand flats and shallow, sandy lagoons (Sefton and Webster 1986), particularly in turtle grass beds (Colin 1978; Sefton and Webster 1986), on hard bottom habitats, and in rubble (Rhines 2000).

Juveniles are preyed on by a variety of gastropod mollusks, cephalopods, crustaceans, and fish (Colin 1978). Adults are preyed upon by crabs, turtles, sharks, and rays (Rhines 2000). The hermit crab (*Petrochirus diogenes*) expropriates the shell of the queen conch after consuming the animal. The conchfish (*Astrapogon stellatus*), and possibly a porcellanid crab, have commensal relationships with the queen conch; the former spends the day within the conch's mantle cavity, emerging at night to feed (Colin 1978).

5.2.1.2 Other Caribbean conch resources

Less is known about the biology and status of the 12 other Caribbean conch and gastropod species. The Council included 8 of these species (Atlantic triton's trumpet, *Charonia variegate;* cameo helmet, *Cassis madagascarensis*; green star shell, *Astrea tuber;* hawkwing conch, *Strombus raninus;* milk conch, *Strombus costatus;* roostertail conch, *Strombus gallus;* true tulip, *Fasciolaria tulipa;* West Indian fighting conch, *Strombus pugilis*) in the management unit for data collection only because they are occasionally marketed, but their economic importance to U.S. Caribbean fisheries has not been assessed. Four additional species (Caribbean helmet, *Cassis tuberose;* Caribbean vase, *Vasum muricatum;* flame helmet, *Cassis flammea;* West Indian top shell, *Cittarium pica*) are included because they are taxonomically classified as gastropods and are occasionally collected for their shells (the Atlantic triton's trumpet is also principally collected for its shell). The West Indian top shell occurs in the intertidal zone and is often consumed by locals. Some, such as the milk conch (*Strombus costatus*) and West Indian fighting conch (*Strombus pugilis*), are used for food, but to a lesser extent than queen conch.

A more detailed summary of the available information on the biology and life history of these species can be found in the Council's Comprehensive SFA Amendment (CFMC 2005). The status of Caribbean conch and gastropod resources other than queen conch is unknown, and no definition of overfished or overfishing has been developed for these species (NMFS 2002).

5.2.2 Reef fish

The reef fish FMUs were originally established within the Council's Reef Fish Fishery Management Plan (CFMC 1985; 50 FR 34850) implemented in September 1985, and were further modified by Amendment 2 in November 1993 (CFMC 1993; 58 FR 53415) and by the Comprehensive SFA Amendment in May 2005. At present, over 137 reef fish species comprise the FMU (four groups are listed at the genus level and there are several species within each of these groups, so the exact number of species comprising the FMU is not fully defined.). Of the 137+ species, 55 are associated with the aquarium trade (this includes the four groups listed at the genus level), leaving 82 reef fish species subject to management by the Council. The present amendment addresses the MSRA mandates for at total of five units comprising 21 species of reef fish considered to be overfished and/or undergoing overfishing. Another amendment is under development by the Council to address the remaining 61 species in the FMU. The 21 species in this amendment comprise Snapper Unit 1 (black snapper, *Apsilus dentatus*; blackfin snapper, *Lutjanus buccanella*; silk snapper, *L. vivanus*; and vermilion snapper, *Rhomboplites aurorubens*), Grouper Unit 1 (Nassau grouper, *Epinephelus striatus*), Grouper Unit 2 (goliath grouper, *E. itajara*), grouper Unit 4 (red grouper, *E. morio*; yellowedge grouper, *E. flavolimbatus*; misty grouper, *E. mystacinus*; tiger grouper, *Mycteroperca tigris*; yellowfin grouper, *M. venenosa*) and 10 species of parrotfish (midnight parrotfish, *Scarus coelestinus*; blue parrotfish, *Sc. coeruleus*; striped parrotfish, *Sc. croicensis*; rainbow parrotfish, *Sc. guacamaia*; princess parrotfish, *Sc. taeniopterus*; queen parrotfish, *Sc. vetula*; redband parrotfish, *Sparisoma aurofrenatum*; redtail parrotfish, *Sp. chrysopterum*; redfin parrotfish, *Sp. rubripinne*; stoplight parrotfish, *Sp. viride*). Brief descriptions are provided

for two other species of reef fish because proposed management measures may include them, which would require their addition to the Caribbean Council's Reef Fish FMU: cardinal snapper, *Pristipomoides macrophthalmus* and black grouper, *Mycteroperca bonaci*. Many other fishes have distribution that overlap the targeted assemblage, compete for resources, and may be indirectly affected by the proposed management measures. Brief descriptions of attributes for those species can be found in the Comprehensive SFA Amendment (CFMC 2005) and are hereby incorporated by reference.

5.2.2.1 Grouper, hind, and sea bass, Serranidae

The Serranidae family contains 449 species in 62 genera, distributed in tropical and temperate oceans across the globe. These species are monoecious, with some functional hermaphrodites (Nelson 1994 in Froese and Pauly 2002). Protogynous hermaphroditism is known to occur in several species of grouper, although in related serranids synchronous hermaphroditism is also encountered. A broad overlap of the length distributions of the sexes is encountered in most species and suggests that there is no close correlation of age or size with sexual transition (Thompson and Munro 1974a). Seven genera are represented in the Caribbean reef fish fishery management unit: *Epinephelus*, *Mycteroperca*, *Hypoplectrus*, *Liopropoma*, *Paranthias*, *Rypticus*, and *Serranus*. Many grouper, but especially the largest *Epinephelus* species, appear to be the resident apex predators of the reef systems that they inhabit (Huntsman et al. 1999). Except for annual spawning aggregations, most species are solitary fishes and tagging studies have shown that grouper are generally resident on a particular reef for long periods of time (often years). This specificity to home range and spawning aggregation sites and the relatively slow growth rate of grouper make them particularly vulnerable to over-fishing (Heemstra and Randall 1993).

5.2.2.1.1 Yellowedge grouper, *Epinephelus flavolimbatus*

The yellowedge grouper occurs in the Western Atlantic, ranging from North Carolina (USA) to southern Brazil, including the Gulf of Mexico and the Caribbean Sea. Its flesh is considered to be of good quality, and is marketed fresh. It is taken in both commercial and recreational fisheries (Heemstra and Randall 1993).

A solitary and demersal species, the yellowedge grouper occurs in rocky areas and on sand mud bottom, ranging from 64-275 m (210-892 ft) depth. On soft bottoms, the yellowedge grouper is often seen in or near trenches or burrow-like excavations. This fish is of low resilience in rebuilding from low abundance, with a minimum population doubling time of 4.5 - 14 years (K=0.10; t_{max}=35). Maximum reported size is 115 cm (45 inches) TL (male); maximum weight, 18.6 kg (41 pounds; Heemstra and Randall 1993). Estimated size at maturity and age at first maturity are 50.5 cm (20 inches) TL and 6.2 years, respectively (Froese and Pauly 2002). In the northeastern Caribbean, individuals in spawning condition have been observed in April (Erdman 1976). Spawning is reported to occur during April through October in the South Atlantic (Keener 1984) and May through September in the Gulf of Mexico (Bullock et al. 1996). Maximum reported age is 32

years (Heemstra and Randall 1993). Natural mortality rate is estimated at 0.20 (Ault et al. 2002). It feeds on a wide variety of invertebrates (mainly brachyuran crabs) and fishes (Heemstra and Randall 1993). *Epinephelus flavolimbatus* is listed as "vulnerable" by Ferreira and Peres (2008) owing to an overall 30% decline from fisheries catch data throughout much of its range, although catch data suggests much higher declines in some areas. Generation length has been assumed during the assessment as 10 yrs (most certainly an underestimate) and the general biological characteristics of the species, including longevity, formation of aggregations for spawning, and its high desirability in regional fisheries, combined with a lack of effective management of multi-species fisheries in much of the region and pressure on such stocks predicted to increase, make this a vulnerable species. The yellowedge grouper has been managed under a seasonal closure (spawning months) in federal waters since 2005 and in the USVI since 2006 (February through April). Puerto Rico has not implemented a seasonal closure for the species.

5.2.2.1.2 Goliath grouper, *Epinephelus itajara*

The goliath grouper, formerly known as the "jewfish," occurs in the Western and Eastern Atlantic, and in the Eastern Pacific Ocean. In the Western Atlantic, its range extends from Florida (USA) to southern Brazil, including the Gulf of Mexico and the Caribbean Sea. Considered to be of excellent quality, its flesh is marketed both fresh and salted. It is targeted in both commercial and recreational fisheries (Heemstra and Randall 1993). But the take and possession of the goliath grouper has been prohibited in both federal and state waters of the USVI since 1993 and 1990, respectively. Puerto Rico implemented new regulations on March 12, 2004, to prohibit the possession or sale of goliath grouper. In many areas of the Caribbean, this species and most of the larger grouper are considered ciguatoxic.

A solitary species, the goliath grouper inhabits rock, coral, and mud bottom habitats from shallow inshore areas to depths of 100-150 m (328-482 ft; Heemstra and Randall 1993, NMFS 2001a). Juveniles are generally found in mangrove areas and brackish estuaries. Large adults also may be found in estuaries. They appear to occupy limited home ranges with little inter-reef movement (Heemstra and Randall 1993).

This species is of low resilience, with a minimum population doubling time of 4.5 - 14 years (K=0.13; tm=5.5-6.5). Maximum reported size is 250 cm TL (98 inches; male); maximum weight, 455 kg (1003 pounds; Heemstra and Randall 1993). NMFS (2001a) reports that males generally range in size between 80-210 cm TL; females, from 30-220 cm (12-87 inches). Estimated size at maturity and age at first maturity are 98 cm TL and 4.3 years, respectively (Froese and Pauly 2002). In the eastern Gulf of Mexico, males were found to mature at 110-115 cm (43-45 inches) TL, and females at 120-135 cm (47-53 inches) TL (Bullock et al. 1992), at approximately 6 years of age. Ault et al. (2002) estimate natural mortality rate to be 0.13. Fish taken from exploited populations range to 37 years of age. But it is likely that this species could live much longer than 40 years if left unexploited (NMFS 2001a).

This species exhibits definite or strongly suggestive indications of sex reversal (protogynous hermaphrodite) (Thompson and Munro 1974a). It forms consistent aggregations (always containing the largest, oldest individuals in the population), but only during the spawning season (Coleman et al. 2000). Aggregations off Florida declined in the 1980s from 50-100 fish to less than 10 per site. Since the harvest prohibition, aggregations have rebounded somewhat to 20-40 fish per site. Spawning in that area occurs in July through September over full moon phases. Fish may move up to 100 km from inshore reefs to the offshore spawning aggregations in numbers of up to 100 or more on ship wrecks, rock ledges, and isolated patch reefs along the southwest coast (NMFS 2001a). In the northeastern Caribbean, individuals in spawning condition have been observed in July and August (Erdman 1976). Bullock et al. (1992) reported that goliath grouper spawn during June through December with a peak in July to September in the eastern Gulf of Mexico.

This fish feeds primarily on crustaceans, particularly spiny lobsters, as well as turtles and fishes, including stingrays.

5.2.2.1.3 Red grouper, *Epinephelus morio*

The red grouper occurs in the Western Atlantic, ranging as far north as Massachusetts (USA) to southern Brazil, including the Gulf of Mexico and Caribbean Sea. This species is taken in both commercial and recreational fisheries, and is utilized in the aquarium trade. It is marketed both fresh and frozen (Heemstra and Randall 1993).

A sedentary species, the red grouper is usually found resting on rocky and muddy bottoms, from 5-300 m (16-984 ft) depth. It is uncommon around coral reefs. Juveniles can be found in shallow water, but adults are usually taken in waters deeper than 60 m (197 ft). This fish is of low resilience, with a minimum population doubling time of 4.5 - 14 years (K=0.1-0.18; t_m=4-6; t_{max}=25; F_{ec}=1.4 million). It is a protogynous hermaphrodite. Maximum reported size is of male fish is 125 cm (49 inches) total length (TL); maximum weight, 23 kg (51 pounds). The world record for hook and line is 17.7 lbs, from Cape Canaveral, Florida (Heemstra and Randall 1993). Size at maturity and age at first maturity are estimated as 47.1 cm (19 pounds) TL and 5.2 years, respectively (Froese and Pauly 2002). Most females transform to males between ages 7 to 14. Maximum reported age is 25 years (Heemstra and Randall 1993). Estimated natural mortality rate is 0.18 (Ault et al. 1998). In the northeastern Caribbean, individuals in spawning condition have been observed from February through May (Erdman 1976). It feeds on a wide variety of fishes and invertebrates (Heemstra and Randall 1993). Although the species has been considered to be rare in commercial catches, large individuals have been reported from the USVI (D. Berry, USVI commercial fisher, pers. comm.). Red grouper have been managed under a seasonal closure (spawning months) in federal waters since 2005 and in the USVI since 2006 (February through April). Puerto Rico has not implemented a seasonal closure for the species.

5.2.2.1.4 Misty grouper, *Epinephelus mystacinus*

The misty grouper occurs in both the Western and Eastern Atlantic Ocean. In the Western Atlantic, it ranges from Bermuda and North Carolina (USA) to Mexico, including the Gulf of Mexico and Caribbean Sea. This species is taken in both commercial and recreational fisheries, and is marketed fresh (Heemstra and Randall 1993).

The misty grouper is a solitary, bathydemersal, deep-water species, ranging from 30-400 m depth. Juveniles occur in shallower waters. Virtually nothing is known about the age, growth, and reproduction of this species. Maximum reported sizes are 160 cm (63 inches) TL and 100 cm (39 inches) TL for males and females, respectively. Maximum reported weight is 107 kg (236 pounds; Heemstra and Randall 1993). Estimated size at maturity is 81.1 cm (32 inches) TL; natural mortality rate, 0.14 (Froese and Pauly 2002). In the northeastern Caribbean, individuals in spawning condition have been observed in January, April, August, and November (Erdman 1976). Prey items include fishes, crustaceans, and squids (Heemstra and Randall 1993). Misty grouper have been managed under a seasonal closure (spawning months) in federal waters since 2005 and in the USVI since 2006 (February through April). Puerto Rico has not implemented a seasonal closure for the species.

5.2.2.1.5 Nassau grouper, *Epinephelus striatus*

The Nassau grouper occurs in the tropical Western Atlantic, ranging from Bermuda, the Bahamas, and Florida (USA) to southern Brazil. It is not known from the Gulf of Mexico, except at the Campeche Bank off the coast of Yucatan, at Tortugas, and off Key West. This species is a popular food fish and also is utilized in the aquarium trade (Heemstra and Randall 1993). However, the take and possession of Nassau grouper has been prohibited in federal waters since 1990. Furthermore, Puerto Rico implemented new regulations on March 12, 2004, to prohibit the possession or sale of Nassau grouper and the USVI implemented new regulations in 2006. Olsen et al. (1984) report that Nassau grouper can be ciguatoxic.

The Nassau grouper occurs from the shoreline to at least 90 m depth. It is a sedentary, and reef associated species, usually encountered close to caves; although juveniles are common in seagrass beds (Heemstra and Randall 1993). Adults lead solitary lives outside of spawning aggregations (NMFS 2001b).

This fish is of low resilience, with a minimum population doubling time of 4.5 - 14 years (Musick et al. 2000 in Froese and Pauly 2002). Maximum reported size is 122 cm (48 inches) TL (male); maximum weight, 25 kg (55 pounds; Heemstra and Randall 1993). Size at maturity and age at first maturity are estimated as 47.5 cm (18 inches) TL and 6.9 years, respectively. Approximate life span is 31.9 years (Froese and Pauly 2002); maximum reported age, 16 years (Heemstra and Randall 1993). Ault et al. (1998) estimate natural mortality rate to be 0.18.

This fish was initially characterized as a protogynous hermaphrodite. But recent investigations of histological and demographic data, and the nature of the mating system, indicates that Nassau grouper may not be strictly protogynous. Thus, it has been characterized as gonochoristic (separate sexes), with a potential for sex change (NMFS 2001b). One study reported 785,101 eggs for a specimen of 35.8 cm (14 inches) SL (Thompson and Munro 1974a).

The Nassau grouper aggregates to spawn at specific times and locations each year (Coleman et al. 2000; Sadovy et al. 1994), reportedly at some of the same sites utilized by the tiger, yellowfin, and black grouper (Sadovy et al. 1994). Concentrated aggregations of a few dozen (NMFS 2001b) up to 30,000 Nassau grouper have been reported from the Bahamas, Jamaica, Cayman Islands, Belize, and the Virgin Islands (Heemstra and Randall 1993). Spawning aggregations composed of about 2000 individuals have been documented north and south of St. Thomas, USVI, at 10-40 m (33-131 ft) depth, from December through February, around the time of the full moon (Rielinger 1999).

According to NMFS (2001b), spawning aggregations occur in depths of 20-40 m (66-131 ft) at specific locations of the outer reef shelf edge always in December and January around the time of the full moon in waters 25-26 degrees C (77-79 degrees F). Thompson and Munro (1974a) indicate that the spawning season probably extends from January to April in Jamaican waters. They report that spawning aggregations lasting up to two weeks have been encountered annually during late January to early February around the Cayman Islands (Thompson and Munro 1974a). In the northeastern Caribbean, individuals in spawning condition have been observed in March (Erdman 1976).

It is a top-level predator. Juveniles feed mostly on crustaceans, while adults (>30 cm; >12 inches) forage alone, mainly on fish (NMFS 2001b), but also on crabs and, to a lesser extent, other crustaceans and mollusks (Heemstra and Randall 1993).

5.2.2.1.6 Black grouper, *Mycteroperca bonaci*

Black grouper has a greyish or dark brown head. The body is similarly colored but has close-set, irregular spots which join to form chain-like horizontal streaks. The upper sides of the body sometimes has 7 or 8 columns of rectangular dark blotches, the first above opercle and the last on caudal peduncle. Most of the pectoral, soft dorsal, and anal fins are dusky brown but become orange at their margins.

Black grouper occur in the Western Atlantic from Bermuda and Massachusetts to southern Brazil, including the southern Gulf of Mexico, Florida Keys, Bahamas, Cuba, and throughout the Caribbean. Black grouper is found on rocky bottoms and coral reefs in depths of 10 to 30 m (33 to 99 ft); but in the eastern Gulf of Mexico, Bullock and Smith (1991) state that it “is usually found at depths of 30 m or greater”. Adults feed primarily on fishes, and juveniles prey mainly on crustaceans. Smith (1959) presented evidence for protogynous hermaphroditism in this species. Bullock and Smith (1991) reported ripe females of 50 to 100 cm (20 to 40 inches) and ripe males 96 to 116 cm (39 to 46 inches) from the Gulf of Mexico. Specimens in spawning condition were caught on the

Campeche Bank in July and August (Smith 1961). Black grouper attains at least 133 cm (52 inches) total length and a weight of 65 kg (143 pounds). Mowbray (1950) reported that *M. bonaci* at Bermuda attain a weight of 81 kg (179 pounds).

Black grouper is one of the most important species in the fishery of Bermuda and also in the fisheries of the southern Gulf of Mexico, Cuba, and the east coast of Venezuela.

5.2.2.1.7 Yellowfin grouper, *Mycteroperca venenosa*

The yellowfin grouper occurs in the Western Atlantic, ranging from Bermuda to Brazil and Guianas, including the Gulf of Mexico and Caribbean Sea. This species is taken in both commercial and recreational fisheries, and also is utilized in the aquarium trade. Although often implicated in ciguatera poisonings, it is a desirable food fish. Even large (5-10 kg; 11-22 pounds) fish taken from areas that are considered to be safe are sold in markets (Heemstra and Randall 1993).

The yellowfin grouper occurs from 2-137 m (7-450 ft) depth. Juveniles are commonly found in shallow turtle grass beds; adults, on rocky and coral reefs. This fish is of low resilience, with a minimum population doubling time of 4.5 - 14 years (K = 0.09-0.17; t_{max} = 15; Fecundity = 400,000). Maximum reported size is 100 cm TL (male); maximum weight, 18.5 kg (41 pounds; Heemstra and Randall 1993). Size at maturity and age at first maturity are estimated as 45.6 cm (18 inches) TL and 3.7 years, respectively. Approximate life span is 16.9 years; natural mortality rate, 0.18 (Ault et al. 1998). This fish is believed to be a protogynous hermaphrodite. One studied specimen contained a total of 1,425,443 eggs (Thompson and Munro 1974a). The yellowfin grouper reportedly aggregates at some of the same sites utilized by the tiger, Nassau, and black grouper (Sadovy et al. 1994). Three spawning aggregation sites have been documented off the USVI. Sites located north and south of St. Thomas are utilized from February through April. A third site located in the USVI National Park off St. John, USVI, is utilized year-round. Individuals aggregating at that site number about 200 (Rielinger 1999). Spawning has been observed in Puerto Rican waters in March. Most spawning appears to occur in Jamaican waters between February and April (Thompson and Munro 1974a). It feeds mainly on fishes (mostly on coral reef species) and squids (Heemstra and Randall 1993). The yellowfin grouper has been managed under a seasonal closure (spawning months) in federal waters since 2005 and in the USVI since 2006 (February through April). Puerto Rico has not implemented a seasonal closure for the species. Additionally, the known spawning aggregation site, Grammanik Bank off St. Thomas, has been protected under a seasonal area closure since 2004.

5.2.2.1.8 Tiger grouper, *Mycteroperca tigris*

The tiger grouper occurs in the Western Atlantic, ranging from Bermuda and south Florida (USA) to Venezuela and, possibly, Brazil, including the Gulf of Mexico and Caribbean Sea. Easily approached, this species is taken in commercial fisheries and also is utilized in the aquarium trade (Heemstra and Randall 1993). Dammann (1969) reports that tiger grouper can be ciguatoxic.

A solitary species, the tiger grouper inhabits coral reefs and rocky areas, from 10-40 m (33-131 ft) depth. This fish is of low resilience, with a minimum population doubling time of 4.5 - 14 years (K=0.11; tm=6.5-9.5). Maximum reported size is 101 cm (40 inches) TL (male); maximum weight, 10 kg (22 pounds; Heemstra and Randall 1993). Size at maturity and age at first maturity are estimated as 39.9 cm (16 inches) TL and 5.8 years, respectively. Approximate life span is 26 years; natural mortality rate, 0.116 (Ault et al. 2002). The size-sex ratios described in a Bermuda study indicate this fish is probably a protogynous hermaphrodite (Heemstra and Randall 1993). It forms aggregations at specific times and locations each year, but only during the spawning season (Coleman et al. 2000, Matos-Caraballo and Posada 1998). A presumptive courting group of three tiger groups also has been observed off the Bahamas, indicating that courtship also may occur in small groups (Sadovy et al. 1994).

One known aggregation site in the U.S. Caribbean is a well-defined promontory of deep reef known as "El Seco," which is located about 4.7 nm (8 km) east of Vieques Island, Puerto Rico. This site was discovered in the early 1980s by a local diver-fisher who also encountered large numbers of yellowfin grouper at the site. The site differs from other aggregation sites described for western Atlantic grouper in that it is relatively level, rather than near a distinct shelf-edge break. Other aggregation sites also have been reported, but not confirmed, including one site north of Vieques Island and another off St. Thomas, USVI. Apparently, both of those sites are used by the yellowfin grouper as well. Aggregating tiger and yellowfin grouper were observed at a site off Guanaja Island, Honduras, that is also used by aggregating Nassau and black grouper (Sadovy et al. 1994).

The "El Seco" tiger grouper aggregation is routinely targeted by fishermen using spear guns and hook and line gear. This fish is only infrequently taken outside of the aggregation season and is not taken by fish traps in the area (Matos-Caraballo and Posada 1998; Sadovy et al. 1994). The aggregation begins about two days after the full moons of February and March and last for about 5-6 days (Matos-Caraballo and Posada 1998). Females taken from the "El Seco" aggregation in 1997 and 1998 averaged 46.2 cm (18 inches) TL and 48.2 cm (19 inches) TL, respectively; males averaged 53.4 cm (21 inches) TL and 54.0 cm (22 inches) TL, respectively. The female to male ratio was 1:6.4 in 1997 and 1:12.0 in 1998 (Matos-Caraballo and Posada 1998). White et al. (2002) reported that spawning aggregations of tiger grouper occur one week following the full moon during January through April off Puerto Rico. The tiger grouper has been managed under a seasonal closure (spawning months) in federal waters since 2005 and in the USVI since 2006 (February through April). Puerto Rico has not implemented a seasonal closure for this species but the landings from the aggregation in Vieques are monitored every year.

The tiger grouper ambushes a variety of fish species, and frequents cleaning stations (Heemstra and Randall 1993). Off the island of Vieques, predation on tiger grouper by sharks at the time of capture is high (one for every six tiger grouper caught during the seasons of 1997 and 1998), and should be considered in the estimation of the number of fish that are being removed, directly or indirectly, from the fishery (Matos-Caraballo and Posada 1998).

5.2.2.2 Snapper, Lutjanidae

The Lutjanidae family contains 103 species in 17 genera, distributed in the tropical and subtropical Atlantic, Indian, and Pacific Oceans (Nelson 1984). These fishes are generally slow-growing and moderately long-lived. Sexes are separate (Thompson and Munro 1974b). Some species are sequential hermaphrodites, but no indications of hermaphroditism have been observed for Caribbean Council-managed species. Genera represented in the Caribbean reef fish fishery management unit include *Apsilus*, *Etelis*, *Lutjanus*, *Ocyurus*, *Pristipomoides*, and *Rhomboplites*.

Most species are believed to exhibit sexually dimorphic growth rates and sizes at maturity (Thompson and Munro 1974b). These fishes are generally serial spawners, releasing several batches of eggs over a spawning season that sometimes extends year round (SAFMC 1999). Spawning activity generally peaks in the spring and summer months in the northeastern Caribbean (Erdman 1976). Annual fecundity reportedly ranges from one hundred thousand eggs released by young snapper and smaller species, to millions of eggs released by older snapper and larger species (SAFMC 1999; Thompson and Munro 1974b).

All species have complex life histories, with most dependent on different habitats during the egg, larval, juvenile, and adult phases of their life cycle. Eggs and early larvae are typically pelagic (AFS 2001). No long-lived oceanic larval or post-larval phases have been reported for snapper, as have been reported for many other reef fish families. Thus, they probably have a relatively short planktonic larval or post-larval life (Thompson and Munro 1974b). Larvae settle into various nearshore nursery habitats such as seagrass beds, mangroves, oyster reefs, and marshes (AFS 2001). Very early juvenile stages of snapper are not often seen but do not appear to be as secretive as hinds and grouper (Thompson and Munro 1974b).

Adults are generally sedentary and residential. Movement is generally localized and exhibits an offshore-inshore pattern, usually associated with spawning events. Many species have been reported to form mass spawning aggregations, where hundreds or even thousands of fish convene to reproduce (Rielinger 1999). Other species also aggregate to swim (Froese and Pauly 2002; SAFMC 1999). Generally, larger snapper inhabit deeper areas than smaller snapper, although there are many exceptions.

Juveniles occupying inshore areas generally feed on shrimp, crab, worms and small fish. Fish becomes a more important component of their diet as they grow and move offshore (SAFMC 1999). On reefs, snapper must certainly compete among themselves for food and space. A 1967 study reported that snapper in the Virgin Islands feed primarily on crabs and fishes, with shrimps, lobsters, gastropods, stomatopods and octopus completing the diet (Thompson and Munro 1974b). Competition with grouper (Serranidae), jacks (Carangidae), moray eels (Muraenidae) and grunts (Pomadasyidae) probably also occurs, although the extent of competition is not known. Predators of juvenile snapper include large carnivorous fishes, such as jacks, grouper, sharks, barracudas, and morays, as well as

large sea mammals and turtles (SAFMC 1999). Major reef predators such as sharks, grouper and barracuda are probably the most important predators of adult snapper (Thompson and Munro 1974b).

5.2.2.2.1 Black snapper, *Apsilus dentatus*

The black snapper occurs in the Western Central Atlantic, off the Florida Keys (USA), and in the western Gulf of Mexico and Caribbean Sea. This species is considered to be a good food fish (Allen 1985). But Halstead (1970) reports that black snapper can be ciguatoxic.

A demersal species, the black snapper is primarily found over rocky bottom habitat, although juveniles are sometimes found near the surface (Allen 1985). It moves offshore to deep-water reefs and rocky ledges as it grows and matures (SAFMC 1999). Allen (1985) reports depth range as 100-300 m (328-984 ft). The findings of a Caribbean study indicate that it is most abundant at depths of 60-100 m (197-328 ft) off Jamaica (Thompson and Munro 1974b).

Maximum reported size is 65 cm (26 inches) TL (male). Maximum reported weight is 3,2kg (7 pounds; Allen 1985). Size at maturity and age at first maturity estimated in Froese and Pauly (2002) are 34.9 cm (14 inches) TL and 1 year, respectively. Observed maximum fork lengths (FL) of catches taken in a Jamaican study were 56 cm (22 inches) FL and 54 cm (21 inches) FL for males and females, respectively; estimated mean sizes of maturity, 43-45 cm (17-18 inches) FL and 39-41 cm (15-16 inches) FL for males and females, respectively (Thompson and Munro 1974b). Aida Rosario (PRDNER, pers. comm.) reports that females with ripe gonads were collected from December to May and from August to September, and were collected with the highest frequency in March and September. In the northeastern Caribbean, individuals in spawning condition have been observed from February through April, and in September (Erdman 1976). Thompson and Munro (1974b) report that, off Jamaica, the greatest proportions of ripe fishes were found in January-April and September-November. Approximate life span is 4.4 years; natural mortality rate, 0.30 (Ault et al. 1998). Large catches occasionally obtained over a short period of time suggest a schooling habit for this species (Thompson and Munro 1974b). Prey includes fishes and benthic organisms, including cephalopods, tunicates (Allen 1985), and crustaceans (Thompson and Munro 1974b).

The black snapper is a member of SU1, a unit that has been managed since 2006 under an October through December seasonal closure in both the EEZ and in the territorial waters of St. Thomas/St. John. A similar October-December seasonal closure has been in effect since 2007 in Puerto Rico, but that closure applies only to silk and blackfin snapper.

5.2.2.2.2 Blackfin snapper, *Lutjanus buccanella*

The blackfin snapper occurs in the Western Atlantic, as far north as North Carolina (USA) and Bermuda, south to Trinidad and northern Brazil, including the Gulf of Mexico and

Caribbean Sea (Allen 1985). This species is very common in the Caribbean, particularly in the Antilles. It is considered to be a good food fish, but can be ciguatoxic (Allen 1985).

The blackfin snapper is a demersal species, found from 20-200 m (66-656 ft) depth. Adults inhabit deeper waters over sandy or rocky bottoms, and near drop-offs and ledges. Juveniles occur in shallower waters, often between about 35 and 50 m (115-164 ft; Allen 1985), and sometimes in small schools (Thompson and Munro 1974b). Suitable bottom type is probably more important than depth in influencing the distribution of this species. Most fish taken in fish traps during a 1978 survey off Puerto Rico were captured at 75-110 m (246-361 ft) depth (Boardman and Weiler 1979).

This species is moderately resilient, with a minimum population doubling time of 1.4-4.4 years (K = 0.10 - 0.70). Maximum reported size is 75 cm (39 inches) TL (male); maximum weight, 14 kg (31 pounds) Allen 1985). The modal lengths for male and female blackfins taken in the Puerto Rican survey were 26 cm (10 inches) FL and 23 cm (9 inches) FL, respectively. Maximum size was 47 cm FL. Estimated lengths of maturity for females and males were 20 cm (8 inches) FL and 38 cm (15 inches) FL, respectively (Boardman and Weiler 1979). Size at maturity and age at first maturity are estimated in Froese and Pauly (2002) as 34 cm (13 inches) TL and 1.9 years, respectively. Approximate life span is 8.2 years; natural mortality rate, 0.23 (Ault et al. 1998).

The findings of Boardman and Weiler (1979) indicate that spawning occurs year-round in the U.S. Caribbean, in relatively large numbers. In the northeastern Caribbean, individuals in spawning condition have been observed in February, April, and September (Erdman 1976). Ripe fishes have been observed in Jamaican waters in February-May and in August-November, with maxima in April and September (Thompson and Munro 1974b). Allen (1985) identified fishes as the primary prey. Thompson and Munro (1974b) report that the main items in the stomachs of this species taken at the Virgin Islands were isopods (37.5%) and fish (33.3%), with shrimps, spiny lobsters, crabs, octopus and squid making up the rest of the diet. Tunicates have been found in the stomachs of some adults (Thompson and Munro 1974b).

The blackfin snapper is a member of SU1, a unit that has been managed since 2006 under an October through December seasonal closure in both the EEZ and in the territorial waters of St. Thomas/St. John. A similar October-December seasonal closure has been in effect since 2007 in Puerto Rico, but that closure applies only to silk and blackfin snapper.

5.2.2.2.3 Silk snapper, *Lutjanus vivanus*

The silk snapper occurs in the Western Atlantic, as far north as Bermuda and North Carolina (USA), southward to central Brazil. It is most abundant around the Antilles and the Bahamas. A good food fish, this species is taken in both commercial and recreational fisheries. It can be ciguatoxic (Allen 1985).

The silk snapper is mainly found from 90-140 m (295-459 ft) depth, commonly near the edge of the continental and island shelves, but also beyond the shelf edge to depths of 300

m (984 ft). Adults are generally distributed further offshore than juveniles (SAFMC 1999), and usually ascend to shallow water at night (Allen 1985). Suitable bottom type is probably more important than depth in influencing the distribution of this species. According to Rivas (1970), silk snapper are the only deep water snapper found over mud substrate in the Western Atlantic. Most fish taken in fish traps during a 1978 survey off Puerto Rico were captured at 112-165 m (368-541 ft) depth. Silk snapper have been reported to school in size groups (Dammann et al.1970). Boardman and Weiler (1979) suggest that silk snapper are commonly associated with blackfin snapper and vermillion snapper, though silk snapper are usually found at a slightly deeper depth.

This species is of low resilience, with a minimum population doubling time of 4.5 - 14 years (K = 0.09-0.32; tm = 5). Maximum reported size is 83 cm (33 inches) TL (male); maximum weight, 8,320 g (18 pounds; Allen 1985). The predominant lengths for males and females surveyed with trap gear in Puerto Rican waters were 29 cm (11 inches) FL and 26 cm (10 inches) FL, respectively, as determined from length-frequency curves. But trap-caught silk snapper tend to be smaller than those caught by hook and line gear. The maximum size of fish taken in that study was 71 cm (28 inches) FL. Females and males appeared to mature at 50 cm (20 inches) FL and 38 cm (15 inches) FL, respectively (Boardman and Weiler 1979). Size at maturity and age at first maturity are estimated in Froese and Pauly (2002) as 43.4 cm (17 inches) TL and 6.3 years, respectively. A Jamaican study estimates mean sizes of maturity as 55-60 cm (22-24 in) FL in males and 50-55 cm (20-22 in) FL in females (Thompson and Munro 1974b). The approximate life span of this fish is 28.7 years; natural mortality rate, 0.23 (Ault et al. 1998). However, Tabash and Sierra (1996) suggested a maximum life span of seven years and estimated an M using Ralston's (1987) method to be 0.86, which was also advocated by the SEDAR process.

The findings of Boardman and Weiler (1979) indicate that this species spawns year-round in the U.S. Caribbean, in low percentages. But the small number of ripe fish observed in that study may have been due to the majority of the catch being smaller than estimated size at maturity. Apparent peaks in spawning in July-September and October-December were probably due to chance collection of spawning groups of a few large fishes (Boardman and Weiler 1979). In the northeastern Caribbean, individuals in spawning condition have been observed from February through April, and in September and November (Erdman 1976). Ripe fishes have been observed off the coast of Jamaica in March-May and August, September and November (Thompson and Munro 1974b).

Prey items include mainly fishes, shrimps, crabs, gastropods, cephalopods, tunicates and some pelagic items, including urochordates (Allen 1985). The main items in the stomachs of fishes captured off the Virgin Islands consisted of fish (50.1%), shrimp (17.8%), and crabs (11%), with isopods and other invertebrate groups completing the diet (Thompson and Munro 1974b).

The silk snapper is a member of SU1, a unit that has been managed since 2006 under an October through December seasonal closure in both the EEZ and in the territorial waters

DRAFT

of St. Thomas/St. John. A similar October-December seasonal closure has been in effect since 2007 in Puerto Rico, but that closure applies only to silk and blackfin snapper.

5.2.2.2.4 Cardinal snapper, *Pristipomoides macrophthalmus*

Little is known of this relatively deep water snapper. Males have been recorded to reach a length of 50 cm (20 inches) TL with average lengths around 30 cm (12 inches) TL. The estimate of size at first maturity is 18 cm (7 inches) TL. This fish in benthopelagic and occurs at depths ranging from 110 – 550 m (361-1,804 ft; Allen 1985). Most commonly found in deeper waters of the shelf near the edge of the continental slope and feeds on small fishes and larger planktonic animals. Cardinal snapper have been recorded to occur in the Western Central Atlantic, Straits of Florida, Bahamas, Greater Antilles, and the Caribbean coast of Nicaragua and Panama. It is distinguished from other snapper by possessing 10 dorsal spines, 11 dorsal soft rays, 3 anal spines, and 8 anal soft rays. The species is described as having a large eye and a short and blunt snout. Its pectoral fins are long, extending to the level of anus. The scale rows on back are parallel to lateral line. The back and upper sides are pink-red with a silvery sheen, grading to silvery ventrally; the fins are translucent to pink..It supports a minor commercial fishery. This species is harvested with the queen snapper (*Etelis oculatus*) of SU2 (E. Piñeiro, PR commercial fisher, pers. comm.). The identification of the species has been confirmed by A. Rosario (PRDNER, pers. comm.).

5.2.2.2.5 Wenchman, *Pristipomoides aquilonaris*

The wenchman occurs in the western Atlantic, ranging from North Carolina to Guiana, including the Caribbean Sea. Although considered to be a good food fish, this species is believed to be of minor importance to commercial fisheries (Allen 1985). Olsen et al. (1984) report that wenchman can be ciguatoxic.

The wenchman is a demersal species, found from 24-370 m (79-1214 ft) depth. Maximum reported size is 56 cm (22 in) TL, and males are generally the larger of the two sexes; maximum weight, 1,990 g (4.4 lbs) (Allen 1985). Size at maturity is estimated as 32 cm (13 in) TL; natural mortality rate, 0.44 (Froese and Pauly 2002). Its diet is composed primarily of small fishes (Allen 1985).

This species, as part of SU1 if the change is approved with this amendment, has been part of SU2 (in the same management unit as the queen snapper) and there has been no management in place in the U.S. Caribbean. If the change from SU2 to SU1 is approved, then the applicable October through December seasonal closure will apply to this species. It is not known if the local governments will establish compatible regulations.

5.2.2.2.6 Vermilion snapper, *Rhomboplites aurorubens*

The vermilion snapper occurs in the western Atlantic, ranging from Bermuda and North Carolina to Brazil and including the Gulf of Mexico and the Caribbean Sea (Allen 1985).

The vermilion snapper is a demersal species, commonly found over rock, gravel, or sand bottoms near the edge of the continental and island shelves (Allen 1985). Suitable bottom type is probably more important than depth in influencing the distribution of this species (Boardman and Weiler 1979). According to Allen (1985), this fish is found in moderately deep waters from 180-300 m (591-984 ft). But most fish taken in fish traps during a 1978 survey off Puerto Rico were captured at 75-110 m (246-361 ft) depth (Boardman and Weiler 1979). Vermilions often form large schools; particularly the young, which generally occur at shallower depths (Allen 1985).

This fish is moderately resilient, with a minimum population doubling time of 1.4 - 4.4 years (K = 0.20; tm = 3; t_{max} = 10; Allen 1985). Maximum size and weight reported by Allen (1985) is 60 cm (24 inches) TL (male) and 3,170 g (7 pounds), respectively. The modal length of both males and females collected in a three-year fish trap survey in Puerto Rican waters was 23 cm (9 inches) FL; maximum size, 38 cm (15 inches). Size at maturity was 14 cm (5.5 inches) FL (males) and 20 cm (8 inches) FL (females) (Boardman and Weiler 1979). Size at maturity and age at first maturity for this species are estimated in Froese and Pauly (2002) as 34.5 cm (14 inches) TL and 3.3 years, respectively. Maximum reported age is 10 years (Allen 1985); natural mortality rate, 0.23 (Ault et al. 1998).

According to Boardman and Weiler (1979), this fish spawns year-round in the U.S. Caribbean and in relatively large numbers. Erdman (1976) reports that the majority of fishes collected off the south coast of Puerto Rico in February, March, April, and June had sub-ripe or ripe gonads. A study off Jamaica captured one active male during May, and one ripe and three active females during October (Thompson and Munro 1974b). Prey items include fishes, shrimps, crabs, polychaetes, other benthic invertebrates, cephalopods, and planktonic organisms (Allen 1985).

The vermilion snapper is a member of SU1, a unit that has been managed since 2006 under an October through December seasonal closure in both the EEZ and in the territorial waters of St. Thomas/St. John. A similar October-December seasonal closure has been in effect since 2007 in Puerto Rico, but that closure applies only to silk and blackfin snapper.

5.2.2.3 Parrotfish, Scaridae

The family Scaridae contains 83 species in 9 genera, distributed in the Atlantic, Indian, and Pacific Oceans (Nelson 1994 in Froese and Pauly 2002). The 10 species in the Caribbean reef fish fishery management unit belong to one of two genera: *Scarus* or *Sparisoma*. All these species are marketed for food and landings are increasing as other traditionally marketed species decline and market demand increases. In St. Croix, parrotfish are considered to be an important commercial fishery and this species group often represents the highest level of finfish landings on the island. With the exception of the midnight parrotfish, *Scarus coelestinus*, all are utilized in the aquarium trade (Sadovy 1991).

Parrotfish are tropical shallow-water fishes, which commonly occur on or adjacent to coral reef habitat, but also can be found over rocky shores and substrates. They have a tendency to exhibit residential behavior for variable periods of time, but may move over distances of up to several hundred meters during feeding (Reeson 1975). These fishes are herbivores. Most species feed on algae scraped from dead coral substrates. The common practice of consuming and crushing bits of rock along with the algae to aid in the digestive process make these fishes some of the most important producers of sand on coral reefs (Nelson 1994 in Froese and Pauly 2002).

Parrotfish are diurnally active, feeding during the day and resting at night. They tend to aggregate in shallow waters near dusk, then move to deeper areas before nightfall. Mixed species aggregations may occur, or the schools may also contain representatives of other families. For example, it is common around Jamaica to find members of the Surgeonfish (Acanthuridae), Goatfish (Mullidae), Grunt (Pomadasyidae) and Wrasse (Labridae) families in association with the usually numerically dominant striped parrotfish (*Scarus croicensis*) (Reeson 1975).

Many species undergo sex reversal, with an initial phase of both males and females, and the latter changing into a brilliantly colored male terminal phase. Terminal males dominate several females. These fishes are pelagic spawners (Nelson 1994 in Froese and Pauly 2002); some spawn in pairs; others in small groups or aggregations (Reeson 1975). Juveniles are present in the northeastern Caribbean year-round (Erdman 1976). Moray eels are believed to be important predators. Other predators include grouper, jacks, and snapper (Reeson 1975). With the exception of the midnight parrotfish, all species in the Caribbean fishery management unit have been known to cause ciguatera poisoning.

High landings of parrotfish, most prominently in St. Croix, were reported by fishers using nets (gill and trammel nets). These gears were banned from the U.S. Caribbean EEZ in 2005. The USVI also banned the use of trammel and gill nets in the Territory in 2006. Puerto Rico regulated the length and the mesh size of nets in 2004. Parrotfish are also harvested using traps and for this gear the regulations of mesh size, the use of biodegradable material and the requirement of an escape panel are the same throughout the US Caribbean.

5.2.2.3.1 Midnight parrotfish, *Scarus coelestinus*

The midnight parrotfish occurs in the western Atlantic, ranging from Bermuda to Brazil and including the Caribbean Sea (Robins and Ray 1986).

The midnight parrotfish occurs from rocky coastal reefs to seaward reefs, in depths of 5-75 m (16-246 ft). It is often encountered in schools, feeding on algae along with surgeonfishes. Maximum reported size is 77 cm (30 inches) TL (male); maximum weight, 7,000 g (15 pounds; Robins and Ray 1986). The midnight parrotfish has been observed to spawn in pairs. A Jamaican study reported that the highest proportion of active and ripe fishes was confined to the period between January and May. Spawning appears to be

confined to the warmer months of the year in Bermuda (Reeson 1975). The midnight parrotfish, along with the blue and rainbow, is one of the largest species of parrotfish.

5.2.2.3.2 Blue parrotfish, *Scarus coeruleus*

The blue parrotfish occurs in the western Atlantic, ranging from Maryland and Bermuda to Brazil, including the Caribbean Sea (Robins and Ray 1986).

The blue parrotfish inhabits coral reef habitat, occurring from 3-25 m (10-82 ft) depth. Juveniles are found on seagrass (*Thalassia*) beds. Maximum reported size is 120 cm (47 inches) TL (male) (Robins and Ray 1986). Estimated size at maturity is 62.9 cm (25 inches) TL; natural mortality rate, 0.43 (Froese and Pauly 2002). This fish is known to form large spawning aggregations (Robins and Ray 1986). In Jamaican waters, the highest proportion of active and ripe fishes occurs between January and May (Reeson 1975). Dietary items include benthic plants and small organisms in the sand (Robins and Ray 1986).

5.2.2.3.3 Rainbow parrotfish, *Scarus guacamaia*

The rainbow parrotfish occurs in the western Atlantic, ranging from Bermuda to Argentina and including the Caribbean Sea (Robins and Ray 1986).

The rainbow parrotfish is found from 3-25 m (10-82 ft) depth. Juveniles are commonly encountered in mangrove areas. It inhabits a home cave at night and when threatened. Maximum reported size is 120 cm (47 inches) TL (male); maximum weight, 20 kg (44 pounds; Robins and Ray 1986). Estimated size at maturity is 62.9 cm (25 inches) TL; natural mortality rate, 0.43 (Froese and Pauly 2002). In Jamaican waters, the largest proportion of active and ripe fish appears to be confined to the period between January and May (Reeson 1975). In the northeastern Caribbean, individuals in spawning condition have been observed in June and July (Erdman 1976). This fish feeds primarily on benthic algae (Robins and Ray 1986).

5.2.2.3.4 Striped parrotfish, *Scarus croicensis*

The striped parrotfish occurs in the western Atlantic, ranging from Bermuda to northern South America (and possibly Brazil) and including the Gulf of Mexico and Caribbean Sea (Böhlke and Chaplin 1993).

The striped parrotfish is found in shallow, clear, waters from 3-25 m (10-82 ft) depth. It is a schooling species, and generally occurs over seagrass (*Thalassia*) beds, but also is found in rocky or coral areas. Maximum reported size is 35 cm (14 inches) TL (male) (Böhlke and Chaplin 1993). Size at maturity is estimated in Froese and Pauly (2002) as 21.2 cm (8 inches) TL; natural mortality rate, 0.61. A study conducted in Bermuda reports that males mature at 11-13 cm (4-5 inches) SL and females at 9-10 cm (3-4 inches) SL (Reeson 1975). Supermales spawn individually with striped females, while sexually mature males in the striped phase spawn in aggregations (Böhlke and Chaplin 1993) of up to 400

individuals (Reeson 1975). One spawning aggregation site has been documented off the southwest coast of Puerto Rico. Striped parrotfish have been observed to spawn at that site in winter months at about 20-30 m (66-98 ft) depth (Rielinger 1999). This species has been observed to spawn in the Virgin Islands in February, March, April, June, and August. Deeper reef fronts (15-20 m; 49-66 ft) appear to be the focal points for spawning groups. It has been observed to migrate daily among specific routes (Reeson 1975). It feeds on plants (Böhlke and Chaplin 1993).

5.2.2.3.5 Princess parrotfish, *Scarus taeniopterus*

The princess parrotfish occurs in the western Atlantic from Bermuda to Brazil and throughout the Caribbean Sea (Robins and Ray 1986).

The princess parrotfish is found on coral or rock bottoms, from 2-25 m (7-82 ft) depth. Juveniles often occur in association with seagrass (*Thalassia*). Maximum reported size is 35 cm (14 inches) TL (male) (Robins and Ray 1986). Size at maturity is estimated as 21.2 cm (8 inches) TL; natural mortality rate, 0.88 (Froese and Pauly 2002). This species appears to spawn throughout the year in Jamaican waters, with the highest proportion of ripe fishes occurring in December and January (Reeson 1975). It feeds on plants in large aggregations, and sleeps in a mucus cocoon (Robins and Ray 1986).

5.2.2.3.6 Queen parrotfish, *Scarus vetula*

The queen parrotfish occurs in the western Atlantic from Bermuda to northern South America and throughout the Caribbean Sea (Robins and Ray 1986).

The queen parrotfish inhabits coral reefs and adjacent habitats from 3-25 m (10-82 ft) depth. It is often observed in groups of one supermale with several young adults, most of which are believed to be females. Maximum reported size is 61 cm (24 inches) TL (male) (Robins and Ray 1986). Size at maturity and age at first maturity are estimated as 30.6 cm (12 inches) TL and 1.1 years, respectively. Approximate life span is 4.8 years; natural mortality rate, 1.05 (Froese and Pauly 2002). In the northeastern Caribbean, individuals in spawning condition have been observed in January, February, May, June, and August (Erdman 1976). Spawning pairs have been observed in August and January off the Virgin Islands and Puerto Rico, respectively (Reeson 1975). The queen parrotfish feeds on algae and sleeps in a mucus cocoon (Robins and Ray 1986).

5.2.2.3.7 Redband parrotfish, *Sparisoma aurofrenatum*

The redband parrotfish occurs in the western Atlantic from Bermuda to Brazil and throughout the Caribbean Sea (Robins and Ray 1986).

The redband parrotfish inhabits coral reefs, occurring from 2-20 m (7-66 ft) depth. Juveniles are usually found in adjacent seagrass beds. It is often observed resting on the sea bottom, either solitary or in small groups. This species is moderately resilient, with a minimum population doubling time of 1.4 - 4.4 years (K=0.20). Maximum reported size

is 28 cm (11 inches) TL (male) (Robins and Ray 1986). Size at maturity is estimated as 17.4 cm (7 inches) TL; natural mortality rate, 1.14 (Froese and Pauly 2002). Reeson (1975) reports that spawning has been observed to occur off the Virgin Islands in the months of March, April, June, and August. Individuals have also been observed in spawning condition in the northeastern Caribbean during February and December (Erdman 1976). Ripe fishes have been caught in both the nearshore and offshore environment, and pair spawning has been observed (Reeson 1975). The redband parrotfish feeds on plants (Robins and Ray 1986).

5.2.2.3.8 Redtail parrotfish, *Sparisoma chrysopterum*

The redtail parrotfish occurs in the western Atlantic from southern Florida to Brazil and throughout the Caribbean Sea (Robins and Ray 1986).

The redtail parrotfish occurs in coral reefs and adjacent habitats to depths of 15 m (49 ft). Juveniles most commonly inhabit seagrass beds. Maximum reported size is 46 cm (18 inches) TL (male) (Robins and Ray 1986). Size at maturity and age at first maturity are estimated in Froese and Pauly (2002) as 23.9 cm (9 inches) FL and 0.9 years, respectively; approximate life span, 3.6 years. Estimated size at 50% maturity based on fishery independent and dependent data collected from Puerto Rican waters is 23.5 cm (9 inches) FL (females). Transitional fish ranged from 20.1 cm FL to 24.8 cm FL (Figuerola Fernández and Torres Ruiz 1997). No estimate of natural mortality rate is available for this species. Spawning period is protracted. According to Figuerola Fernández and Torres Ruiz (1997), no peaks are apparent in the U.S. Caribbean, but spawning activity appears to decrease during the summer (May through August). Data from a Jamaican study indicate that the highest proportion of active and ripe fishes occurs between January and May (Reeson 1975). The redtail parrotfish feeds on benthic algae and seagrasses (Robins and Ray 1986).

5.2.2.3.9 Redfin parrotfish, *Sparisoma rubripinne*

The redfin parrotfish occurs in both the eastern and western Atlantic. In the western Atlantic, this species ranges from Massachusetts to Brazil and throughout the Caribbean Sea. It is apparently absent in the Gulf of Mexico (Randall 1990).

The redfin parrotfish inhabits coral reefs and seagrass beds to depths of 15 m (49 ft). Maximum reported size is 47.8 cm (19 inches) TL (male) (Randall 1990). Size at maturity and age at first maturity are estimated as 28.3 cm (11 inches) TL and 1.2 years, respectively. Approximate life span is 4.9 years; natural mortality rate, 1.05 (Froese and Pauly 2002). Spawning usually occurs in small groups (Randall 1990), but also in pairs. Deeper reef fronts (15-20 m; 49-66 ft)) appear to be the focal points for spawning groups. Data collected in a Jamaican study indicate that the highest proportion of active and ripe fishes occurs between January and May. Ripe males and females have been collected in all months of the year off the Virgin Islands (Reeson 1975). The redfin parrotfish feeds on benthic algae and seagrasses (Randall 1990).

5.2.2.3.10 Stoplight parrotfish, *Sparisoma viride*

The stoplight parrotfish occurs in the western Atlantic from southern Florida to Brazil and throughout the Caribbean Sea (Cervigón et al. 1992).

The stoplight parrotfish inhabits clear water coral reefs, occurring from 3-49 m (10-161 ft) depth. Juveniles may be found in seagrass beds and other heavily vegetated bottoms. This species is strictly diurnal, and spends the night resting on the sea bottom. It occurs singly or in small groups. Maximum reported size is 64 cm (25 inches) TL (male); maximum weight, 1,600 g (3.5 pounds). This fish is a protogynous hermaphrodite, functioning first as a female and, later, as a male (Cervigón et al. 1992). Size at maturity is estimated in Froese and Pauly (2002) as 36.1 cm (14 inches) TL; natural mortality rate, 0.66. Size at 50% maturity estimated from a survey conducted off Puerto Rico is 20.5 cm (8 inches) FL (females) (Figuerola Fernández and Torres Ruiz 1997). A Bermuda study reports that males mature at 16-20 cm (6-8 inches) SL and females at 16.3 cm (6 inches) SL (Reeson 1975).

Spawning period is protracted. According to Figuerola Fernández and Torres Ruiz (1997), no peaks are apparent in the U.S. Caribbean, but spawning activity appears to decrease during the summer (May through August). Pair spawning has been observed in May off the Virgin Islands (Reeson 1975). This fish feeds primarily on soft algae, but also has been observed to graze on live corals, such as *Montastrea annularis*. It produces a significant amount of sediment through bioerosion using its strong beak-like jaws and constantly regrowing teeth (Cervigón et al. 1992).

5.2.3 Protected Species, Including Threatened and Endangered Species

NOAA Fisheries is responsible for the protection of threatened and endangered species under the Endangered Species Act (ESA) of 1973 and the Marine Mammal Protection Act (MMPA) of 1972. The ESA promotes the protection of the ecosystems on which threatened and endangered species depend and a program for the conservation of threatened and endangered species. ESA-listed species under the purview of NOAA Fisheries that occur in the action area include hawksbill sea turtle (*Eretmochelys imbricata*), green sea turtle (*Chelonia mydas*), leatherback sea turtle (*Dermochelys coriacea*), loggerhead sea turtle (*Caretta caretta*), humpback whale (*Megaptera novaeangliae*), blue whale (*Balaenoptera musculus*), fin whale (*B. physalus*), sei whale (*B. borealis*), sperm whale (*Physeter macrocephalus*), elkhorn coral (*Acropora palmata*), and staghorn coral (*A. cervicornis*). The MMPA establishes a national policy to prevent marine mammal species and population stocks from declining beyond the point where they cease to be significant functioning elements of the ecosystems of which they are a part. All marine mammals, regardless of their listing status under the ESA, are protected under the Marine Mammal Protection Act.

5.2.3.1 Marine Mammals

Marine mammals are primarily ocean-dwelling animals including cetaceans (whales, dolphins, and porpoises), sirenians (manatees), and pinnipeds (seals). Cetaceans are

divided into two groups, the toothed whales, which also include dolphins and porpoises, and baleen whales. Baleen whales are usually larger than toothed whales and have baleen plates rather than teeth that enable them to filter water in order to separate out food such as krill and small fish. Baleen plates are flat and flexible with frayed edges that look like hair. In fact, the plates are made of the same material as hair, keratin.

NMFS lists five species of marine mammals, which are known to transit through waters around Puerto Rico and the USVI, as being in danger of extinction under the ESA. The most common marine mammals under NMFS' jurisdiction that are found in the area are the humpback whale, in particular during its winter migration along the west coast of Puerto Rico and the bottlenose dolphin (*Tursiops truncatus*). Only the whale species listed as endangered are discussed in more detail below.

According to the 2009 MMPA List of Fisheries, the Caribbean gillnet fishery is listed as Category III with the possibility of incidental death or injury to the West Indian manatee as the only potential impact of this fishery on listed species. However, gill and trammel nets were banned in the U.S. Caribbean EEZ in 2005 and in USVI territorial waters in 2006. The Caribbean snapper-grouper and other reef fish bottom longline/hook-and-line, pelagic hook-and-line/harpoon, mixed species trap/pot, and spiny lobster trap/pot have not resulted in the documentation of any death or injury to marine mammals as a result of these fisheries and are in Category III (73 73032).

5.2.3.1.1 Humpback Whale (*Megaptera novaeangliae*)

The humpback whale is a large baleen whale and was listed as endangered throughout its range under the ESA on June 2, 1970. Humpbacks are considered depleted under the MMPA.

The humpback whale is distributed worldwide but is less common in Arctic waters. Humpback whales migrate seasonally. During the winter, which is their breeding season, they are typically found in temperate and tropical waters. In summer, which is their feeding season, humpbacks are usually in higher latitude waters of high productivity. There are currently four recognized stocks of humpback whales in the U.S. designated based on geographically distinct winter ranges: The Gulf of Maine stock (previously known as the western North Atlantic stock), the eastern North Pacific stock (previously known as the California-Oregon-Washington stock), the central North Pacific stock, and the western North Pacific stock.

Humpback whales are affected by human activities in many parts of their range, which may impede recovery of the species. Humpback whales were historically hunted for their meat and blubber. Entanglements and collisions with vessels are factors that may slow recovery of the population. Disturbance by whale watching may also be an issue in some areas of the humpback's range as this industry continues to grow. In Puerto Rico, there are several businesses dedicated to whale watching during the winter migratory season in the area of Rincón. Pollution and habitat alteration and destruction from coastal development may also affect humpback whales.

A visual and passive acoustic survey of the area around Puerto Rico found winter aggregations of humpbacks around Cabo Rojo and the northern shore of Mona Island that appear to be as dense as those in waters of the Dominican Republic (Swartz et al 2001). The highest concentrations of humpbacks have been found to occur along the northwestern coast of Puerto Rico (especially Punta Higuero in Rincón and Punta Agujereada in Aguadilla), Cabo Rojo, and Mona Passage, near Saba Bank, the northern VI and off the east end of St. Croix in waters less than 200 meters deep (CFMC 2004). In April 2008, a female gave birth in Guayanilla Bay and then continued migrating through Mona Passage. Thus, the area contains groups of humpback whales, in particular during their winter migration between November and May.

5.2.3.1.2 Blue Whale (*Balaenoptera musculus*)

The blue whale is listed as endangered under the ESA and protected under the MMPA. Blue whales are also listed as endangered under the International Union for Conservation of Nature's (IUCN) Red List of Threatened Species.

The blue whale, a baleen whale, is the largest animal ever known to have lived on Earth. Blue whales are found in oceans worldwide and are separated into North Atlantic, North Pacific, and Southern Hemisphere populations. The blue whale has also been subdivided into three subspecies: *B. musculus intermedia* found in Antarctic waters, *B. musculus musculus* found in the Northern Hemisphere, and *B. musculus brevicauda* found in the southern Indian Ocean and southwest Pacific Ocean. In the U.S., blue whale stocks are divided into the western North Atlantic stock, the eastern North Pacific stock, and the Hawaiian stock. The stocks of blue whales were severely depleted by past hunting activities. Now, blue whales are at least occasionally injured or killed by ship collisions based on observations in California and the Gulf of St. Lawrence.

The blue whale is considered an occasional visitor in the U.S. Atlantic EEZ. Neither the southern limit of its range nor its population size are clearly defined (NMFS 2002). Blue whales are found both on the continental shelf and far offshore in deep water. While the Navy's Sound Surveillance System program has tracked blue whales in the North Atlantic, including subtropical waters north of the West Indies (NMFS 2002), no blue whales have been reported in waters of Puerto Rico or the USVI.

5.2.3.1.3 Fin Whale (*B. physalus*)

The fin whale was first listed as endangered under the ESA on June 2, 1970. It is now designated as endangered throughout its range.

Fin whales were greatly depleted by whaling but large numbers of these species still remain worldwide. These whales are still hunted in Greenland as part of permitted aboriginal subsistence hunting and Japan is beginning to kill these whales as part of its scientific program. Other potential threats to finback whales are collisions with vessels, entanglement in fishing gear, habitat degradation, and disturbance from low-frequency

noise. In addition, because fin whales rely on large schools of fish for their diet in many areas, trends in fish populations, whether driven by fishery operations, human-caused environmental deterioration, or natural processes, may strongly affect the size and distribution of fin whale populations (NMFS 2006).

Populations of fin whales in the North Atlantic, North Pacific, and Southern Ocean probably mix rarely (if at all), and there are geographical populations within these ocean basins (NMFS 2006). In U.S. waters, fin whales are divided between the North Atlantic and North Pacific (Alaska (Northeast Pacific), California/Washington/Oregon, and Hawaii) stocks. Fin whales do not have an obvious north/south migration pattern like other baleen whales. However, acoustic studies indicate that there is a southward movement in the fall into the West Indies. Limited sightings of fin whales are reported for Puerto Rico and the USVI, in particular in the winter (December-January), which corresponds with the breeding season of this species (CMFC 2004). However, reports do not distinguish between fin and sei whales, which are very similar in appearance. Sighting off Puerto Rico have been in the area north of Mona Island and south of Cayo Ratones, Salinas. More sighting occur around the Virgin Islands, south of St. Thomas and west and east of St. Croix (CFMC 2004).

5.2.3.1.4 Sei Whale (*B. borealis*)

Sei whales are another of the baleen whales and were listed as endangered under the ESA on December 2, 1970 and are considered depleted under the MMPA.

Sei whales are divided into two subspecies: *B. borealis borealis* in the Northern Hemisphere and *B. borealis schlegellii* in the Southern Hemisphere. Sei whales occur in subtropical, temperate, and subpolar waters worldwide. Sei whales in U.S. waters have been divided into four stocks: Hawaiian, Eastern North Pacific, Nova Scotia, and Western North Atlantic. There are no current population estimates for the stocks in Nova Scotia and the Western North Atlantic. Sei whales were greatly depleted by past commercial hunting and whaling. Ship strikes and interactions with fishing gear, such as traps and pots, may affect current populations of sei whales.

Sei whales are commonly found in the Gulf of Maine and on Georges Bank and Stellwagen Bank in the western North Atlantic during the summer. However, the entire distribution and movement patterns of this species are not well known. Some populations of sei whales may migrate seasonally toward lower latitudes during the winter and higher latitudes during the summer. Limited sightings of sei whales have been reported from the U.S. Caribbean, both inshore and offshore near the shelf edge. Some of these reports may actually be for fin whales as these two species are difficult to separate visually in the field. Sightings have been from north of Mona Island and south of Cayo Ratones, Salinas, in Puerto Rico and around the Virgin Islands, south of St. Thomas and west and east of St. Croix (CFMC 2004).

5.2.3.1.5 Sperm Whale (*Physeter macrocephalus*)

Sperm whales are the largest of the toothed whales. Sperm whales were listed as endangered under the ESA in 1970 and are considered depleted under the MMPA throughout their range.

Sperm whales inhabit oceans worldwide. Sperm whale migrations are not as well understood as those of most baleen whales, although their distribution is likely dependent on their food source and breeding conditions. In temperate and tropical waters, there appears to be no obvious seasonal migration. In U.S. waters, sperm whales have been divided into five stocks: California-Oregon-Washington, North Pacific (Alaska), Hawaiian, Northern Gulf of Mexico, and North Atlantic. Hunting of sperm whales in the past greatly depleted all populations of this species. Sperm whales are still targeted in a few areas such as Indonesia and Japan in limited numbers but there is some evidence that illegal hunting in some areas of the world is still occurring. Sperm whales may be harmed by ship strikes and entanglement in fishing gear, though the tendency of sperm whales to be in extremely deep offshore waters may reduce the probability of these interactions. Coastal pollution and noise in areas of oil and gas exploration and commercial shipping may also affect these whales.

Both large and small adults and calves and juveniles occur in the southeastern Caribbean, in particular sightings have been from the leeward sides of islands (NMFS 2002). Sightings off Puerto Rico and the USVI reported sperm whales off the coast of Mona Island in the Mona Passage, off the coast of Rincón, Ponce, San Juan, and Loíza, south of Vieques, and between St. Thomas and St. Croix (CFMC 2004). Swartz et al. 2001 detected sperm whales in deep waters, in particular in areas of high bottom relief, southwest of Puerto Rico and in Mona Passage using acoustics.

5.2.3.2 Sea Turtles

Sea turtles are important components of tropical seas and the marine food web. However, due to historical overfishing of all sea turtle species for use of their meat as well as for use of their shell in artisanal and utilitarian articles, sea turtles are considered to be threatened or in danger of extinction in the United States and in other countries.

The U.S. Caribbean provides nesting, foraging, and developmental habitat primarily for three species of sea turtles listed as endangered or threatened under the ESA: the leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelys imbricata*), and green (*Chelonia mydas*). Nesting by the loggerhead sea turtle is infrequent and these animals are only rarely seen in waters around Puerto Rico and the USVI.

Sea turtles that nest in the U.S Caribbean have similar life cycles. Basically, all the species migrate, at least short distances, from the feeding areas to the breeding grounds, which are near nesting areas. Following breeding, the males are thought to return to the feeding areas while the females move to nesting areas. Females return to the feeding areas and begin to prepare for the next reproductive season once nesting is complete. In

order to ensure reproductive success, most sea turtles exhibit iteroperous reproduction, which means they produce their offspring in a series of separate events. Several clutches are laid during nesting season and, in tropical areas, nesting is often year-round with peak periods.

Based on stranding data for western Puerto Rico, including Guánica, Lajas, Cabo Rojo, Mayagüez, Añasco, Rincón, and Aguadilla for the period from 1999-2007 (PRDNER 2008a), fishing gear impacted several species of sea turtles. Hawksbill and green sea turtles were particularly affected by fishing gear and most interactions with fishing gear resulted in mortality. PRDNER notes that these numbers are very low as they depend upon PRDNER receiving a stranding report from the public or another agency or finding the animals while on patrols. Stranding data included two hawksbill sea turtles killed by entanglement in fishing line; one green and two hawksbill sea turtles with fishing hooks in their throats that were rehabilitated and liberated; one green turtle that drowned entangled in a fish trap; two hawksbill sea turtles killed by spear guns; four green sea turtles entangled in nets one of which was found alive and liberated, five hawksbill sea turtles entangled in nets two of which were found alive, rehabilitated and later liberated, and one leatherback killed by entanglement in a net (PRDNER 2008a). Note that a ban on nets (gill and trammel) went into effect in the U.S. Caribbean EEZ in 2005 and in the territorial waters of the USVI in 2006.

5.2.3.2.1 Hawksbill Sea Turtle (*Eretmochelys imbricata*)

Hawksbill sea turtles were listed as endangered in 1970 under the ESA.

Hawksbill sea turtles are found in tropical and subtropical seas of the Atlantic, Pacific, and Indian Oceans. In the continental U.S., the species is recorded from all the gulf states and along the eastern seaboard as far north as Massachusetts, with the exception of Connecticut, although sightings north of Florida are rare. Nesting occurs principally in Puerto Rico and the USVI, where the species is very common. Hawksbill sea turtles nest year-round in the area and adults and hatchlings can be found in waters throughout the year. The two most important nesting sites are Mona Island off Puerto Rico and Buck Island off St. Croix. Mona Island supports one of the largest nesting populations of hawksbills in Puerto Rico. For this reason, the United States Fish and Wildlife Service designated the beaches of Mona Island as critical habitat for hawksbill sea turtles under the ESA, and NMFS designated the waters up to three nautical miles around Mona and Monito Islands as critical habitat.

The greatest threat to hawksbill sea turtles is poaching as their eggs, shell, and meat continue to be in demand. Stranding data from PRDNER (2008a) for the period from 1999-2007 contain reports of seven hawksbill deaths as a result of illegal poaching and the successful rehabilitation and liberation of three others that were hunted illegally. This is an underestimate as these are only the animals recovered by PRDNER. Another threat is boat strikes. PRDNER (2008a) stranding data indicate that five hawksbills were killed by boat strikes during 1999-2007 and these are only the animals that were reported. Coastal development may also affect these animals through the loss or degradation of habitat,

pollution, and entanglement in or ingesting of marine debris. Hawksbills are also impacted by interactions with fishing gear as indicated above. Note that a ban on nets (gill and trammel) went into effect in the U.S. Caribbean EEZ in 2005 and in the territorial waters of the USVI in 2006.

5.2.3.2.2 Green Sea Turtle (*Chelonia mydas*)

Green sea turtles were listed as threatened except the breeding population off the Florida coast and the Pacific coast of Mexico, which are listed as endangered under the ESA. The species was listed on July 28, 1978. NMFS has designated critical habitat for green sea turtles as the area up to three nautical miles around the Island of Culebra and its surrounding islands and cays.

In the southeastern U.S., green sea turtles are found around the USVI, Puerto Rico, and the continental U.S. from Texas to Massachusetts. Adults and juveniles of this species can often be seen in the USVI and Puerto Rico, particularly in the area of Culebra. Green sea turtle nests in Puerto Rico are reported in Manatí, Loíza, Fajardo, Ceiba, Naguabo, Culebra, Vieques, Caja de Muertos, Mona Island, and larger cays within the La Cordillera Reefs Natural Reserve off the coast of Fajardo based on annual PRDNER nesting surveys.

Green sea turtles are still threatened by illegal poaching of eggs, juveniles and adults. Stranding data from PRDNER (2008a) for the period from 1999-2007 contain reports of five green sea turtle deaths as a result of illegal poaching and the rehabilitation and liberation of two others that were hunted illegally. This is an underestimate as these are only the animals recovered by PRDNER. Two green sea turtles were killed by boat strikes during 1999-2007 based on PRDNER (2008a) data. Coastal development may also affect these animals through the loss or degradation of habitat, pollution, and entanglement in or ingesting of marine debris. Green sea turtles are also impacted by interactions with fishing gear as indicated above. A ban on nets (gill and trammel) went into effect in the U.S. Caribbean EEZ in 2005 and in the territorial waters of the USVI in 2006.

5.2.3.2.3 Leatherback Sea Turtle (*Dermochelys coriacea*)

Leatherback sea turtles were listed as endangered throughout their range on June 2, 1970 under the ESA. NMFS has designated critical habitat for this species around Sandy Point, St. Croix, USVI due to the importance of this area as a nesting beach and the concentration of leatherbacks in the water in this area during the nesting season.

The range of this species extends from Cape Sable, Nova Scotia, south to the U.S. Caribbean. Adults and juveniles of leatherback sea turtles can be observed in particular during their nesting peak in April-August. In Puerto Rico, leatherbacks nest on beaches in Mayagüez, Mona Island, Añasco, Isabela/Quebradillas, Guánica, Arecibo, Manatí, Isla Verde, Loíza, Río Grande, Luquillo, Fajardo, Humacao, Vieques, and Culebra based on annual PRDNER nesting surveys. The greatest concentration of leatherback nests in Puerto Rico is in the area of San Miguel, Luquillo/Fajardo.

Leatherbacks are still occasionally hunted for meat or their eggs are collected illegally, although this threat is only during the nesting season as the rest of the time these turtles are offshore. Leatherbacks can become entangled in fishing gear, in particular longlines, and are susceptible to injuries from marine debris, which they frequently ingest. A ban on nets (gill and trammel) went into effect in the U.S. Caribbean EEZ in 2005 and in the territorial waters of the USVI in 2006. It is anticipated that this ban will reduce or eliminate interactions between leatherbacks, and gill and trammel nets. Leatherbacks are also vulnerable to impacts from boat collisions and the death of a leatherback off Sandy Point, St. Croix, was reported by the Department of Planning and Natural Resources during the 2008 nesting season due to a boat strike.

5.2.3.2.4 Loggerhead Sea Turtle (*Caretta caretta*)

The loggerhead sea turtle was listed as threatened throughout its range on July 28, 1978. In the Atlantic, loggerheads are found from Newfoundland to Argentina.

Loggerhead sea turtle nests in Puerto Rico have been reported by PRDNER in Loíza, Humacao, Vieques, and Culebra, but nesting is infrequent and these turtles are not common in waters of Puerto Rico and the USVI. PRDNER (2008a) stranding data did contain a report of a loggerhead that was injured off the west coast of Puerto Rico in an attempt to hunt the animal but the animal was rehabilitated and released.

Marine debris, dredging impacts related to habitat loss as well as direct injury to these turtles, bycatch during commercial fishing operations, collisions with vessels, entanglement in discarded fishing gear, and coastal pollution are some of the threats facing loggerhead sea turtles. Again, the ban on gill and trammel nets that went into effect in the U.S. Caribbean EEZ in 2005 and in the territorial waters of the USVI in 2006 would be expected to reduce interactions between those gears and loggerhead sea turtles.

5.2.3.3 Corals

Coral reefs cover less than 2% of the marine bottom worldwide. However, they provide around 25% of all the known marine organisms (Buddemeier et al. 2004). The complex of organisms, including corals, other invertebrates, algae, and vertebrates like fish and sea turtles, and their interactions form the coral reef ecosystem. Corals include hard or stony corals, soft corals, black corals, and hydrocorals. Corals are mainly colonial organisms, although a small percentage of corals are solitary. The basic individual is termed a polyp and it is a small animal with tentacles around an opening that functions as a mouth. The complex of many polyps forms a coral colony (this is what we normally identify as a coral in the field). The individuals that form a coral colony are interconnected by tissues that enable them to exchange nutrients and other compounds. The complex of many hard coral colonies cemented and established at a site forms the principal structure of a coral reef. Two of the hard corals, elkhorn (*Acropora palmata*) and staghorn (*A. cervicornis*) were listed as threatened on May 9, 2006. Elkhorn and staghorn corals were very common in the Caribbean and were the main components of reefs in shallow waters until

the 1970's when they began to suffer from diseases and natural events like hurricanes, and began to die throughout their range.

Critical habitat was designated by NMFS for elkhorn and staghorn corals on December 26, 2008. The primary constituent element (PCE) of critical habitat for elkhorn and staghorn corals is substrate of suitable quality and availability, in water depths from the mean high water line to 30 m, to support successful larval settlement, recruitment, and reattachment of fragments. Substrate of suitable quality and availability means consolidated hardbottom or dead coral skeletons free from fleshy macroalgae and sediment cover.

While algae, including crustose coralline algae (CCA), and fleshy and turf macroalgae, are a natural component of healthy reef ecosystems, the recent increase in the dominance of fleshy macroalgae as major space-occupiers on many Caribbean coral reefs impedes the recruitment of new corals. This "phase shift" (sensu Jompa and McCook 2002) in benthic community structure (from the dominance of stony corals to that of fleshy algae) on Caribbean coral reefs is generally attributed to the greater persistence of fleshy macroalgae under reduced grazing regimes due to human overexploitation of herbivorous fishes (Hughes 1994) and the regional mass mortality of the herbivorous long-spined sea urchin (*Diadema antillarum*) in 1983-84 (Carpenter 1990). Although herbivorous fish and particularly parrotfish are able to substantially compensate for the loss of grazing coverage provided by *D. antillarum* (Carpenter 1990), chronic harvest of these herbivores has reduced that capacity for compensation. Reduced abundance of herbivores and particularly parrotfish on Caribbean coral reefs can, in part, be attributed to the use of fish traps as large-bodied parrotfish are highly susceptible to fish traps (Rakitin and Kramer 1996). As a result, fleshy macroalgae are better able to colonize coral skeletons and other available substrate, preempting space available for coral recruitment. Further, increased nutrients from land-based sources contribute to the phase shift by increasing the growth rate of macroalgae (Waritan and Fong 2008, Sjöö and Mörk 2008, Smith 2008). Increased nutrient loads can also alter the species of macroalgae growing on the reef and simultaneously decrease the efficiency of grazers. Thus, it is a combination of increased nutrients under reduced grazing regimes that reduces the availability of appropriate substrate for acroporid recruitment (Jompa and McCook 2002).

The persistence of fleshy macroalgae under reduced grazing regimes has impacts on CCA growth, which may reduce settlement of coral larvae as CCA is thought to provide chemical cues for settlement. Most CCA are susceptible to fouling by fleshy algae, particularly when herbivores are absent (Steneck 1986). As Mumby et al. (2007) demonstrated via a modeling analysis, an unexploited community of parrotfish can maintain approximately 40 percent of the reef in a permanently grazed state but overfishing reduces this capacity to about 5 percent. Most grazing thresholds lie near the upper level observed for parrotfish in nature, suggesting that reefs are highly sensitive to parrotfish exploitation (Mumby et al. 2007). Patterns observed in St. Croix waters also indicate a strong positive correlation between CCA abundance and herbivory (Steneck 1997). A study in which Miller et al. (1999) used cages to exclude large herbivores from the study site resulted in increased cover of both turf algae and macroalgae, and decreased

CCA coverage. In experimental microcosm studies, Brock (1979) found that, at low densities of parrotfish (<0.6 parrotfish or <9 g wet weight/m^2) and in the absence of other grazers, the benthic community structure proceeded to macroalgal dominance; at intermediate levels of parrotfish grazing intensity (0.6 to 1.5 parrotfish or 9 to 17 g wet weight/ m^2) a diverse community developed.

High grazing activity in exposed situations appears to favor CCA and thus coral recruitment. This suggests parrotfish may serve as a keystone species (Paine 1969) and that fishing effects on parrotfish grazing may profoundly influence coral dynamics (Mumby et al. 2007). Therefore, active management of parrotfish is both highly desirable and a feasible conservation goal (Mumby et al. 2007). In 2005 and 2006, gill and trammel nets were banned from the U.S. Caribbean EEZ and from the territorial waters of the USVI. The primary reason for the ban was the unprecedented use of these nets by SCUBA divers to herd parrotfish into the nets, a practice that resulted in large numbers of parrotfish being harvested (CFMC 2005).

In addition to the designation of critical habitat for *Acropora* species, NMFS finalized a 4(d) rule that took effect on November 21, 2008. This rule extends the "take" prohibitions of the ESA to elkhorn and staghorn corals. The only exceptions are activities that contribute to the conservation of threatened coral species, including scientific research and enhancement activities conducted under seven specific existing federal, state, or territorial research permitting programs, and restoration activities carried out by an authorized federal, state, territorial, or local natural resource agency.

5.2.3.3.1 Elkhorn Coral (*Acropora palmata*)

Elkhorn corals are commonly found on the seaward face of reefs in turbulent, shallow water, including the reef crest and spur-and-groove zone. Colonies may be exposed at low tide. Historically, elkhorn was the primary builder of shallow reef crest areas, commonly known as the elkhorn zone, in the western Caribbean. In Puerto Rico, the most well known elkhorn reef is in Rincón on the west coast within the area known as Tres Palmas that has been designated a Natural Reserve and was recently established as a no-take area through PRDNER Administrative Order Number 2008-32. Reefs in the area of La Parguera in Lajas and several of the coral cays in Cabo Rojo and Guánica were created by elkhorn corals, although many of these reefs now contain only skeletons of this species and an abundance of algae, sponges, and other hard and soft corals. Recent surveys indicate that large elkhorn reefs are present off the north coast, particularly in the area of Manatí and Vega Baja.

Due to the preference of this species for shallow waters, it is prone to impacts from recreational boating, maritime activities, coastal development, and fishing gear.

5.2.3.3.2 Staghorn Coral (*A. cervicornis*)

Staghorn corals are commonly found in depths between 5-15 m. This species may be found interspersed among colonies of elkhorn coral but staghorn coral is more frequently

found in more protected, deeper water seaward of the elkhorn zone where there is more protection from waves. Staghorn coral is the primary reef builder in mid-depths in the western Caribbean. In Puerto Rico, staghorn corals were once common behind the elkhorn zone but are now limited to scattered colonies around coral cays and other reef areas. This species continues to co-occur with elkhorn coral and it is still common to observe at least a few colonies in areas where live elkhorn coral is present. Staghorn corals may also be found in deeper areas and are even reported along the shelf edge in some areas such as La Parguera in Lajas.

Because this species occurs in nearshore waters, it too is prone to impacts from recreational boating, maritime activities, coastal development, and fishing gear.

5.3 DESCRIPTION OF THE ECONOMIC AND SOCIAL ENVIRONMENT

5.3.1. Introduction

The fisheries of Puerto Rico and the USVI provide food, livelihoods and income to Puerto Ricans and U.S. Virgin Islanders. The two territories' commercial fisheries have been characterized as "artisanal" because their commercial fishing vessels tend to be less than (and commonly much less than) 45 feet long, have small crews, participate in multiple fisheries, and yield smaller revenues and/or their seafood processors are small-scale producers. Fishing vessel permits are not required to commercially harvest any of the species in the five stock complexes experiencing overfishing in federal waters of the U.S. Caribbean.

Puerto Rico is surrounded by a narrow insular shelf where waters are less than 650 meters deep. The shelf varies in width from less than 1.2 mi (2 km) northwest of the island to greater than 15 mi (25 km) southwest of the island (Renken et al. 2002). The insular shelf of the southwest coast is relatively broad compared to the rest of the island. The east coast lies on the same geological platform as the USVI of St. Thomas and St. John. On the north, south and east coasts the insular shelf breaks precipitously at depths less than 656 ft (200 m). Historically, most of Puerto Rico's fishing (except that targeting SU1 and SU2) has occurred on the insular shelf, which has an area of 1,764 nm^2 (6,050 km^2) and which is the platform from the coastline to the 100-fathom (600 feet or about 183 meters) isobath (Collazo and Calderón 1987/88). The area of fishable habitat is about 2,467 nm^2 (8,462 km^2) (CFMC 2005: 19). About 4.7 percent (116 nm^2 or 398 km^2) of the fishable area is in the U.S. Caribbean EEZ (CFMC 2005). Puerto Rico's state waters comprise an area of approximately 3,832 nm^2 (13,160 km^2) (Puerto Rico Coastal Zone Management Program 2007), and the territorial waters of the USVI are approximately 437 nm^2 (1,564 km^2) in size (Island Resources Foundation 2002). The USVI shelf encompasses an area of approximately 630 nm^2 (2,161 km^2). Of that area, 38 percent (240 nm^2 or 823 km^2) occurs in the U.S. Caribbean EEZ. The bulk of the shelf occurs off St. Thomas and St. John, with a 291 nm^2 (998 km^2) total area in territorial waters and a 218 nm^2 (748 km^2) total area in federal waters. St. Croix has 98 nm^2 (336 km^2) of fishable habitat in territorial waters and only a 21 nm^2 (72 km^2) area off its east coast that resides in the EEZ.

Fishing areas shift with regulatory change, land use and development, land-based pollution, and other factors, such as climate change. For example, water temperature increased in both Guyanilla and Tallaboa Bays of Puerto Rico as a result of hot water discharged by the Central Costa Sur Power Plant, and cloro was discharged by PPG Industries that had a significant adverse impact on marine and coastal resources on the south coast (Pérez 2005: 235). Fishers that operated in the bays had difficulty selling their catches because buyers and consumers feared the fish were tainted with cloro or another contaminant. In response, some fishers went into deeper waters, which was difficult for those with small vessels and modest fishing gear to do. Access to fisheries also has been challenged in both Puerto Rico and the USVI, and privatization of beach front areas continues to reduce public access to fisheries. Fishing behavior in the U.S. Caribbean is also altered by changes in the global and local economies; for example, changes in the price of oil and recent declines in local and external tourism have impacted local fisheries.

5.3.2 Puerto Rico Fisheries

5.3.2.1 Overview of Puerto Rico Geography and Fishing Locations

Approximately 40 percent of Puerto Rico consists of mountains, 35 percent of hills, and 25 percent of plains. It is this topography, coupled with a tropical climate and soils that largely lack depth and plant materials, that has limited agricultural development on the island. The central portion of the island is mountainous, but the bulk of the island's population lives on the low-lying flat coastal plains. According to Macari and Hoyos (2005: 278), the coastal areas, especially in the western areas of the island, "are extremely vulnerable to earthquake-induced hazards." The concentration of Puerto Rico's population in low-lying coastal areas, the island's confined harbors, and its Caribbean location make it vulnerable to natural disasters, such as hurricanes, tropical storms, earthquakes, flooding, mudslides, tsunamis, and drought.

Table 5.3.1. Reported commercial fishing trips per year per coast. *Source*: Matos-Caraballo 2007.

Coast	Trips Per Year			Percent of Total Trips Per Year		
	2004	2005	2006	2004	2005	2006
North	3,414	2,502	1,537	10.4%	9.0%	5.9%
South	8,965	7,281	8,075	27.4%	26.1%	31.1%
East	5,319	3,790	2,923	16.3%	13.6%	11.2%
West	14,977	14,320	13,461	45.8%	51.3%	51.8%
Total	***32,675***	***27,893***	***25,996***	***100.0%***	***100.0%***	***100.0%***

Puerto Rico's geography, especially its narrow insular shelf, influences fishing locations and targeted species. North coast fishers are limited by a narrow shelf, adverse weather, high wave action during six months of the year, and a coastal topography that offers few protected areas in which to anchor fishing boats (Figure 5.3.1). These conditions result in fewer reported commercial fishing trips by north shore fishers than their counterparts on the other coasts (Table 5.3.1). Conditions also discourage the use of traps and SCUBA

and instead north coast fishers use lines and nets. In 2008, 88 percent of north coast fishers reported targeting reef fish (yellowtail snapper, trigger fish, and parrotfish), 65 percent targeted pelagic species, and 53 percent targeted baitfish. Fewer north coast commercial fishers fished in oceanic waters in 2008 than in 2002, according to the commercial fishery censuses conducted in those years (Table 5.3.2). During the same period, there were dramatic increases in the percentage of north coast commercial fishers who fished along the shore and on the shelf break.

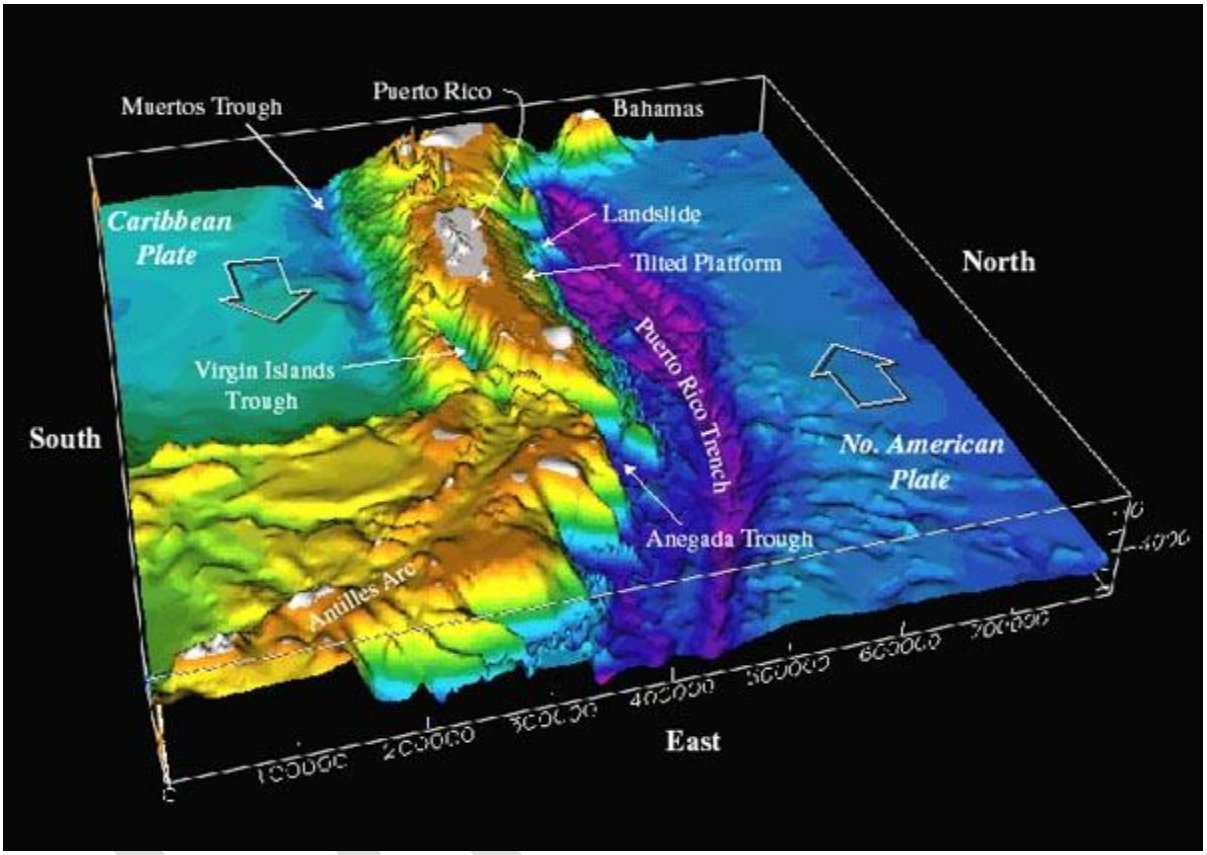


Figure 5.3.1. Puerto Rico coastal topography. Image Source: NOAA Ocean Explorer. Obtained online at: http://oceanexplorer.noaa.gov/explorations/03trench/trench/media/trench.html.

Features that make the south coast more suitable for fishing operations than the north coast include a somewhat less abrupt drop-off, the presence of a number of cays and sandy beaches that make the use of beach seines (banned in PR state waters in 2004) possible, and less exposure to storms, which is more conducive for the use of fish traps and pots. The size of the insular shelf area off the south coast is about 360 nm^2 (1,237 km^2), which is about 1.85 times the size of the shelf off the north coast (Collazo and Calderón 1987/88). South coast fishers make more trips annually than those on the north and east coasts according to the 2002 and 2008 survey of commercial fishers (Table 5.3.2). The percentage of south coast commercial fishers who fished in oceanic waters

increased from 2002 to 2008, which is contrary to what happened on the north and other coasts. In fact, the percentages of south coast commercial fishers fishing along the shore, shelf break, and oceanic waters rose substantially in 2008 (Table 5.3.2). Of the commercial fishermen surveyed for the 2008 census, 57 percent and 45 percent targeted lobster and conch, respectively; 88 percent stated that they harvested reef fish species (yellowtail snapper, mutton snapper, lane snapper, porgy, parrotfish, hogfish and grunts), and 40 percent said they fished for deep-water snapper (silk snapper). Griffith et al. (2007) divide the south coast into west, central and east sections. In the central portion of the south coast, there are two fishing zones and eight fishing areas, which are particularly popular among fishers from Ponce and other nearby municipalities (Griffith et al. 2007). The larger of these two zones extends farther from the coast. One of the eight areas near the larger zones includes relatively rich fishing grounds off the island of Caja de Muertos, which are only a few miles offshore and a favorite for both recreational and commercial fishers. Along the eastern end of the south coast are two zones close to the fishing ports of Port Arroyo and Bahia de Jobos.

Table 5.3.2. Geographic locations of commercial fishing by coast and percentage of commercial fishers by coast, 2002 & 2008. S*ource*: Matos-Caraballo 2004, 2009.

Year	Coast	Percent of Interviewed Fishers Who Fished in These Locations, 2008			
		Shore	Insular Shelf	Shelf Break	Oceanic Water
2008	North	66	90	83	46
	South	48	84	67	60
	East	22	93	45	25
	West	14	71	52	27
2002	North	17	82	8	68
	South	7	92	19	30
	East	13	94	18	35
	West	15	69	30	42

The 785 nm^2 (2,693 km^2) of insular shelf area off the east coast is the largest of the four coasts, and it represents 46 percent of Puerto Rico's insular shelf (Collazo and Calderón 1987/88). East coast fishers rank third behind their west and south coast counterparts in the number of annual trips they make (Table 5.3.1). East coast commercial fishers decreased fishing in oceanic waters and increased fishing along the shore and shelf break from 2002 to 2008 (Table 5.3.2). In 2008, about 76 percent of interviewed east coast fishers reported that they harvested reef fish (yellowtail, lane and mutton snapper; hogfish; porgies; grunts and parrotfish), 72 percent targeted deep-water snapper (silk and queen snapper), 67 percent pelagic (mackerel), 65 percent lobster, 35 percent conch, and 33 percent baitfish. Griffith et al. (2007) identify the east coast fishing zone as a triangular region north of Vieques and west of Culebra; however, there are additional fishing areas. According to Griffith et al. (2007), 14 of the east coast's popular fishing areas are in waters off Port Yabucoa, Cayo Batata, Bajo Parse, Port Humacao, Port Naguabo, Isla

Palominos, Arecifes de la Cordillera, Cayo Luis Pena, Cayo Norte, Bajos Grampus, Pta Vaca, Port la Esperanza, Port Pta Mula, and Pta Conejo.

The west coast is about one-third the length of either the north or south coast; however, its insular shelf area of 362 nm^2 (1,243 km^2) is greater than the shelf areas of the north and south coast (Collazo and Calderón 1987/88). Along the west coast is the Mona Passage, which contains islands, deep water, rocky stretches of bottom, and shallower inshore, muddy and rocky bottom areas that are easily accessible in small vessels (Griffith and Valdéz Pizzini 2002). According to Griffith et al. (2007), the west coast has the largest fishing zone with over 30 fishing areas within the zone. West coast commercial fishers account for the majority of the territory's annual fishing trips, from 46 percent in 2004 to 52 percent in 2006 (Table 5.3.1). In 2008, 65 percent of interviewed west coast fishers reported fishing for reef fish (yellowtail, lane and mutton snapper), 51 percent fished for deep-water snapper (silk and queen snapper), 49 percent targeted lobster, 33 percent targeted conch, 16 percent fished for pelagic species, and 30 percent for baitfish (Matos-Caraballo 2009). Fewer west coast commercial fishers fished in oceanic waters in 2008 than 2002, which mirrors what occurred on the north and east coasts. However, unlike their counterparts on the other coasts, more west coast fishers did not fish inshore waters in 2008 than in 2002. In 2008, significantly more fishers on the west coast fished at the shelf break than in 2002, and there was a small increase in the percentage of these fishers who fished on the shelf in 2008 (Table 5.3.2).

Surveys of Puerto Rico's commercial fishers have shown that they operate in more than one location, and they shift locations over time. For example, in 1996, 31 percent of commercial fishers fished inshore waters, which fell to 17 percent in 2002, then rose to 32 percent in 2008. During the same years, 46 percent of commercial fishers fished in oceanic waters in 1996, 48 percent did in 2002, and 36 percent in 2008. One factor that led to the decrease in fishing in oceanic waters and increase in fishing along the shore in 2008 was the price of gasoline (Matos-Caraballo 2009), which rose significantly from 2004 to 2008. According to *The San Juan Star* on June 23, 2008, "rising costs of fuel are taking a heavy toll on businesses as [commercial fishers] fight to make a living." Commercial fishing vessels in Puerto Rico tend to be small, landing up to but usually less than 50 pounds per day, while it costs $20 to $30 to fuel the boat for that day. According to the same article, in order to lessen the adverse impacts from rising fuel costs, commercial fishers raised the price of fish and the example given was raising the price of red snapper from $3.50 to $5.00 per pound.

5.3.2.2 Puerto Rico Commercial Fishing Centers and Associations

There are 78 municipalities in Puerto Rico, of which 44 can be considered coastal communities (Figure 5.3.2). Eighteen of these municipalities are along the north coast, 12 along the south, eight along the east, and six along the west coast. Forty-three of these municipalities have official fishing centers (landing areas), and the number of these centers has changed over time. Suárez-Caabro (1975) reported 90 fishing centers (centros pesqueros) in 1972, which declined later that decade to 75 fishing centers in 43 coastal municipalities (Weiler and Suárez-Caabro 1986). There were 88 fishing centers in 1985,

92 in 1996, 100 in 1997and 92 in 2002 (Griffith et al. 2007; Matos-Caraballo 2000 for 1996 figure, and Matos-Caraballo et al. 2002 for 2002 figure). Matos-Caraballo (2007) reports there were 88 official fishing centers in 42 of the municipalities from 2004 through

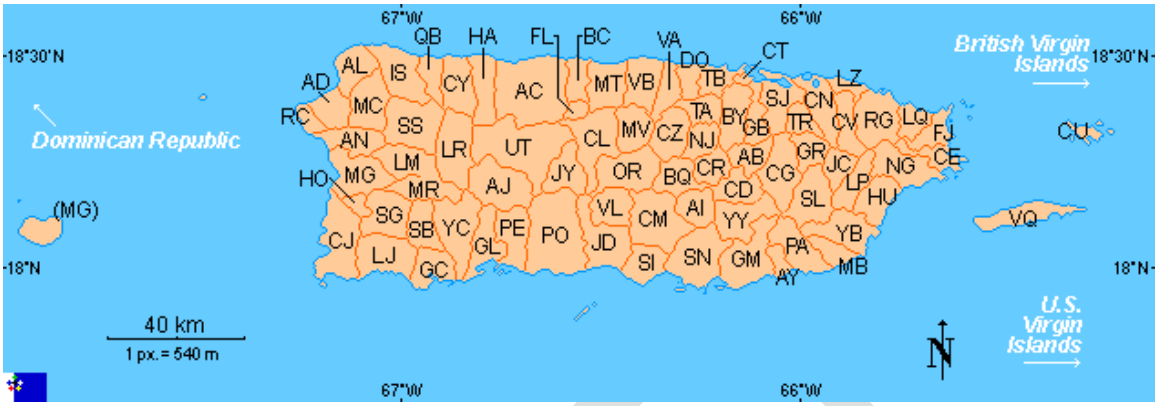


Figure 5.3.2. Municipalities of Puerto Rico. Source: http://www.crwflags.com/fotw/Flags/pr%28.html.

Table 5.3.3. Municipalities ranked by 1999-2003 landings (pounds) and their number of landing centers. Source: Griffith et al. (2007): Table I.1, p. 11.

Rank by Landings	Municipality	N. Centers	Coast		Rank	Municipality	Coast	N. Centers
1	Cabo Rojo	7	West		22	Arecibo	North	1
2	Lajas	3	South		23	Loiza	North	1 to 4*
3	Vieques	2	East		24	Vega Baja	North	1
4	Aguadilla	4	West		25	Yabucoa	East	1 to 2*
5	Guánica	3 to 4*	South		26	Añasco	West	1
6	Fajardo	3 to 4*	East		27	Patillas	South	1 to 2*
7	Naguabo	2	East		28	Cataño	North	1
8	Rincón	2	West		29	Rio Grande	North	1 to 2*
9	Juana Díaz	2	South		30	Carolina	North	1
10	Ponce	1 to 2*	South		31	Maunabo	South	1
11	Guayama	3	South		32	Culebra	East	1
12	San Juan	3	North		33	Barceloneta	North	2 to 3*
13	Mayagüez	3	West		34	Vega Alta	North	1
14	Humacao	3	East		35	Dorado	North	1
15	Aguada	2	West		36	Manatí	North	1
16	Ceiba	2	East		37	Isabela	North	1 to 2*
17	Salinas	3	South		38	Luquillo	North	1
18	Guayanilla	1 to 2*	South		39	Camuy	North	1
19	Peñuelas	1	South		40	Hatillo	North	1
20	Santa Isabel	3	South		41	Toa Baja	North	1
21	Arroyo	1	South					

*: one or more landing centers reported zero landings in one or more years.

DRAFT

2007. That rose to 92 in 2008 (Matos-Caraballo 2009). The changing number of fishing centers is due to changes in activity with time. The southern municipality of Yauco does not have and appears to have never had a fishing center, which is why some fishing-related documents suggest that there are 43, not 44, coastal municipalities. Yauco commercial fishers tend to land their catches in Puñuelas (PE). Also, for example, from 1999 to 2003 there were no reported commercial landings in the northern municipality of Quebradillas (QB). Cabo Rojo had the largest number of active landing centers from 1999 to 2003 and ranked first in the number of pounds landed during those years (Table 5.3.3).

One of the primary institutions of Puerto Rico's fishery infrastructure is the fishing association, more commonly known as the villa pesquera (Griffith and Valdés Pizzini 2002), which is intended to "allow fishers to organize, centralize, and stabilize their markets; store equipment; and gain access to credit and training." Almost every one of Puerto Rico's coastal municipalities has at least one villa pesquera. The official number has changed over time. In 1985, for example, Gutierrez Sanchez et al. (1986: 2) reported that there were 88 landing centers but only 34 villas pesqueras. Of those 88 landing centers, only 40 had facilities for storing fishing gear, and some of these facilities were modern but others were deteriorating or abandoned. Ten years later, Matos-Caraballo (1997) included a map that located 100 fishing centers. The observation that Gutierrez Sanchez et al. (1986) made about fishing locations remains relevant today, some centers are thriving and others are either deteriorating or abandoned (Griffith et al. 2007).

Sixty-six percent of 1,163 fishers interviewed in 2002 and 60 percent of 874 fishers interviewed in 2008 reported to belong to a fishing association (Matos-Caraballo 2009, Matos-Caraballo et al. 2002). The relatively small majority of fishers belonging to an association may be surprising given the intent of the villa pesqueras, which should be appealing for all fishers. Membership benefits can include access to lockers, freezers and other facilities, as well, as ability to sell the catch to the association at the landing site. However, the associations vary considerably. Some lack freezers and have piers and other facilities needing repair. Still others have become defunct, while others have become significant political and economic institutions within their communities. Some associations buy fish from both members and non-members. There have been complaints that the Puerto Rican government unfairly distributes its funds to the associations, which creates and exacerbates the differences.

5.3.2.3 Puerto Rico's Commercial Fishers

The Fishing Law of 1998 (Ley 278) defines a commercial fisher (full time, part time, and beginner) as a person dedicated to fishing and selling the catch for profit, who reports at least 50% of his/her income from fishing, and who has a fishing license to that effect. According to PRDNER, Puerto Rican fisheries regulations do not define "commercial fishing" and as a consequence, the application requirements for a commercial fishers' license result in significantly more people having such a license than those who report to be using it. For example, in 2000 and 2004, approximately 5,000 and 3,500 commercial fishing licenses were issued, respectively; although there were only 1,758 and 1,163

"active" commercial fishers in 1996 and 2002, meaning 1,758 and 1,163 commercial fishers reported landings to PRDNER during these respective years (PRDNER 2004). The implementing regulation to require Puerto Rico's commercial fishers to report fishing statistics did not occur until March 11, 2004 (SEDAR 2007: 11). Hence, commercial fishers who landed catch in 1996 and 2002 and chose not to report those landings are not counted as active fishers, although they were actively fishing and in compliance with commercial fishing regulations at that time.

The number of Puerto Rico's active commercial fishers has shown varying trends, increasing dramatically from 800 in 1899 to 2,656 in 1946, declining to 991 in 1969 then rising to 1,872 in 1982, followed by 1,155 in 1992, a rise to 1,959 in 1994 and down to 875 in 2008 (Figure 5.3.3; Matos-Caraballo 1996, 2009; Cummings and Matos-Caraballo 2003; PRDNER 2004). In 1996, there were 1,758 active commercial fishers and six years later in 2002 there were 1,163, a drop of 595 active commercial fishers. Matos-Caraballo (2007) suggests the 43 percent fall in the number of active fishers during this 6-year period was due to overfished resources, which caused commercial fishers to exit the fishery and transfer to construction or agricultural jobs. Others migrated to the mainland U.S. to work in factories or landscaping. Migrating to the mainland, however, does not mean they never return to fishing. According to García-Quijano (2009), former fishers who migrate monitor changes in fisheries in Puerto Rico by communicating with current fishers in the event that the former return to fishing. The 2008 figure of 875 active fishers is the lowest number of active fishers since 1931; however, this figure under-represents the actual number of fishers because a fisher is defined as "active" if s/he reports landings. Hence, non-reporting fishers, who are actively fishing, are not included in this figure.

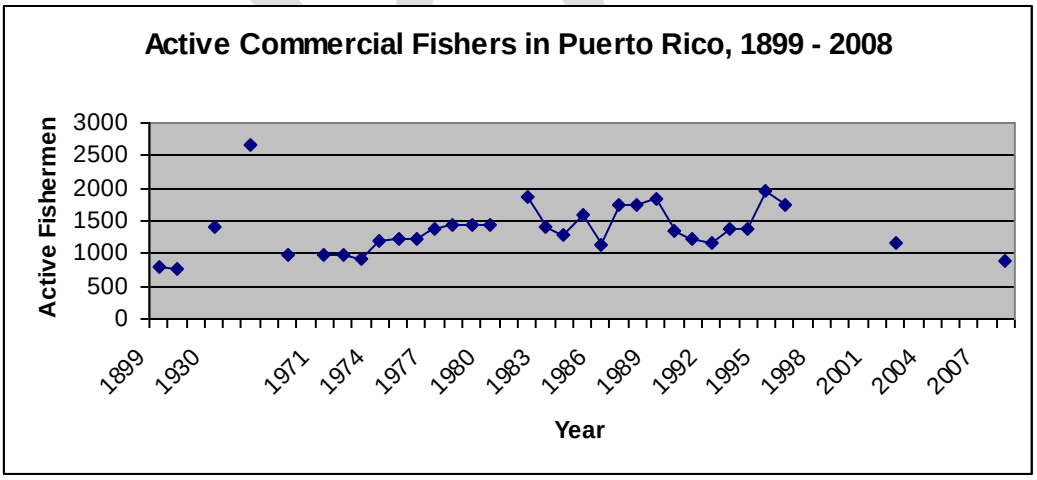


Figure 5.3.3. Number of active commercial fishers in Puerto Rico, 1899-2002. Sources: Matos-Caraballo 1996, 2009; Cummings and Matos-Caraballo 2003 for 2008 and 1899 to 1996 figures and PRDNER (2004) for 2002 figure.

Commercial fishing tends not to be a full-time job. Pérez's (2005: 225) survey found that "full-time fishing is not an option for any small-scale fisherman's household in southern

Puerto Rico." During economic downturns, fishers are more likely to combine fishing with other occupations in the pursuit of maintaining household incomes. That may require fishers moving to urban areas on the island or to the U.S. mainland. However, that does not mean they abandon or do not return to fishing. Puerto Rican commercial fishers depend more upon fishing when industrial unemployment rises (Pérez 2000: 4). McCaffrey (1999: 112) describes fishing as an "occupational safety net," and according to Griffith et al. (2007), fishing "absorbs the unemployed and poor during difficult economic times and on the other subsidizes individuals working part-time or full-time in the formal economy." Griffith et al.'s (2007) ethnographic work found that between 40 percent and 45 percent of commercial fishers listed other occupations that were held to supplement fishing incomes.

The number of full-time east coast fishers dropped from 293 in 1996 to 122 in 2008. In just six years (from 1996 to 2002), the number of full-time fishers decreased 40.5 percent on the east coast (Table 5.3.4). There was a sharper decline in the numbers of part-time fishers, which resulted in a net loss of active commercial fishers. According to Matos-Caraballo (2007: 8), many part-time commercial fishers retired from fisheries and some turned to illegal fishing (no license, no sales tax, and no reports to PRDNER) after October 1, 2006, when they were required to pay a municipal tax on landings they sold.

If fishers are more likely to combine fishing with other occupations in the pursuit of maintaining household incomes during an economic downturn, a graphical comparison of the number of active fishers and the unemployment rate do not suggest such a relationship. Nonetheless, during times of recession, depression or other economic downturns, such as experienced from 2007 to 2010 in Puerto Rico, commercial fishing increases in importance for fishing households. The unemployment rate in August 2009 was 15.8 percent, and it is expected to rise because of continuing layoffs of private and public sector employees by the end of the year. On August 21, 2009, the Puerto Rico Planning Board announced its preliminary estimate of a decline in the territory's real Gross National Product (GNP) from July 1, 2008, to June 30, 2009, ranging from 4.8 to 5.5 percent. The prolonged and deep recession is the territory's worst economic downturn since the Great Depression. Given this economic downturn, former commercial fishers may be returning to fishing, whether they are defined as "active" or not.

The average number of hours a Puerto Rican commercial fisher devoted to different fishing tasks per week in 2008 was 46 hours: 32 hours for fishing, five hours for vessel maintenance, five hours for gear maintenance, and four hours for marketing. There are differences among the coasts. The average west coast fishers spent 51 hours each week working on fishing tasks, compared to 47 hours for those on the south coast, 44 hours for those on the east coast, and 42 hours for those on the north coast. The average west coast fisher also spent more time than his/her counterparts on the other coasts maintaining vessels and gears. This latter fact is consistent with the significantly larger number of annual trips made by west coast fishers than those on the other coasts.

Hours devoted weekly to fishing are not constant throughout the calendar year. According to Griffith et al. (2007), commercial fishing effort is highest during the months

of May through July and lowest in October and November, although average fishing effort only ranges from 15 to 18 days per month.

Table 5.3.4. Full-time and part-time active commercial fishers by coast, 1996-2002. *Source*: Matos-Caraballo 1996, 2004, 2009.

North							
Year	**Full-Time**	**Part-Time**	**Total**	**Percent Full-Time**	**Percent Part-Time**	**Percent Change Full-Time**	**Percent Change Part-Time**
1996	211	217	428	49.3%	50.7%		
2002	68	198	266	25.6%	74.4%	-37.9%	-48.1%
2008	105	57	162	64.8%	35.2%	54.4%	-71.2%
South							
Year	**Full -Time**	**Part-Time**	**Total**	**Percent Full-Time**	**Percent Part-Time**	**Percent Change Full-Time**	**Percent Change Part-Time**
1996	364	78	442	82.4%	17.6%		
2002	136	182	318	42.8%	57.2%	-28.1%	-48.1%
2008	176	56	232	75.9%	24.1%	29.4%	-69.2%
East							
Year	**Full -Time**	**Part - Time**	**Total**	**Percent Full-Time**	**Percent Part-Time**	**Percent Change Full-Time**	**Percent Change Part-Time**
1996	293	134	427	68.62%	31.38%		
2002	106	148	254	41.73%	58.27%	-40.5%	-39.2%
2008	122	34	156	78.21%	21.79%	15.1%	-77.0%
West							
Year	**Full -Time**	**Part - Time**	**Total**	**Percent Full-Time**	**Percent Part-Time**	**Percent Change Full-Time**	**Percent Change Part - Time**
1996	394	67	461	85.5%	14.5%		
2002	113	212	325	34.8%	65.2%	-29.5%	-59.3%
2008	252	72	324	77.8%	22.2%	123.0%	-66.0%

According to the 2008 survey of commercial fishers, significant numbers of them stated that all of their household incomes derive from fishing. Of those fishers who stated the percent of their household income that derives from fishing, about 61 percent of those on the west coast stated that 100 percent of their household income comes from fishing (Table 5.3.5). Similarly, over half of the fishers interviewed on the south and east coasts reported that all of their household income derives from fishing. On the north coast, however, almost 25 percent of the fishers reported that all of their household incomes derive from fishing. Some of the fishers reported that none of their household income derives from fishing. One interpretation of this response is that fishing by these

commercial fishers is for subsistence, not for sale: for their own, their family's or community's consumption. That interpretation is supported by key informants of García-Quijano's ethnographic study of southeastern Puerto Rico fishers from 2003 to 2004 who said fishing provides fish for their families and communities, and the emphasis is on "maintenance, subsistence, and reproduction rather than on profit or returns" from fishing (García-Quijano 2009: 6). Agar et al. (2008) also found fish trap fishers to retain part of their catch for household consumption.

Table 5.3.5. Percent of interviewed fishers by percent of household (HH) income that derives from fishing by coast. *Source*: Data from Matos-Caraballo 2009.

Percent HH Income from Fishing	North Coast		South Coast		East Coast		West Coast	
	All Inter. Fishers	All Answer Question	All Inter. Fishers	All Answer Question	All Inter. Fishers	All Answer Question	All Inter. Fishers	All Answer Question
100	24.7%	24.8%	52.2%	52.2%	55.1%	55.8%	61.1%	62.1%
75 to 99	3.1%	3.1%	7.8%	7.8%	3.2%	3.2%	9.6%	9.7%
50 to 74	29.6%	29.8%	28.0%	28.0%	10.9%	11.0%	19.1%	19.4%
25 to 49	22.2%	22.4%	4.7%	4.7%	13.5%	13.6%	4.9%	5.0%
1 to 24	14.8%	14.9%	4.3%	4.3%	3.8%	3.9%	2.8%	2.8%
0	4.9%	5.0%	3.0%	3.0%	12.2%	12.3%	0.9%	0.9%
No Answer	0.6%		0.0%		1.3%		1.5%	
TOTAL	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***

The average age of active Puerto Rican commercial fishers has increased since 1995-1996. In 1996, the average age by coast varied from 44 years to 49 years, and in 2008, that distribution changed from 44 to 55 years. In 2008, the average age of an east coast fisher was 55 years.

In 1996, there were 427 active fishers on the east coast; in 2008, there were 156. If retiring east coast commercial fishers are not replaced, commercial fishing activity on the east coast could disappear. The Fishing Law of 1998 (Ley 278) specifically distinguishes between commercial and recreational fishers and prohibits the sale of fish by recreational fishers. However, according to Matos-Caraballo (2009), "every successful recreational fisher will sell his catch," and in Puerto Rico there are estimated to be 200,000 recreational fishers. Hence, Matos-Caraballo believes it is likely that recreational fishers will formally enter the commercial fishery in upcoming years.

According to Griffith et al. (2007), most commercial fishers and charter boat operators have one to two crew members (mean of 1.8 and a median of 2), and most of these crew members are friends or family. The largest percentage of the commercial fishers and charter boat captains and crew members (49.4 percent) fish with friends, followed by those who fish with fishing partners (16.2 percent), with children (11.9 percent), and with brothers (7.9 percent). The overwhelming majority of crew members are Puerto Rican. When fishers were asked how easy or difficult it was to find suitable crew, 51 percent of

those that answered the question reported that it was "difficult or very difficult" and 37.2 percent of them reported that it was "easy or very easy" (Griffith et al. 2007).

Commercial fishing in Puerto Rico is not restricted to men. This is evidenced by the fact that two of the 20 expert southeastern fishers interviewed by García-Quijano (2009) were female.

Puerto Rican commercial fishers use different methods to market their catch: selling to a fish buyer/house, restaurant, their own fish house, association and/or to others while walking. According to Matos-Caraballo (2004: 61), the percentage of interviewed fishers who sold their catch by walking decreased from 41 percent in 1995/96 to 28 percent in 2002. Perhaps, in response to gasoline price increases, the percentage of those walking rose to 35 percent in 2008. Similarly, while the percentage of those who sold their catch through fishing associations rose from 40 percent to 47 percent from 1995/96 to 2002, the percentage fell to 27 percent in 2008. The percentage of those interviewed who sold their catch to a fish buyer/house fell from 33 percent to 30 percent then rose back to 33 percent during the time periods. For all of the three time periods, more than 50 percent of commercial fishers interviewed sell to a fish house and/or by selling while walking along the highway or from their homes. Matos-Caraballo et al. (2002) attribute the declines of fishers selling their catch to restaurants to restaurants' increased use of imported fish products.

Not all fishers use multiple marketing methods. Of the 875 commercial fishers interviewed in 2008 for the fishery census, 768 (87.8 percent) fishers sold their catch using one marketing method only. Of those that used only one method, the largest number of fishers sold all of their catch to a fish house that was not their own, followed by those who sold their catch walking along the street or from their homes, and selling to a fishing association.

Table 5.3.6. Percent of interviewed commercial fishers by coast that use marketing methods, 2008. *Source*: Data from Matos-Caraballo 2009.

Marketing Method	Percent of Interviewed Fishers that Use Marketing Method			
	North	South	East	West
Fishing Assoc.	40.7%	29.3%	25.0%	20.9%
Restaurants	2.5%	1.7%	6.3%	10.2%
Fish House	20.4%	26.7%	38.5%	41.8%
Own Fish H.	7.4%	6.5%	6.4%	3.7%
Walking/Home	45.1%	40.1%	36.5%	26.5%

The 2008 survey of Puerto Rico's commercial fishers suggests there are coastal differences regarding marketing strategies of fishers. The most popular method of selling catch on the north and south coasts is by walking along the road or selling catch from one's home, while on the east and west coasts more fishers sell some to all of their catch to fish houses (Table 5.3.6). While about 10 percent of the interviewed fishers on the west coast sold catch to restaurants, less than 2 percent of those on the south coast sold to

restaurants. Along the north coast more fishers (7.4 percent of those interviewed) sell their catch from their own fish houses, while less than 4 percent of those on the west coast sell catch from their own fish houses. The least popular method on the north, south and east coasts is selling catch to a restaurant, while the least popular method reported on the west coast is selling catch from one's own fish house.

Not all fish caught by commercial fishers are sold and, according to ethnographic wok by Griffith et al. (2007), it is rare for a fisher to sell all of his catch. Part of the catch is kept for home and community consumption. Of 256 commercial fishers interviewed by Griffith et al. (2007), about 74 percent reported using some fish for household consumption. Most of the fishers interviewed for their study "reported giving away some of their catch to neighbors, elderly, family, etc. and we heard in several locations that fish consumption made up substantial portions of the diets of fishers and their families." This demonstrates that a decrease in the commercial catch may not only decrease potential revenues and incomes earned from sales of the catch, but may decrease home consumption of fish within the households of the boat-owning fishers, their crews and community as well.

5.3.2.4 Puerto Rico Commercial Fishing Fleet

As the number of active commercial fishers rose and fell over time, so too did the size of the commercial fishing fleet since 1899. There was an increasing trend from 1899 with 350 active fishing vessels to 1996's high of 1,501. That trend ended after 1996, however, as the number of vessels has fallen since then. In 2008, there were 690 active commercial fishing vessels. The rate of decline has not been the same across the four coasts. The west coast lost 10.3 percent of its active fishing vessels from 2002 to 2008, while the other three coasts had losses greater than 30 percent from 2002 to 2008 (Table 5.3.7).

Table 5.3.7. Active Puerto Rican commercial fishing vessels by coast, 2002 & 2008. *Source*: Matos-Caraballo 2004, 2009.

Coast	2002	2008	Percent Change 2002 - 2008
North	216	146	-32.4%
South	279	187	-33.0%
East	199	122	-38.7%
West	262	235	-10.3%
Total	***956***	***690***	***-27.8%***

The lengths of active commercial vessels have varied slightly since 1969. There are slight differences among coasts. For example, in 2000, there were no active vessels 40 feet or longer on the south coast; however, 2 percent of active vessels on the east coast were of that size. In 2008, the only active commercial fishing vessels 40 feet or longer were on the west coast.

The large majority of commercial vessels have small motors that are gasoline powered, regardless of coast, although the percentage of diesel motors is highest along the west coast. The north coast likely has the largest percentage of motors over 100 horsepower because of the surge conditions off the north coast.

5.3.2.5 Gears Used by Commercial Fishers

Puerto Rico commercial fishers use multiple gears, such as nets, hook-and-line gears, and traps, as well as spears, baskets and gaff while diving, and typically they use multiple gears per trip (Dennis et al. 1996). For example, fishers may dive while soaking nets. The three most common primary gear types are hooks & lines, traps/pots, and gill nets, and the most common species captured with hook & lines, traps/pots and gill nets are snapper-grouper species (reef fish) and lobster. Most gear is locally made and inexpensive (García-Quijano 2009).

Table 5.3.8. Percent of commercial pounds landed by gear type for 1997-1999 and 2004-2006. *Source*: Matos-Caraballo 2000, 2007.

		Percent of Pounds Landed by Gear Type				
Year	**Species**	**Hook & Line**	**Nets**	**Traps/Pots**	**Diving**	***Total***
1997	Fish	46.7%	24.8%	22.8%	5.7%	*100.0%*
	Shellfish	0.0%	3.8%	28.7%	67.5%	*100.0%*
	Total	*39.8%*	*21.7%*	*23.7%*	*14.9%*	*100.0%*
1998	Fish	46.3%	25.6%	21.5%	6.6%	*100.0%*
	Shellfish	0.0%	6.0%	24.8%	69.1%	*100.0%*
	Total	*37.9%*	*22.0%*	*22.1%*	*18.0%*	*100.0%*
1999	Fish	49.0%	25.1%	19.6%	6.3%	*100.0%*
	Shellfish	0.0%	6.2%	30.7%	63.1%	*100.0%*
	Total	*40.2%*	*21.7%*	*21.6%*	*16.4%*	*100.0%*
2004	Fish	50.8%	20.7%	20.3%	8.3%	*100.0%*
	Shellfish	0.2%	3.5%	21.7%	74.6%	*100.0%*
	Total	*38.4%*	*16.5%*	*20.6%*	*24.5%*	*100.0%*
2005	Fish	64.3%	12.8%	15.5%	7.3%	*100.0%*
	Shellfish	0.7%	2.5%	22.0%	74.7%	*100.0%*
	Total	*48.4%*	*10.3%*	*17.2%*	*24.2%*	*100.0%*
2006	Fish	55.8%	21.1%	15.4%	7.7%	*100.0%*
	Shellfish	0.3%	4.0%	22.1%	73.5%	*100.0%*
	Total	*42.1%*	*16.9%*	*17.0%*	*23.9%*	*100.0%*

The use of traps has generally declined. According to Griffith et al. (2007), traps have become less popular for a variety of reasons, "including problems with losing traps due to weather or other factors, having traps stolen, the time and monetary costs of trap construction as opposed to other gear, and problems with storing traps while leaving

fishing to work in the wage labor sector. According to Griffith and Valdes-Pizzini (2002: 79), full-time trap fishers who use traps as their primary gear report that "they spend two to three hours at a time in trap construction and maintenance." Both Matos-Caraballo (1997) and Valdés Pizzini et al. (1992) found increases in the use of SCUBA gear as the use of traps/pots declined.

According to Matos-Caraballo (2009), most commercial fishers used hook-and-line gear to obtain their catch. This is evidenced during the two 3-year periods of 1997 to 1999 and 2004 to 2006. During these time periods, hook-and-line gear took the most pounds of fish, varying from 46.3 percent of annual pounds to 64.3 percent of annual pounds landed. Most shellfish, from 63.1 percent of pounds landed in 1999 to 74.7 percent of pounds landed in 2005, were taken by diving. Hook-and-line gear took from zero to 0.7 percent of shellfish during the two 3-year periods from 1997 to 1999 and 2004 to 2006. The percent of landings taken by traps/pots fell from 22.8 percent in 1997 to 19.6 percent in 1999, then rose to 20.3 percent in 2004 to fall to 15.4 percent in 2006 (Table 5.3.8). A more detailed discussion of gears used to catch the species within the FMUs affected by this amendment is presented later in this section.

Among the nets that have been have been used are beach seines and gill, trammel, and cast nets; however, since March 12, 2007, the beach seine has been banned. The most popular net gears are gill and cast nets, although their total use declined from 1996 to 2008. On the west coast, however, more gill nets and cast nets were used during that time period. Along the south coast, significantly more trammel nets were used in 2008, especially lobster trammel nets. Since November 2005, federal regulations have prohibited the use of gill and trammel nets in the U.S. Caribbean EEZ to harvest Caribbean reef fish, which may partially explain the decreased use of these gears, although depth of water in the EEZ does not favor the use of these nets. Fishing with traps/pots, bottom longlines, gill nets, or trammel nets is prohibited year-round in the seasonally closed areas established to protect red hind spawning aggregations as well as the mutton snapper spawning aggregation off St. Croix. This prohibition has been extended by the local governments to areas of shared jurisdiction.

From 1997 through 1999 and from 2004 through 2006, gill nets accounted for the majority of landings (in pounds) for all fish landings reported to be taken by net gear. A large percent of reported landings were by trammel net, locally known as mallorquín. Although at least 10 percent of the pounds landed by nets were taken by beach seine in 2006, the use of beach seine is presently prohibited.

The use of net gear is contested in Puerto Rico. Among the views of those who oppose net gear are that nets are harmful to marine ecosystems, are barriers to navigation, and are nuisances to recreational fishing and other activities.

Hook-and-line gear includes rod and reel, and long, bottom, hand and troll lines. Hand line is a very important gear in Puerto Rico in part because, compared to other gears, it has the lowest cost. Commercial fishers who use hand lines typically target species of coral reef fishes, mainly those of the families Serranidae, mostly red hind and coney, and Lutjanidae, mostly yellowtail snapper and mutton snapper (Matos-Caraballo 2005). The

U.S. Caribbean EEZ has been closed to the possession of mutton snapper from April 1 to June 30 of each year since November 2005, which may partially explain the decreased use of hand line. The local government of Puerto Rico also established, beginning in 2004, a seasonal closure for mutton snapper during the months of April and May.

West coast fishers depend on deep-water hook-and-line fishing in the Mona Passage (Griffith and Valdes-Pizzini 2002: 79). Although the EEZ off the west coast of Puerto Rico has been closed to the possession of red hind from December 1 to the end of February each year since November 2005, and in Puerto Rico state waters since 2004, there is no indication that this closure has affected the use of net gear along that coast.

The total pounds landed by hook-and-line gear decreased from 1997 to 2006, and the pounds landed by each type of hook-and-line gear significantly decreased during this period (Matos-Caraballo 2007). Of the annual catch taken by hook-and-line gear, bottom lines took at least 70 percent of the fish from 1997 to 1999 and at least 75 percent of the fish from 2004 to 2006. With the exception of 1999, rod and reel accounted for less than 0.4 percent of annual catch taken by hook-and-line gear during the two 3-year periods. Troll line ranks second among the hook-and-line gear in terms of catch.

Diving is another means of commercially harvesting fish and shellfish and for some commercial fishers; it is preferred because they can target their catch with great selectivity. Skin diving (or free diving) in shallow waters has a very long tradition, while SCUBA diving's presence in Puerto Rico is no more than 35 to 45 years old. Scuba diving is more frequent than skin diving. The majority of shellfish are taken by diving.

From 1996 to 2008, there was a general decrease in the use of diving and diving gears. In 2008, diving was more prevalent on the west coast. The fishery survey changed categories of gear used with diving from 1996 to 2008. In 1996 and 2002, divers were asked if they used spear, gaff, lace and/or bucket. In the 2008 survey, they were asked if they used snare, spear, basket, slurp gun and/or ornamental hand nets.

Reported commercial landings from SCUBA diving dwarf reported landings from skin diving during the two 3-year periods of 1997 to 1999 and 2004 to 2006. Scuba diving took from 96.4 percent to 98.3 percent of the fish taken by diving from 1996 to 1999 and from 97.8 percent to 99.3 percent of the fish taken by diving from 2004 to 2006. Similarly, SCUBA diving took from 90.3 percent to 92.6 percent of the shellfish landed from 1996 to 1999 and from 94.5 percent to 98.2 percent of shellfish landed from 2004 to 2006. However, from 1997 to 2006, there was a significant decline in the pounds of fish reported to be landed by SCUBA diving (Matos-Caraballo 2000, 2007).

According to NMFS HMS (2009), U.S. Caribbean commercial fishing associations are looking for fish aggregation or attracting devices (FADs) or anything that could be done to improve their ability to catch fish. Commercial fishers want new FADs while prohibiting recreational fishers from fishing around FADs. A FAD can improve the production of artisanal fishers by lowering fuel costs and reducing the time spent at sea looking for fish. However, a study of six FADS that were deployed off the northeast coast

of Puerto Rico from June 1986 to December 1986 by Feigenbaum et al. (1989) concluded that although there was a positive effect on commercial and recreational fisheries, there was not a dramatic increase in harvest. Moreover, five of the FADS were lost, and the study showed that FADs that are successful elsewhere are not adequate to survive ship traffic and fish bites in Puerto Rico waters.

5.3.2.6 Reported and Adjusted Landings

Puerto Rico Law Number 278 of November 29, 1998, authorized the PRDNER to require commercial fishers to report commercial fishing statistics; however, the implementing regulation (Fishing Regulation 6768 that established a trip-ticket system) did not occur until March 11, 2004 (SEDAR 2007: 11). As an incentive to encourage voluntary reporting, fishers received discounted mooring fees if they submitted their catch records, and they did. However, the 2004 reporting requirement has met much resistance. According to Matos-Caraballo (2007: 8), most fishers believe the government's action was ultimately to eliminate, not protect, the commercial fisheries. In consequence, commercial fishing leaders instructed fishers, many of whom had been friendly with PRDNER staff and voluntarily reported their landings prior to 2004, to stop submitting trip tickets and they have (Matos-Caraballo 2007). García-Quijano (2009) found, as a result of ethnographic work, that official records of landings are unreliable because protesting fishers purposely report inaccurate landings or do not report landings.

Other regulations have also motivated commercial fishers to not report their landings and engage in other acts of civil disobedience (Kirkley et al. 2008). First, commercial fishers oppose the territory's prohibition on fishing for Nassau grouper, although ironically landings of the species are reported. Second, since October 1, 2006, PRDNER staff have observed that "many part-time commercial fishers [have] retired and some of them have become illegal fishers [no license, no reports to PRDNER]" because on October 1, 2006, the Puerto Rican government implemented a sales tax that required commercial fishers to pay a municipal sales tax on the catch that they sold (Matos-Caraballo 2007: 11). Moreover, because of recent changes in federal tax laws, Puerto Rico's commercial fishers are now required to file an income tax return. Although most Puerto Rican fishers presently have a 90-percent exemption from federal taxes if they are considered a bonafide fisher (Puerto Rico Internal Revenue Code of 1994), in the past, they did not have to file an income tax return. Hence, this recent tax-filing requirement has also been an incentive for some to not report their landings (NMFS HMS 2009).

Various methods have been used to adjust the voluntary (before March 11, 2004) and compulsory (since March 11, 2004) reported landings in Puerto Rico in order to generate a more accurate account of commercial fishing activity (Matos-Caraballo 2001, 2007). Without such an adjustment, the significance of existing commercial fishing activity and its impacts on local fisheries and economies would be underestimated and understated. Thus, adjustment factors have been developed and applied to voluntarily reported landings and required trip-ticket reported landings in order to generate more accurate estimates of commercial landings for Puerto Rico's fisheries, including the five fisheries experiencing overfishing. Adjustment factors are used are to estimate actual commercial landings by

weight and value in Puerto Rico for the analysis of economic and social impacts of this amendment (Tables 5.3.9 and 5.3.10). Note that the adjustment factors are the same for each year's landings by weight and dollars.

Table 5.3.9. Reported and adjusted landings (pounds) and adjustment factors, 1983-2007.

Year	Total Reported Landings	Total Adjusted Landings	Adj. Factor	Adj. Factor North	Adj. Factor South	Adj. Factor East	Adj. Factor West
1983	3,916,688	6,420,800	1.64				
1984	3,154,298	5,346,268	1.69				
1985	2,855,085	5,098,366	1.79				
1986	2,535,388	3,380,517	1.33				
1987	2,081,941	2,775,921	1.33				
1988	2,013,663	3,595,827	1.79				
1989	2,290,865	4,491,892	1.96				
1990	2,179,705	4,273,931	1.96				
1991	2,458,664	4,820,910	1.96				
1992	2,043,970	3,406,616	1.67				
1993	2,495,161	4,158,601	1.67				
1994	2,708,878	4,232,622	1.56				
1995	3,687,686	5,193,924	1.41				
1996	3,581,209	5,043,956	1.41				
1997	3,804,030	4,876,962	1.28				
1998	3,452,976	4,426,892	1.28				
1999	3,325,991	4,264,092	1.28				
2000	3,244,005	5,691,236	1.75				
2001	3,387,748	4,981,983	1.47				
2002	3,271,960	3,804,605	1.16				
2003	2,387,974	4,230,409		1.96	1.52	1.01	2.33
2004	1,864,679	4,002,550		2.50	3.70	1.52	1.47
2005	1,440,024	5,725,259		1.01	5.00	12.50	1.35
2006	1,311,981	2,380,695		7.69	1.52	3.45	1.01
2007	1,254,156	2,198,377		3.33	1.30	3.70	1.45

DRAFT

Table 5.3.10. Reported and adjusted total ex-vessel revenue (dollars), 1983-2007.

Year	Total Ex-Vessel Revenue		Adj. Factor	Adj. Factor North	Adj. Factor South	Adj. Factor East	Adj. Factor West
	Rep.	Adj.					
1983	4,719,730	7,737,263	1.64				
1984	3,969,018	6,727,148	1.69				
1985	4,004,500	7,150,894	1.79				
1986	3,724,647	4,966,196	1.33				
1987	3,025,652	4,034,203	1.33				
1988	3,096,188	5,528,907	1.79				
1989	3,794,705	7,440,598	1.96				
1990	3,560,764	6,981,890	1.96				
1991	4,292,384	8,416,439	1.96				
1992	3,707,795	6,179,658	1.67				
1993	4,444,681	7,407,802	1.67				
1994	5,156,078	8,056,372	1.56				
1995	7,242,214	10,200,301	1.41				
1996	6,993,718	9,850,307	1.41				
1997	7,607,758	9,753,536	1.28				
1998	7,180,042	9,205,182	1.28				
1999	7,227,771	9,266,373	1.28				
2000	7,062,855	12,390,973	1.75				
2001	7,677,129	11,289,895	1.47				
2002	7,502,764	8,724,145	1.16				
2003	5,621,405	9,785,319		1.96	1.52	1.01	2.33
2004	4,517,619	9,863,395		2.50	3.70	1.52	1.47
2005	3,756,903	15,514,054		1.01	5.00	12.50	1.35
2006	3,721,152	6,650,178		7.69	1.52	3.45	1.01
2007	3,647,144	6,319,083		3.33	1.30	3.70	1.45

5.3.2.7 Puerto Rico Combined Commercial Landings

During the 25-year period from 1983 to 2007, reported commercial landings in Puerto Rico varied from a high of nearly 3.92 million pounds (whole weight) in 1983 to a low of approximately 1.25 million pounds in 2007 (Figure 5.3.4 and Table 5.3.9). Adjusted landings varied from a high of approximately 6.42 million pounds in 1983 to just under 2.2 million pounds in 2007. During the same years, the reported value of commercial landings peaked at approximately $7.68 million in 2001 (adjusted to $11.29 million) and declined to approximately $3.65 million (adjusted to $6.32 million) in 2007 (Figure 5.3.5 and Table 5.3.10).

DRAFT

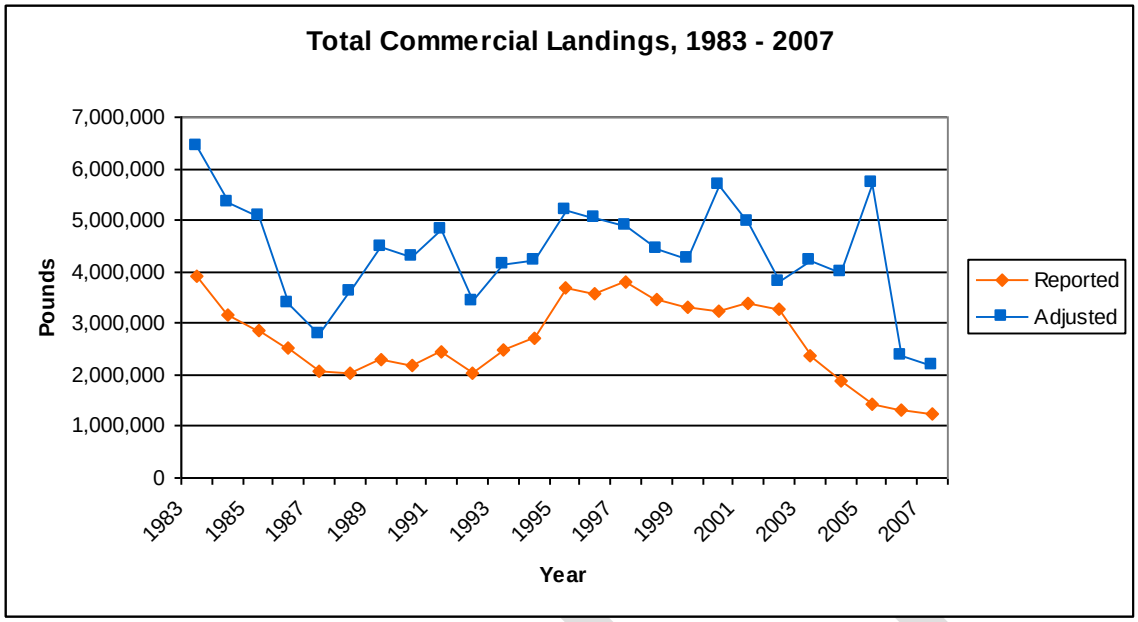


Figure 5.3.4. Total commercial landings (pounds), 1983-2007.

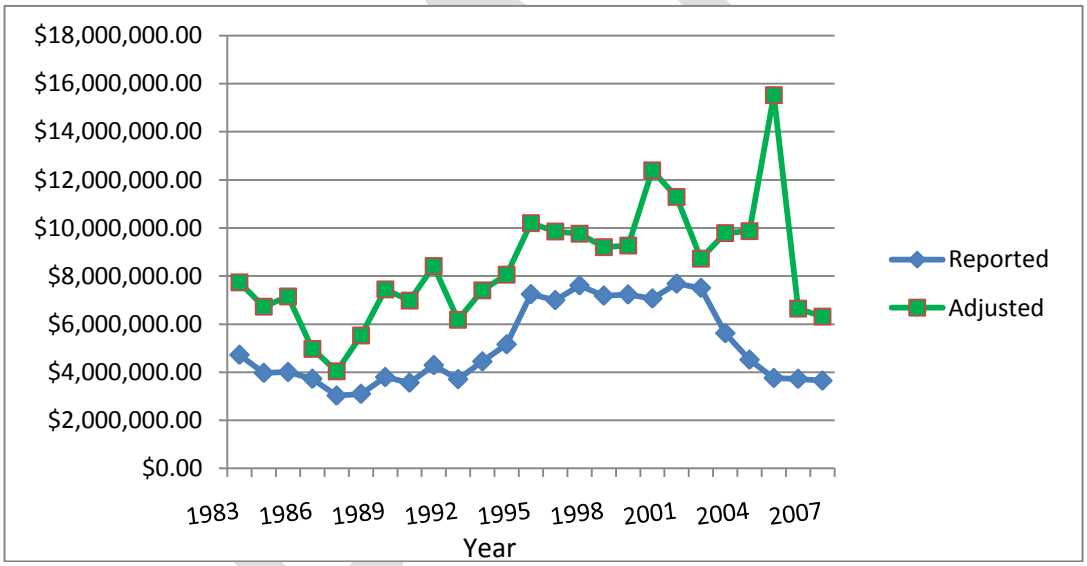


Figure 5.3.5. Ex-vessel revenue (dollars) from total commercial landings, 1983-2007.

Finfish landings account for the majority of Puerto Rico's annual commercial landings, representing from 73 percent to 87 percent of annual landings of all species (in pounds) from 1983 to 2007. However, the proportion of all reported commercial landings attributed to shellfish has increased over this 25-year period as a result of declining finfish landings.

Finfish landings also represent the majority of the ex-vessel revenue from commercial landings, although the contribution has declined since peaking in 1993. In 2007, finfish

landings accounted for 55.2 percent of reported and 56.5 percent of adjusted ex-vessel revenues from all commercial landings.

The west coast has consistently been the most productive area in terms of fishing over time (Collazo & Calderón 1987/88, Matos-Caraballo 2007), and reported landings from 1996 to 1999 and from 2004 to 2006, for example, agree. The west coast consistently accounted for most reported landings. From 1996 to 1999, west coast landings represented from 35 percent to 39 percent of annual reported landings in pounds, and from 2004 to 2006, west coast landings represented from 46 percent to 55 percent of annual reported landings in pounds (Table 5.3.11). Along the west coast is the Mona Passage, which is one of the primary fishing grounds for west coast commercial fishers because it is there where snapper, sea basses, grouper, trunkfish, and pelagic species of tuna, jacks, king mackerel, marlin, sailfish, and swordfish are caught.

The south coast consistently has accounted for the second most landings in both pounds and dollars. From 1996 to 1999, south coast reported landings represented an average of 32 percent of pounds and 34 percent of value of total annual landings. Similarly, the south coast's reported landings represented an average of 25 percent of pounds and 27 percent of value of total annual reported landings from 2004 to 2006. The north coast consistently accounts for the smallest share of reported landings by pounds and dollars.

Table 5.3.11. Percent of annual reported commercial landings (pounds and dollars) from all species by coast, 1997-1999, 2004-2006. *Source*: Matos-Caraballo 2000, 2007.

Year	Coast	Percent of Landings	Percent of Revenue	Year	Coast	Percent of Landings	Percent of Revenue
1997	North	12.4%	14.3%	**2004**	North	9.0%	8.6%
	South	31.5%	34.7%		South	25.7%	27.5%
	East	18.7%	20.8%		East	19.1%	20.5%
	West	37.4%	30.2%		West	46.2%	43.3%
	All	***100.0%***	***100.0%***		***All***	***100.0%***	***100.0%***
1998	North	12.5%	13.3%	**2005**	North	7.5%	6.7%
	South	30.7%	32.3%		South	23.5%	25.2%
	East	17.7%	17.8%		East	15.2%	16.4%
	West	39.1%	36.6%		West	53.8%	51.6%
	All	***100.0%***	***100.0%***		***All***	***100.0%***	***100.0%***
1999	North	12.7%	13.3%	**2006**	North	4.6%	4.0%
	South	32.7%	33.5%		South	25.9%	27.8%
	East	19.5%	20.5%		East	14.5%	15.0%
	West	35.1%	32.6%		West	55.0%	53.2%
	All	***100.0%***	***100.0%***		***All***	***100.0%***	***100.0%***
3-Year Average	North	12.5%	13.7%	**3-Year Average**	North	7.3%	6.6%
	South	31.6%	33.5%		South	25.0%	26.9%
	East	18.6%	19.7%		East	16.5%	17.5%
	West	37.2%	33.1%		West	51.1%	49.1%
	All	***100.0%***	***100.0%***		***All***	***100.0%***	***100.0%***

Monthly landings of fish, excluding shellfish, for each month from January 1997 to December 1999 tend to show the highest monthly landings in March and April, which corresponds to the Christian religious season of Lent. During Lent, demand for seafood tends to increase significantly in Puerto Rico, which motivates increased fishing activity (Griffith et al. 2007). Lent was from February 12 to March 30 in 1997, February 25 to April 12 in 1998, and February 17 to April 4 in 1999. Monthly commercial landings of fish in 2005 and 2006 also show increases in March. Lent was from February 25 to April 11 in 2004, February 9 to March 27 in 2005, and March 1 to April 16 in 2006. Curiously, 2004 does not show similar trends, but this may be partially attributable to the March 11, 2004, regulation that changed reporting of catch from a voluntary act to a mandatory one. Many fishers, who had been voluntarily reporting, did not report in protest of the change. The decline in landings in December 2005 and from December to February in 2006 may partially reflect seasonal closures implemented in November 2005.

In 2008, 874 commercial fishers were interviewed for the most recent survey. Among the questions asked of each fisher was what species they targeted. Across the four coasts, most fishers reported that they target reef fish (Table 5.3.12). On the north, east and west coasts, the second most targeted species are deep-water snapper. The second most targeted species on the south coast is lobster. Deep-water snapper species include silk snapper (Snapper Unit 1), reef fishes includes Grouper Units 1 (Nassau grouper) and 4 (red, misty, tiger, yellowedge, and yellowfin), and parrotfish.

Table 5.3.12. Species targeted by interviewed commercial fishers, 2008. *Source*: Matos-Caraballo 2009.

	Percent of Interviewed Fishers				
Targeted Species	**North**	**South**	**East**	**West**	**Puerto Rico**
Reef Fishes	88%	88%	76%	65%	77%
Ornamental	1%	1%	2%	2%	2%
Deep-Water Snapper*	72%	4%	72%	52%	56%
Pelagic Fishes	65%	30%	67%	27%	42%
Lobster	28%	57%	65%	47%	49%
Conch	13%	45%	35%	35%	33%
Octopus	2%	19%	0%	1%	6%
Bait	53%	31%	33%	19%	31%
Land Crab	9%	6%	11%	2%	6%
Sirajo Gobies	8%	1%	0%	0%	2%

*At least one of the percentages for the 4 coasts in this row may be under-reported.

5.3.2.8 Per Capita Consumption and Imports of Fish & Shellfish

The annual per capita consumption of fish and shellfish for human food is low in Puerto Rico. During the three-year period from 2003 to 2005, it averaged to be 1.8 pounds (*Fisheries Statistics of the United States 2008*). That contrasts sharply with average

annual per capita consumption of 94.9 pounds in Antigua, 53.4 pounds in the U.S., 29.6 pounds in the USVI, and 22.3 pounds in the Dominican Republic.

Fish or shellfish have not historically been a mainstay of the Puerto Rican diet, although imported codfish has been a significant part of the weekly diet of Puerto Rican families, especially those in rural areas (Fernández et al. 1971). Historically, per capita consumption of fresh and frozen fish and seafood has ranked toward the bottom of per capita consumption of major food groups. For example, of 19 major food groups, per capita consumption of fresh and frozen fish and seafood ranked from last to third from the last from 1950/51 to 1972/73. Per capita consumption of processed fish and seafood ranked higher, but its ranking declined from 1950-51 to 1973-73.

Although Puerto Rico's per capita consumption of seafood is low, the territory imports substantially more pounds of edible fish products than the pounds annually landed by commercial fishers. On average, pounds imported of edible seafood dwarf the pounds landed by commercial fishers annually (Table 5.3.13). From 1999 to 2007, pounds of edible fish products imported annually were on average 28 times larger than the pounds commercially landed annually. During the same period, snapper products represented an average of 1.37 percent of annual imports of edible fish products and similarly, grouper products represented an average of 0.26 percent by weight. Also, conch imports represented an average of one tenth of a percent of annual imports of edible fish products, by weight, during the same 9-year period.

Table 5.3.13. Puerto Rico imports of edible fish products and adjusted commercial landings (pounds), 1999-2007. *Source*: NMFS: http://www.st.nmfs.noaa.gov/st1/trade/index.html.

Year	Pounds		Imports ÷ Adj. Landings
	Imports	Adj. Landings	
1999	229,848,577	4,264,092	53.90
2000	195,624,554	5,691,236	34.37
2001	130,457,565	4,981,983	26.19
2002	83,410,049	3,804,605	21.92
2003	89,671,350	4,230,409	21.20
2004	76,628,491	4,002,550	19.14
2005	35,835,074	5,725,259	6.26
2006	79,722,470	2,380,695	33.49
2007	78,560,997	2,198,377	35.74
Average	*111,084,347*	*4,142,134*	*28.02*

5.3.2.9 Fisheries Directly Affected by Amendment

5.3.2.9.1 Snapper Unit 1 Commercial Fishery

The Snapper Unit 1 stock complex is presently composed of silk (*Lutjanus vivanus*), black (*Apsilus dentatus*), vermilion (*Rhomboplites aurorubens*) and blackfin (*Lutjanus buccanella*) snapper. These species are typically caught at depths ranging from 80 meters to 350 meters. Silk snapper is the indicator species for the unit.

Table 5.3.14. Reported and adjusted landings (pounds) of Snapper Unit 1 as percentages of all species commercially landed, 1983-2007.

	Reported Landings			Adjusted Landings		
Year	**Snapper Unit 1**	**All Species**	**Percent of All Species from Snapper Unit 1**	**Snapper Unit 1**	**All Species**	**Percent of All Species from Snapper Unit 1**
1983	396,343	3,916,688	10.1%	649,742	6,420,800	10.1%
1984	357,156	3,154,298	11.3%	605,349	5,346,268	11.3%
1985	371,827	2,855,085	13.0%	663,977	5,098,366	13.0%
1986	356,898	2,535,388	14.1%	475,864	3,380,517	14.1%
1987	209,399	2,081,941	10.1%	279,198	2,775,921	10.1%
1988	172,843	2,013,663	8.6%	308,648	3,595,827	8.6%
1989	247,800	2,290,865	10.8%	485,883	4,491,892	10.8%
1990	179,375	2,179,705	8.2%	351,715	4,273,931	8.2%
1991	171,495	2,458,664	7.0%	336,265	4,820,910	7.0%
1992	214,040	2,043,970	10.5%	356,733	3,406,616	10.5%
1993	252,207	2,495,161	10.1%	420,344	4,158,601	10.1%
1994	346,201	2,708,878	12.8%	540,939	4,232,622	12.8%
1995	381,463	3,687,686	10.3%	537,271	5,193,924	10.3%
1996	321,423	3,581,209	9.0%	452,709	5,043,956	9.0%
1997	300,475	3,804,030	7.9%	385,224	4,876,962	7.9%
1998	229,730	3,452,976	6.7%	294,525	4,426,892	6.7%
1999	246,922	3,325,991	7.4%	316,567	4,264,092	7.4%
2000	220,957	3,244,005	6.8%	387,643	5,691,236	6.8%
2001	320,868	3,387,748	9.5%	471,865	4,981,983	9.5%
2002	231,059	3,271,960	7.1%	268,674	3,804,605	7.1%
2003	196,018	2,387,974	8.2%	372,234	4,230,409	8.8%
2004	131,818	1,864,679	7.1%	241,719	4,002,550	6.0%
2005	108,678	1,440,024	7.5%	285,765	5,725,259	5.0%
2006	88,425	1,311,981	6.7%	169,913	2,380,695	7.1%
2007	70,681	1,254,156	5.6%	132,688	2,198,377	6.0%
Average	***244,964***	***2,669,949***	***9.1%***	***391,658***	***4,352,928***	***9.0%***

Snapper Unit 1 is composed of important commercial species. During the 25-year period from 1983 to 2007, combined landings of SU 1 species represented an average of 9.1

percent (9.0 percent adjusted) of annual commercial landings for all species. Annual reported commercial landings of SU 1 species combined varied from a low of 70,681 pounds (adjusted to 132,688 pounds) in 2007 to a high of 381,463 pounds (adjusted to 537,271 pounds) in 1995 (Table 5.3.14). Note that reported pounds landed fell by approximately 19 percent from 2005 to 2006 and adjusted pounds by approximately 41 percent in that time. In 2005, an October through December seasonal closure was established in the U.S. Caribbean EEZ while the government of Puerto Rico implemented in 2004 a minimum size for silk snapper. The minimum size was later rescinded and an October through December seasonal closure established in state waters for both the silk and blackfin snapper.

During the same 25-year period, annually reported commercial landings of SU 1 represented from 7.7 percent to 16.9 percent of all reported commercial finfish landings (pounds), averaging 11 percent. Similarly, adjusted annual commercial landings of the unit represented from 6.8 percent to 16.9 percent of adjusted annual commercial landings (pounds) of all finfish species, averaging nearly 11 percent annually.

Table 5.3.15. Ex-vessel revenues (dollars) from Snapper Unit 1 and finfish, 1983-2007.

	Snapper Unit 1 Ex-Vessel Revenues		Finfish Ex-Vessel Revenues		% Finfish Revenues from Snapper Unit 1	
Year	**Reported**	**Adjusted**	**Reported**	**Adjusted**	**Reported**	**Adjusted**
1983	642,214	1,052,809	3,118,241	5,111,871	20.6%	20.6%
1984	584,371	990,459	2,580,801	4,374,240	22.6%	22.6%
1985	710,300	1,268,393	2,750,198	4,911,068	25.8%	25.8%
1986	683,168	910,891	2,603,266	3,471,021	26.2%	26.2%
1987	387,445	516,593	2,175,507	2,900,676	17.8%	17.8%
1988	355,936	635,600	2,048,773	3,658,523	17.4%	17.4%
1989	522,591	1,024,689	2,626,506	5,150,011	19.9%	19.9%
1990	389,005	762,756	2,526,284	4,953,497	15.4%	15.4%
1991	393,056	770,697	3,023,464	5,928,360	13.0%	13.0%
1992	509,122	848,536	2,718,188	4,530,313	18.7%	18.7%
1993	617,704	1,029,507	3,256,633	5,427,722	19.0%	19.0%
1994	859,834	1,343,491	3,776,362	5,900,566	22.8%	22.8%
1995	953,513	1,343,405	5,289,514	7,450,019	18.0%	18.0%
1996	837,276	1,179,262	4,906,958	6,911,209	17.1%	17.1%
1997	769,443	986,465	5,422,712	6,952,195	14.2%	14.2%
1998	643,751	825,322	4,917,691	6,304,732	13.1%	13.1%
1999	702,842	901,080	4,912,010	6,297,449	14.3%	14.3%
2000	631,038	1,107,084	4,888,421	8,576,177	12.9%	12.9%
2001	941,145	1,384,037	5,384,157	7,917,879	17.5%	17.5%
2002	676,228	786,312	5,141,651	5,978,664	13.2%	13.2%
2003	571,664	1,088,372	3,739,175	6,646,332	15.3%	16.4%
2004	404,013	746,552	2,737,777	6,001,433	14.8%	12.4%
2005	342,422	922,332	2,309,731	8,884,820	14.8%	10.4%
2006	301,716	570,210	2,117,209	4,038,619	14.3%	14.1%
2007	240,860	441,256	2,012,864	3,572,308	12.0%	12.4%
Average	*586,826*	*937,444*	*3,479,364*	*5,673,988*	*17.2%*	*17.0%*

Ex-vessel revenues from SU 1 landings represent a significantly higher portion of such revenues from finfish species. From 1983 to 2007, reported SU 1 revenues represented from 12 to approximately 26 percent of reported revenues from all finfish landings, while adjusted revenues for the Unit represented from approximately 10 to 26 percent of adjusted revenues from all species (Table 5.3.15). Note that reported ex-vessel revenue from SU 1 landings fell from approximately 12 percent from 2005 to 2006 and approximately 21 percent from 2006 to 2007, while adjusted ex-vessel revenue for the unit fell from approximately 38 percent from 2005 to 2006 and approximately 23 percent from 2006 to 2007.

Silk snapper (commonly called chillo) dominates the reported commercial landings of SU 1, representing from 100 percent to 83.1 percent of annual landings of the unit from 1983 to 2007. However, reported landings of silk snapper have shown a declining trend since 1983. From 1992 to 2004, 90 percent of silk snapper were caught before reaching the minimum size for sexual maturation of 410 mm fork length (PRDNER 2004). According to Griffith et al. (2007), "[f]ull-time Puerto Rican commercial fishers view fishing as a 'moral' enterprise" and this "implies that they view fishing as a productive use of natural resources that provides some food or subsistence security and is directed toward socially beneficial outcomes, such as raising families." Moreover, as such, the commercial fishers "regard wasting fish, as occurs when they have to discard undersized species, as morally reprehensible."

Vermilion snapper's contribution to SU 1's annual commercial landings rose from zero before 1987 to 14 percent in 2001 and then consistently fell after 2001. In 2007, reported landings of vermilion snapper represented 2.2 percent of the reported landings of the unit. Annual commercial landings of black snapper represent less than 1 percent of the unit's annual landings, and blackfin snapper landings represent, on average, 1.6 percent of the unit's annual landings.

Annual reported commercial landings of blackfin snapper do not follow a similar trend, having risen from zero from 1983 to 1987 to a high of 10,650 (18,684 adjusted) pounds in 1999, then falling to 873 (1,419 adjusted) pounds in 2007. Similarly, vermilion snapper landings changed during the same time period, rising from 1,418 reported (2,531 adjusted) pounds in 1988 to 44,794 reported (65,875 adjusted) pounds in 2001, then down to 3,096 reported (14,748 adjusted) pounds in 2007. The increasing trend in blackfin snapper and vermilion snapper landings from the mid 1980s to 2001 coincides with declining landings of silk snapper during that same period.

During the 25-year period from 1983 to 2007, the average nominal annual reported ex-vessel price of silk snapper was $2.54 per pound, while such prices of blackfin, black, and vermilion snapper were $2.63, $1.40 and $2.17, respectively. The prices of the species tend to show a 2-period moving average with a general upward trend (Figure 5.3.6). Note that the price of black snapper tends to be less and many times substantially less than the prices of the other species within the unit.

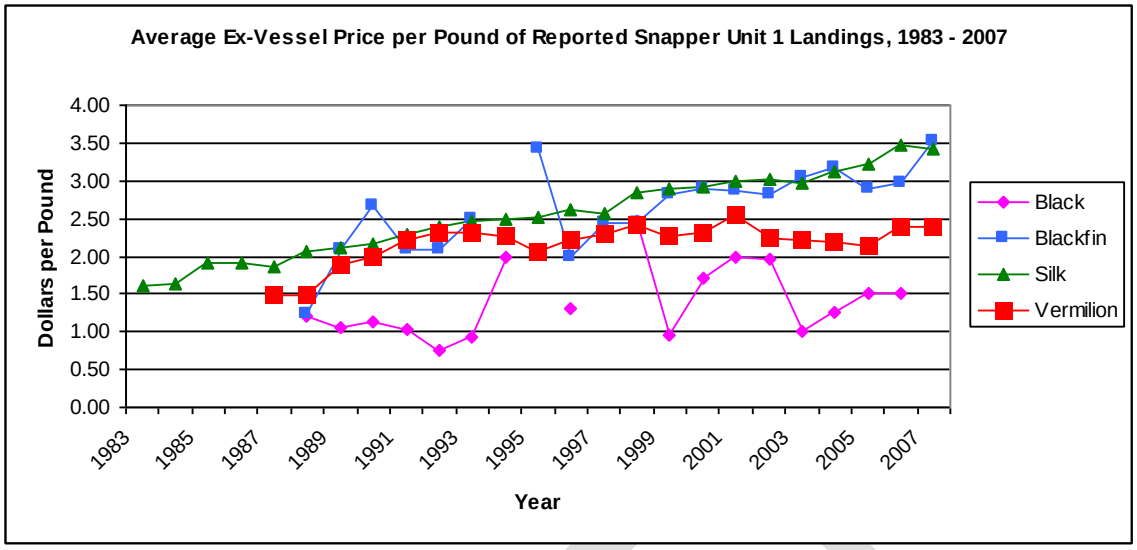


Figure 5.3.6. Average ex-vessel nominal price per pound of reported Snapper Unit 1 landings, 1983-2007.

A graph of the ex-vessel price index for SU 1 in Puerto Rico shows a relatively stable increasing trend from 1983 to 2006 (Figure 5.3.7). The index was obtained for the unit by multiplying the current annual price by the total quantity caught in 1983 (the base year), then dividing the resulting number by the 1983 value to obtain the index:

$$\frac{\text{(100 x Current annual price x 1983 quantity)}}{\text{1983 Annual value}} = \text{Index.}$$

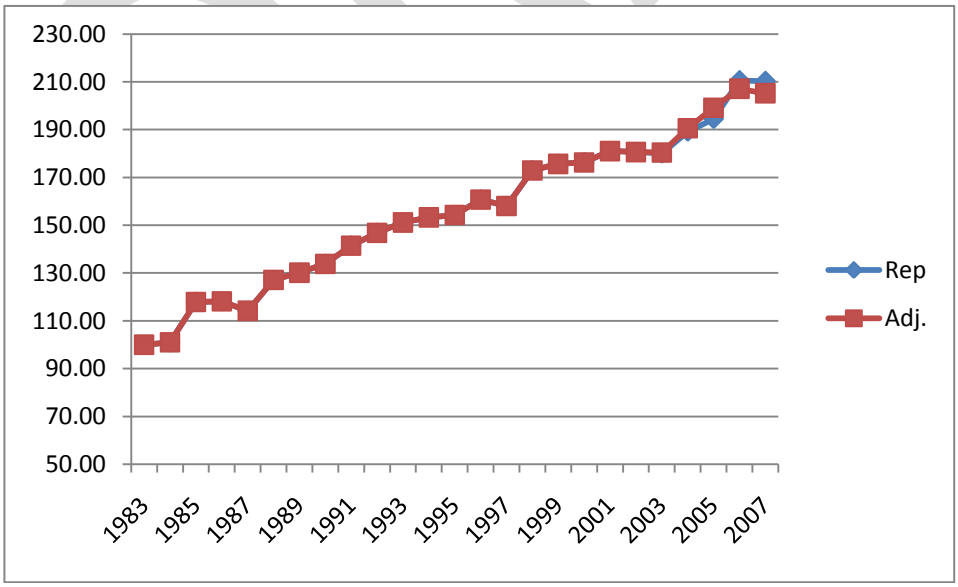


Figure 5.3.7. Ex-vessel price index for Snapper Unit 1, 1983-2007. 1983 =100. Rep. refers to the reported price and quantity and Adj. refers to the adjusted price and quantity.

Snapper Unit 1 species are taken by multiple gear. During the two 3-year periods of 1997 to 1999 and 2004 to 2006, for example, the large majority silk snapper was taken by bottom line, which is a hook-and-line gear that is fished first from the bottom then higher and higher in the water column. Bottom line accounted for an average of about 76 percent of annual silk snapper landings from 1997 to 1999 and about 87 percent from 2004 to 2006. Silk snapper was also taken by fish trap and long line, with fish trap ranked a distant second behind bottom line, during these 6 years.

From 2004 to 2006, blackfin snapper were taken with bottom line, fish traps, and long line, and vermillion snapper were taken with bottom line, fish traps, gill nets, long line. During the 3-year period, bottom line yielded 64 percent to 83 percent of annual blackfin snapper and 64 percent to 84 percent annual vermilion snapper landings (in pounds). Fish traps yielded 16 percent to 35 percent of annual blackfin snapper landings and 11 percent to 33 percent of vermilion snapper landings.

Puerto Rico's west coast accounts for the majority of silk snapper commercial landings. During the 3-year period from 2004 to 2006, 70 to 75 percent of silk snapper landings and 47 to 69 percent of blackfin snapper landings (in pounds) were on the west coast (Table 5.3.16). The most vermilion snapper landings were on the east and north coast. The north coast accounted for an average of 42 percent of annual landings (in pounds), closely followed by the east coast with an average of 40 percent of the territory's vermilion snapper landings. The north coast had the least blackfin snapper landings and the south coast the least vermilion snapper landings in all 3 years.

Table 5.3.16. Percent of annual landings (pounds) of silk, vermilion, and blackfin snapper by coast, 2004-2006. *Source*: Matos-Caraballo 2007.

Year	Species	North	South	East	West
2004	Silk	14.4%	8.2%	7.3%	70.0%
2005		10.4%	6.0%	8.5%	75.0%
2006		7.1%	10.9%	11.8%	70.2%
2004	Vermilion	49.4%	4.5%	40.7%	5.4%
2005		32.3%	6.2%	50.3%	11.2%
2006		44.3%	11.1%	27.6%	17.0%
2004	Blackfin	13.1%	19.6%	20.5%	46.7%
2005		3.0%	26.3%	21.6%	49.1%
2006		3.2%	15.6%	12.4%	68.8%
2004	First 3 Combined	16.9%	8.3%	10.1%	64.7%
2005		11.3%	6.5%	10.9%	71.3%
2006		8.2%	11.1%	12.4%	68.3%

DRAFT

According to Griffith et al. (2007), silk snapper was the most commonly landed commercial species in the west coast municipalities of Añasco, Aguada, and Aguadilla and north coast municipalities of Arecibo, Barceloneta, Vega Baja, Vega Alta, Dorado, and Loíza from 1999 to 2003. Silk snapper was the second most common commercially landed species in the west coast municipality of Rincón and the third most common commercially landed species in the north coast municipality of Isabela (Table 5.3.17). During that 5-year period, landings of silk snapper represented 41 percent of the total pounds of all species landed in Añaso, 13 percent in Aguada, 13 percent in Aguadilla, and 25 percent of total pounds landed in Rincón (Griffith et al. 2007). Vermilion snapper was the second most landed species in Loíza and Rio Grande, representing 8.5 percent and 9.9 percent of each municipality's total landings, respectively.

Table 5.3.17. Municipalities where silk snapper is one of th top three species landed, 1993-2003. *Source*: Griffith et al. 2007: 11, 12.

Silk Snapper Landings			
Coast	**Municipality**	**As Percent of Total Pounds Landed in Municip.**	**Rank Silk Snapper**
North	Arecibo	32.9%	1st
	Barceloneta	14.2%	1st
	Isabela	12.1%	3rd
	Vega Baja	10.2%	1st
	Vega Alta	10.3%	1st
	Dorado	10.0%	1st
	Loíza	10.5%	1st
West	Aguada	13.0%	1st
	Aguadilla	12.9%	1st
	Añasco	41.0%	1st
	Rincón	25.1%	2nd

Silk and blackfin snapper were identified by Ojeda-Serrano et al. (2007) as having potential spawning aggregation sites. Four silk snapper and two blackfin snapper spawning aggregation sites are located off the southwest coast.

Silk and vermilion snapper landings tend to be the smallest during the months of November and December. That is consistent with federal regulations that prohibit commercial and recreational fishing for, or possession of, vermilion, black, silk, or blackfin snapper in or from the Caribbean EEZ from October 1 through December 31 each year (50 CFR §622.33(a)(6)). In 2006, the lowest monthly landings of blackfin and vermilion snapper occurred during the months of October, November, and December.

DRAFT

5.3.2.9.2 Grouper Unit 4 Commercial Fishery

Grouper Unit 4 is composed of five species, including red (*Epinephelus morio*), misty (*E. mystacinus*), tiger (*Mycteroperca tigris*), yellowedge (*E. flavolimbatus*) and yellowfin (*M. venenosa*) grouper. Yellowfin grouper is the indicator species for the unit. Yellowfin grouper is a desirable food fish, although it has often been implicated in ciguatera poisonings. It is also utilized in the aquarium trade.

Table 5.3.18. Reported and adjusted commercial landings (pounds) of Grouper Unit 4 and all finfish, 1983-2007.

Year	Grouper Unit 4 Landings		Finfish Landings		Percent of Finfish Landings from Grouper Unit 4	
	Reported	Adjusted	Reported	Adjusted	Reported	Adjusted
1983	0	0	3,168,086	5,193,584	0.0%	0.0%
1984	0	0	2,543,721	4,311,392	0.0%	0.0%
1985	0	0	2,318,516	4,140,207	0.0%	0.0%
1986	0	0	2,117,790	2,823,720	0.0%	0.0%
1987	78	104	1,771,152	2,361,536	0.0%	0.0%
1988	460	821	1,615,805	2,885,366	0.0%	0.0%
1989	1,275	2,500	1,919,811	3,764,336	0.1%	0.1%
1990	3,220	6,313	1,873,948	3,674,407	0.2%	0.2%
1991	4,485	8,793	2,110,379	4,137,998	0.2%	0.2%
1992	6,560	10,934	1,775,341	2,958,902	0.4%	0.4%
1993	5,367	8,945	2,134,713	3,557,855	0.3%	0.3%
1994	5,435	8,493	2,303,526	3,599,259	0.2%	0.2%
1995	7,044	9,920	3,153,054	4,440,921	0.2%	0.2%
1996	9,822	13,834	2,994,132	4,217,087	0.3%	0.3%
1997	6,453	8,272	3,225,148	4,134,805	0.2%	0.2%
1998	7,348	9,421	2,830,084	3,628,312	0.3%	0.3%
1999	10,072	12,912	2,723,868	3,492,139	0.4%	0.4%
2000	7,543	13,233	2,640,875	4,633,114	0.3%	0.3%
2001	9,852	14,488	2,805,498	4,125,732	0.4%	0.4%
2002	12,595	14,645	2,688,808	3,126,521	0.5%	0.5%
2003	10,759	19,794	1,921,822	3,429,954	0.6%	0.6%
2004	7,001	11,405	1,408,841	3,064,285	0.5%	0.4%
2005	7,104	19,332	1,081,270	4,199,370	0.7%	0.5%
2006	6,556	9,779	958,683	1,812,116	0.7%	0.5%
2007	7,503	13,361	915,457	1,620,054	0.8%	0.8%
Average	***5,461***	***8,692***	***2,200,013***	***3,573,319***	***0.3%***	***0.3%***

There were no reported commercial landings of GU4 species from 1983 to 1986. However, from 1987 to 2005 annual commercial landings of GU4 species varied from 104 pounds to 28,896 pounds (Table 5.3.18). Grouper Unit 4 landings represent on average less than half of one percent of annual landings of finfish during the 25-year period; however, the share of finfish landings attributable to GU4 increased from 0.3 percent in

2000 to 0.8 percent in 2008. Note that no yellowedge grouper landings were reported during these years.

Grouper Unit 4 landings also represent a small portion of the value of finfish landings. From 1983 to 2007, the dollar value of reported and adjusted landings of the unit represented an average of 0.6 percent of the dollar value of reported and adjusted landings of all finfish landings. However, that percent has increased from 0.6 percent in 2000 to 1.8 percent in 2007.

Table 5.3.19. Reported commercial landings (pounds) of Grouper Unit 4 species, 1983-2007.

	Reported Landings						Percent of Total Unit 4 Landings				
Year	**Yellow-edge**	**Yellowfin**	**Misty**	**Tiger**	**Red**	**Total**	**Yellowfin**	**Misty**	**Tiger**	**Red**	**Total**
1983	0	0	0	0	0	0					
1984	0	0	0	0	0	0					
1985	0	0	0	0	0	0					
1986	0	0	0	0	0	0					
1987	0	78	0	0	0	78	100.0%	0.0%	0.0%	0.0%	100.0%
1988	0	460	0	0	0	460	100.0%	0.0%	0.0%	0.0%	100.0%
1989	0	1,249	26	0	0	1,275	98.0%	2.0%	0.0%	0.0%	100.0%
1990	0	558	2,662	0	0	3,220	17.3%	82.7%	0.0%	0.0%	100.0%
1991	0	1,701	2,784	0	0	4,485	37.9%	62.1%	0.0%	0.0%	100.0%
1992	0	920	5,106	0	535	6,560	14.0%	77.8%	0.0%	8.2%	100.0%
1993	0	1,482	3,885	0	0	5,367	27.6%	72.4%	0.0%	0.0%	100.0%
1994	0	447	4,988	0	0	5,435	8.2%	91.8%	0.0%	0.0%	100.0%
1995	0	827	5,941	151	125	7,044	11.7%	84.3%	2.1%	1.8%	100.0%
1996	0	1,615	5,462	2,745	0	9,822	16.4%	55.6%	27.9%	0.0%	100.0%
1997	0	2,088	4,347	0	18	6,453	32.4%	67.4%	0.0%	0.3%	100.0%
1998	0	1,791	5,557	0	0	7,348	24.4%	75.6%	0.0%	0.0%	100.0%
1999	0	3,348	6,717	0	7	10,072	33.2%	66.7%	0.0%	0.1%	100.0%
2000	0	2,298	5,246	0	0	7,543	30.5%	69.5%	0.0%	0.0%	100.0%
2001	0	3,641	6,183	0	28	9,852	37.0%	62.8%	0.0%	0.3%	100.0%
2002	0	6,916	5,679	0	0	12,595	54.9%	45.1%	0.0%	0.0%	100.0%
2003	0	4,893	5,860	0	6	10,759	45.5%	54.5%	0.0%	0.1%	100.0%
2004	0	2,188	4,786	0	27	7,001	31.3%	68.4%	0.0%	0.4%	100.0%
2005	0	684	6,308	0	113	7,104	9.6%	88.8%	0.0%	1.6%	100.0%
2006	0	975	5,581	0	0	6,556	14.9%	85.1%	0.0%	0.0%	100.0%
2007	0	1,017	6,486	0	0	7,503	13.6%	86.4%	0.0%	0.0%	100.0%
Ave.	***0***	***1,567***	***3,744***	***116***	***34***	***5,461***	***36.1%***	***61.9%***	***1.4%***	***0.6%***	***100.0%***

For 19 of the 21 years from 1987 to 2007, misty grouper and yellowfin grouper have been the primary species landed in Grouper Unit 4. There have been no reported commercial landings of yellowedge grouper, and the only reported commercial landings of tiger grouper occurred in 1995 and 1996 (Table 5.3.19). Red grouper landings were reported from 1992 to 1999, but sporadically since then. Annual commercial landings of misty

grouper have represented more than 50 percent of annual commercial landings of GU4 since 1990, with exception for 2000 and 2002, when yellowfin grouper represented 68 percent and 54.9 percent of annual landings, respectively.

Misty grouper has similarly dominated both the reported and adjusted ex-vessel revenues of GU4 landings since 1990, with the exception in 2002 when yellowfin grouper represented approximately 57 percent of the unit's adjusted ex-vessel revenue as compared to misty grouper which represented 43 percent (Figure 5.3.8).

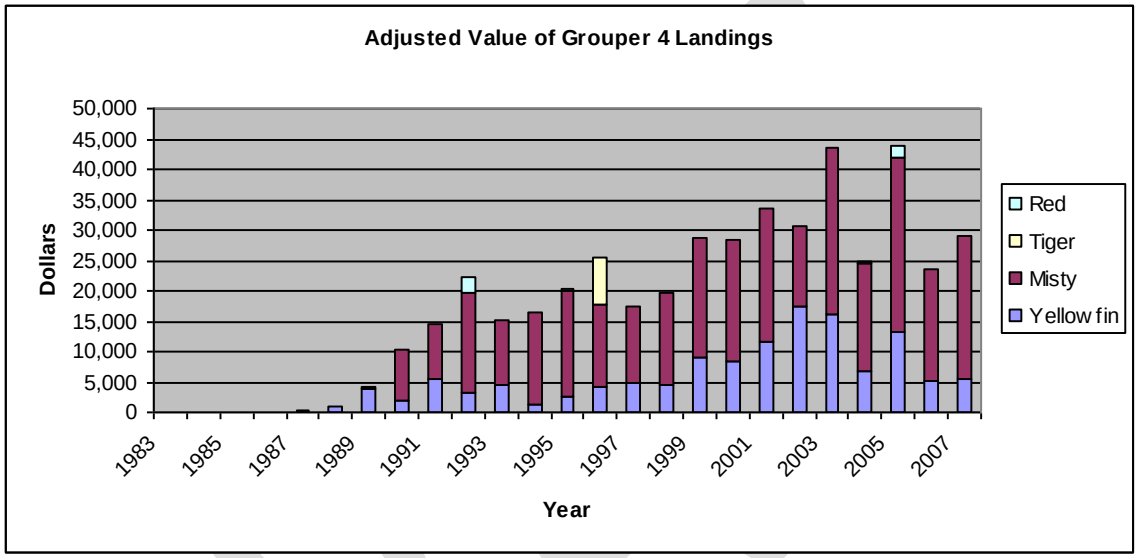


Figure 5.3.8. Ex-vessel revenue (dollars) from adjusted commercial landings of Grouper Unit 4 species, 1983-2007.

The greatest variation in the average ex-vessel price per pound of reported landings for species in GU4 is found in red grouper landings, although red grouper represents a small fraction of the unit's combined landings in pounds. In 1995, the average annual price of red grouper was $0.50 per pound, and from 2003 to 2005, the average annual price was at $3.00 per pound (Figure 5.3.9). The ex-vessel prices of the unit's species tend to follow a 2-year moving average.

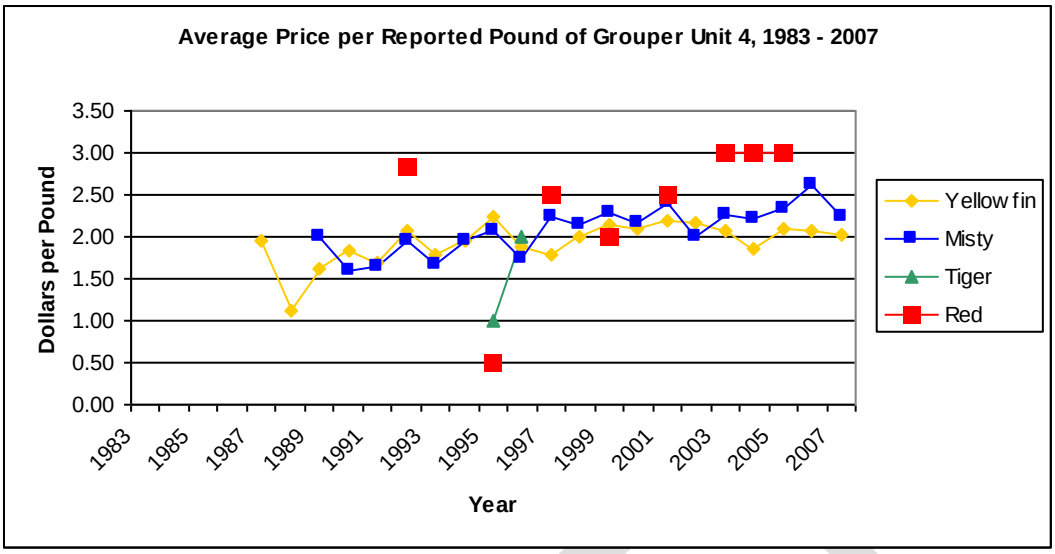


Figure 5.3.9. Average nominal ex-vessel price per reported pound of Grouper Unit 4 species, 1983-2007.

A graph of the ex-vessel price index for GU4 in Puerto Rico shows a relatively stable increasing trend after 1988, with a drop from 2006 to 2007 that parallels the drop in the average ex-vessel price of misty grouper, the species that tends to dominate the unit's landings (Figure 5.3.10).

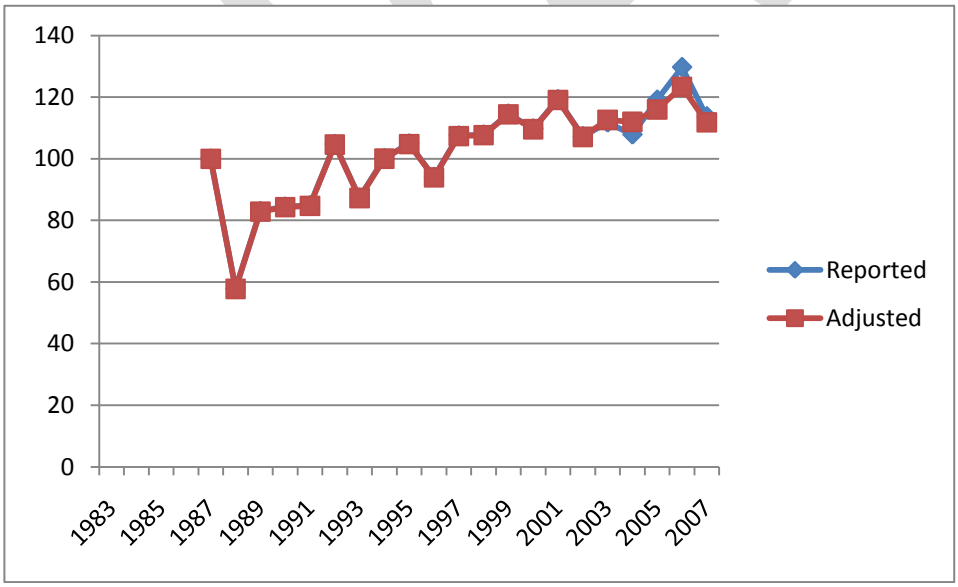


Figure 5.3.10. Ex-vessel price index for Grouper Unit 4 in Puerto Rico, 1987-2007. 1987 = 100.

Commercial landings of misty grouper and yellowfin grouper dominate landings of this stock complex. Consequently, the remainder of this section on GU4 commercial landings focuses on these two species.

The west coast tends to dominate landings of misty and yellowfin grouper. For example, west coast landings of the two species represent 80 percent to 92 percent of annual landings of misty and yellowfin grouper from 2004 to 2006 (Table 5.3.20). In 2004, the west coast also dominated landings of yellowfin grouper; however, in 2005 and 2006, the east coast had more yellowfin grouper landings.

Table 5.3.20. Commercial landings (pounds) of misty and yellowfin grouper by coast, 2004-2006. *Source*: Matos-Caraballo 2007.

	Percent of Landings of Misty Grouper			**Percent of Landings of Yellowfin Grouper**		
Coast	**2004**	**2005**	**2006**	**2004**	**2005**	**2006**
North	2.9%	1.3%	0.2%	3.0%	0.5%	0.0%
South	6.2%	5.9%	10.4%	3.7%	11.0%	13.7%
East	10.1%	1.1%	9.3%	27.8%	68.4%	61.9%
West	80.7%	91.7%	80.0%	65.5%	20.1%	24.3%
Total	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***	***100.0%***

Misty and yellowfin grouper are taken by multiple gears. Reported commercial landings of misty and yellowfin grouper from 2004 to 2006, for example, were taken by long line, bottom line, troll line, fish trap, and by skin and SCUBA diving. During the 3-year period, most (68.4-84.5 percent) misty grouper were taken with bottom line. In 2004, bottom line accounted for most landings of yellowfin grouper; however, in 2005 and 2006, the majority of yellowfin grouper landings were taken by fish traps.

The average ex-vessel nominal price of misty grouper and yellowfin grouper varies considerably by coast. For example, in 2005, yellowfin grouper sold on average for $2.00 per pound on the west coast and $3.00 per pound on the north coast.

According to Griffith et al. (2007), none of the species within GU4 were among the top three species landed in any municipality from 1999 to 2003. However, the generic category of grouper ranked third in species landed commercially in the southern municipality of Ponce.

Ojeda-Serrano et al. (2007) identified 51 potential spawning aggregation sites for species of GU4. Eight of these sites are for red grouper, 17 for tiger grouper, and the remaining 26 for yellowfin grouper. Ten of the yellowfin grouper spawning aggregation sites are along the east coast, which is the coast that accounts for most yellowfin grouper commercial landings from 2004 to 2006. Seven of the yellowfin sites were along the west coast.

DRAFT

According to Matos-Caraballo and Posada (1998), the spawning aggregation site known as "El Seco" is a well-defined promontory of deep reef that was officially discovered in 1982, although Vieques fishers had known about and fished at the site before that date. Tiger grouper were once heavily fished at this and nearby sites during spawning aggregations because the species' aggregation period occurs around the full moons of February and March, which is near the Christian religious holiday of Easter when fish consumption significantly increases (Matos-Caraballo 1997). The aggregation was fished by divers and hook and line but the depths and the number of diving accidents shift effort to hook and line only. A significant decrease in fishing effort on the aggregation sites resulted from the fishers turning to other jobs (charters, transportation) during the years of protesting the NAVY presence in Vieques.

5.3.2.9.3 Grouper Unit 1 Commercial Fishery

Grouper Unit 1 is composed of Nassau grouper (*Epinephelus striatus*). In Puerto Rico, Nassau grouper is more commonly known as mero cherna or cherna. Since 1990, no person may fish for or possess Nassau grouper in or from the Caribbean EEZ (50 CFR 622.32(b)(1)(ii)). In Puerto Rico, since 2004, no individual may fish for, possess, or offer for sale, Nassau grouper.

Before 1970, Nassau grouper was a common and very important food fish, reaching a weight of 50 pounds (22.7 kg) or more (Sadovy 1993) and in 1990, it remained within the top four species commercially landed in Puerto Rico. According to Sadovy (1993), for many decades at about the time of the full moon each December and January, a small fleet of sloops and dories would sail from fishing villages in western Puerto Rico to the spawning grounds of the species, located on the southwestern corner of the island's insular platform. With thousands of fish in the spawning area, the "catches were spectacular" (Sadovy 1993). By the 1990s, Nassau grouper was rarely landed and those that were landed were juveniles, and since 2000, it has been considered to be extinct for commercial purposes in Puerto Rico (Matos-Caraballo 2000).

Before the ban on Nassau grouper fishing in 2004, reported commercial landings peaked in 1998 at 19,070 pounds; however, it is estimated that actual (adjusted) pounds peaked in 2001. Since the ban, commercial landings of the species have been reported; however, they dropped dramatically in 2004 (Table 5.3.21). Nassau grouper landings represent an average of 0.3 percent of all annual finfish landings during the period from 1983 to 2007, which is equal to the percent of finfish landings attributable to GU4.

Landings of Nassau grouper since 2004 represent illegal economic activity. The reported illegal landings are not to suggest the absence of law enforcement. According to PRDNER's website, Puerto Rican, NOAA, and U.S. Fish and Wildlife Service law enforcement agents found three Nassau grouper on sale at a fish market in Punta Santiago in the town of Humacao in February 2009.

During the 22-year period from 1986 to 2007, the average annual ex-vessel price of Nassau grouper ranged from $1.21 to $1.89 per pound reported. That tends to be

significantly lower than the average annual ex-vessel price per pound of silk snapper and vermilion snapper. The ex-vessel price of Nassau grouper also tends to be less than the ex-vessel price of yellowfin grouper and misty grouper.

Table 5.3.21. Reported and adjusted commercial landings (pounds) of Grouper Unit 1, 1983-2007.

Year	Grouper Unit 1 Landings		Finfish Landings		Percent of Finfish Landings from Grouper Unit 1	
	Reported	Adjusted	Reported	Adjusted	Reported	Adjusted
1983	0	0	3,168,086	5,193,584	0.0%	0.0%
1984	0	0	2,543,721	4,311,392	0.0%	0.0%
1985	0	0	2,318,516	4,140,207	0.0%	0.0%
1986	57	76	2,117,790	2,823,720	0.0%	0.0%
1987	320	426	1,771,152	2,361,536	0.0%	0.0%
1988	2,022	3,610	1,615,805	2,885,366	0.1%	0.1%
1989	2,047	4,013	1,919,811	3,764,336	0.1%	0.1%
1990	2,341	4,589	1,873,948	3,674,407	0.1%	0.1%
1991	4,352	8,534	2,110,379	4,137,998	0.2%	0.2%
1992	6,612	11,020	1,775,341	2,958,902	0.4%	0.4%
1993	5,018	8,363	2,134,713	3,557,855	0.2%	0.2%
1994	7,735	12,085	2,303,526	3,599,259	0.3%	0.3%
1995	7,772	10,946	3,153,054	4,440,921	0.2%	0.2%
1996	12,594	17,738	2,994,132	4,217,087	0.4%	0.4%
1997	15,457	19,817	3,225,148	4,134,805	0.5%	0.5%
1998	19,070	24,448	2,830,084	3,628,312	0.7%	0.7%
1999	14,966	19,188	2,723,868	3,492,139	0.5%	0.5%
2000	12,940	22,702	2,640,875	4,633,114	0.5%	0.5%
2001	17,572	25,841	2,805,498	4,125,732	0.6%	0.6%
2002	18,698	21,742	2,688,808	3,126,521	0.7%	0.7%
2003	10,217	17,380	1,921,822	3,429,954	0.5%	0.5%
2004	4,229	7,245	1,408,841	3,064,285	0.3%	0.2%
2005	1,850	8,188	1,081,270	4,199,370	0.2%	0.2%
2006	1,673	2,154	958,683	1,812,116	0.2%	0.1%
2007	1,137	2,150	915,457	1,620,054	0.1%	0.1%
Average	***6,747***	***10,090***	***2,200,013***	***3,573,319***	***0.3%***	***0.3%***

Landings of Nassau grouper since 2004 represent illegal economic activity in the U.S. Caribbean. The reported illegal landings are not to suggest the absence of law enforcement. According to PRDNER's website, Puerto Rican, NOAA, and U.S. Fish and Wildlife Service law enforcement agents found three Nassau grouper on sale at a fish market in Punta Santiago in the town of Humacao in February 2009.

During the 22-year period from 1986 to 2007, the average annual ex-vessel price of Nassau grouper ranged from $1.21 to $1.89 per pound reported. That tends to be significantly lower than the average annual ex-vessel price per pound of silk snapper and

vermilion snapper. The ex-vessel price of Nassau grouper also tends to be less than the ex-vessel price of yellowfin grouper and misty grouper.

Most commercial landings of Nassau grouper have occurred on the west coast. Before 2004, the north coast had the second most landings; however, from 2004 to 2006, the east coast had the second most landings. Commercial landings of Nassau grouper declined significantly and consistently from 2004 to 2006 on Puerto Rico's north, east, and south coasts; however, landings increased along the territory's west coast from 2005 to 2006.

According to Griffith et al. (2007), Nassau grouper was a primary species of commercial interest in the northwestern coastal municipality of Isabela and eastern island municipality of Culebra from 1999 to 2003, representing Isabella's second most (14.1 percent) and Culebra Island's top (17.2 percent) commercially landed species during that period.

The reported ex-vessel price of Nassau grouper varies by coast, with the highest price on the east coast and lowest on the west coast. For example, in 1997, the average reported ex-vessel price per pound ranged from a low of $1.19 per pound on the west coast to a high of $2.03 on the east coast. The reported ex-vessel price of Nassau grouper tends to be smaller than the reported ex-vessel prices received from sales of silk snapper, vermilion snapper, blackfin snapper, misty grouper, and yellowfin grouper; however, the average reported ex-vessel price of Nassau grouper on the east coast was greater than average reported ex-vessel price of vermilion snapper, misty grouper, and yellowfin grouper in 2004 and 2006.

Nassau grouper has been taken by beach seine, gill net, long line, bottom line, troll line, fish trap, lobster trap, and by SCUBA diving. The illegal landings of Nassau grouper by bottom line increased from 2005 to 2006, while those from other gears decreased. In 2006, landings from bottom line represented about 89 percent of illegal, but reported, commercial Nassau grouper landings.

Monthly landings of Nassau grouper from 2004 to 2006 varied throughout the year, not peaking in December and January as occurred in the earlier decades of the fishery. From 2004 to 2006, the months with the highest average landings were March, April, May, and September.

Ojeda-Serrano et al. (2007) have identified 15 potential spawning aggregation sites for Nassau grouper in Puerto Rico. Eight of these are along the west coast where most landings of Nassau grouper occur. Aggregations of Nassau grouper have been reported off Mona Island and the south and southwest coasts of Puerto Rico (Sadovy and Eklund 1999).

5.3.2.9.4 Parrotfish Commercial Fishery

The Caribbean parrotfish complex is composed of 10 species, 6 of the genus *Scarus* and 4 of the genus *Sparisoma*: blue (*Scarus coeruleus*), midnight (*Sc. coelestinus*), princess (*Sc. taeniopterus*), queen (*Sc. vetula*), rainbow (*Sc. guacamaia*), striped (*Sc. croicensis*),

redband (*Sparisoma aurofrenatum*), redtail (*Sp. chrysopterum*), stoplight (*Sp. viride*) and redfin (*Sp. rubripinne*) parrotfish. There is no indicator species for this unit.

Parrotfish have been abundant on the reefs of Puerto Rico and in some areas they are a preferred food fish (CFMC 1985). Their Spanish names are: brindao (blue), judio (midnight), loro (princess, queen, striped, redband, redtail, and redfin), guacamayo (rainbow), and chaporra (stoplight).

Table 5.3.22. Reported and adjusted commercial landings (pounds) of parrotfish and percent of finfish landings, 1983-2007.

	Reported Landings			Adjusted Landings		
Year	**Parrotfish**	**Finfish**	**Percent of Finfish Landings from Parrotfish**	**Parrotfish**	**Finfish**	**Percent of Finfish Landings from Parrotfish**
1983	233,619	3,168,086	7.4%	382,982	5,193,584	7.4%
1984	231,387	2,543,721	9.1%	392,181	4,311,392	9.1%
1985	221,378	2,318,516	9.5%	395,318	4,140,207	9.5%
1986	105,546	2,117,790	5.0%	140,728	2,823,720	5.0%
1987	76,852	1,771,152	4.3%	102,469	2,361,536	4.3%
1988	12,208	1,615,805	0.8%	21,800	2,885,366	0.8%
1989	4,278	1,919,811	0.2%	8,387	3,764,336	0.2%
1990	36,848	1,873,948	2.0%	72,250	3,674,407	2.0%
1991	68,051	2,110,379	3.2%	133,433	4,137,998	3.2%
1992	92,118	1,775,341	5.2%	153,530	2,958,902	5.2%
1993	160,195	2,134,713	7.5%	266,992	3,557,855	7.5%
1994	116,023	2,303,526	5.0%	181,286	3,599,259	5.0%
1995	80,191	3,153,054	2.5%	112,945	4,440,921	2.5%
1996	102,870	2,994,132	3.4%	144,888	4,217,087	3.4%
1997	110,978	3,225,148	3.4%	142,279	4,134,805	3.4%
1998	97,556	2,830,084	3.4%	125,072	3,628,312	3.4%
1999	80,719	2,723,868	3.0%	103,486	3,492,139	3.0%
2000	73,115	2,640,875	2.8%	128,272	4,633,114	2.8%
2001	96,761	2,805,498	3.4%	142,295	4,125,732	3.4%
2002	107,544	2,688,808	4.0%	125,051	3,126,521	4.0%
2003	69,586	1,921,822	3.6%	116,002	3,429,954	3.4%
2004	51,678	1,408,841	3.7%	147,492	3,064,285	4.8%
2005	29,383	1,081,270	2.7%	133,262	4,199,370	3.2%
2006	31,576	958,683	3.3%	50,684	1,812,116	2.8%
2007	33,658	915,457	3.7%	57,981	1,620,054	3.6%
Average	***92,965***	***2,200,013***	***4.1%***	***151,243***	***3,573,319***	***4.1%***

Not all of the above parrotfish have a category in the trip-ticket form specific to the species. The trip-ticket form has a category for each of the following five species: blue, midnight, rainbow, redtail and stoplight. Three of the other five species (princess, queen, striped) are reported in the generic 'parrotfishes' category. It is assumed here that redband

and redfin parrotfish (*Sparisoma aurofrenatum* and *Sparisoma rubripinne*) are also placed within this category when landed.

Reported commercial landings of parrotfish varied considerably from 1983 to 2007, falling from a high of 233,619 pounds in 1983 to 4,278 pounds in 1989, then rising to 160,195 pounds in 1993 followed by a general decline to 33,658 pounds in 2007 (Table 5.3.22). Parrotfish landings represent an average of 4.1 percent of all finfish landings (pounds) annually.

On average, ex-vessel revenue from all parrotfish landings represents less than 3 percent of the ex-vessel revenue from all finfish landings from 1983 to 2007. Ex-vessel revenue from SU1 landings, by comparison, represents an average of approximately 17 percent of ex-vessel revenue from all finfish landings.

Landings of rainbow, midnight, blue, stoplight, and redtail parrotfish represent a very small portion of all parrotfish landings (Table 5.3.23). At least 98.7 percent of each year's landings of parrotfish are in the generic category, parrotfish, during the 25-year period from 1983 to 2007.

Table 5.3.23. Adjusted Commercial Landings (Pounds) of Parrotfish, 1983 – 2007.

	Adjusted Pounds Landed						
Year	**Parrotfish**	**Rainbow**	**Midnight**	**Blue**	**Stoplight**	**Redtail**	**TOTAL**
1983	382,916			66			382,982
1984	392,181						392,181
1985	395,318						395,318
1986	140,728						140,728
1987	102,469						102,469
1988	21,800						21,800
1989	8,387						8,387
1990	72,250						72,250
1991	133,433						133,433
1992	153,196		333				153,530
1993	266,969				23		266,992
1994	180,818			469			181,286
1995	112,478	354		6	108		112,945
1996	144,760	4	7		117		144,888
1997	142,216			6	56		142,279
1998	124,974			19	78		125,072
1999	103,248	13	24	13	38	149	103,486
2000	128,250			0	21		128,272
2001	142,176			106	13		142,295
2002	124,904	140			8		125,051
2003	115,360	617	8	17			116,002
2004	145,364	2,128					147,492
2005	131,407	1,855					133,262
2006	50,463	220					50,684
2007	57,981						57,981

DRAFT

The average nominal ex-vessel price per pound for reported landings of parrotfish species ranges from $0.54 per pound in 1984 for the generic category, "parrotfishes," to $3.50 per pound in 1995 for rainbow parrotfish (Figure 5.3.11).

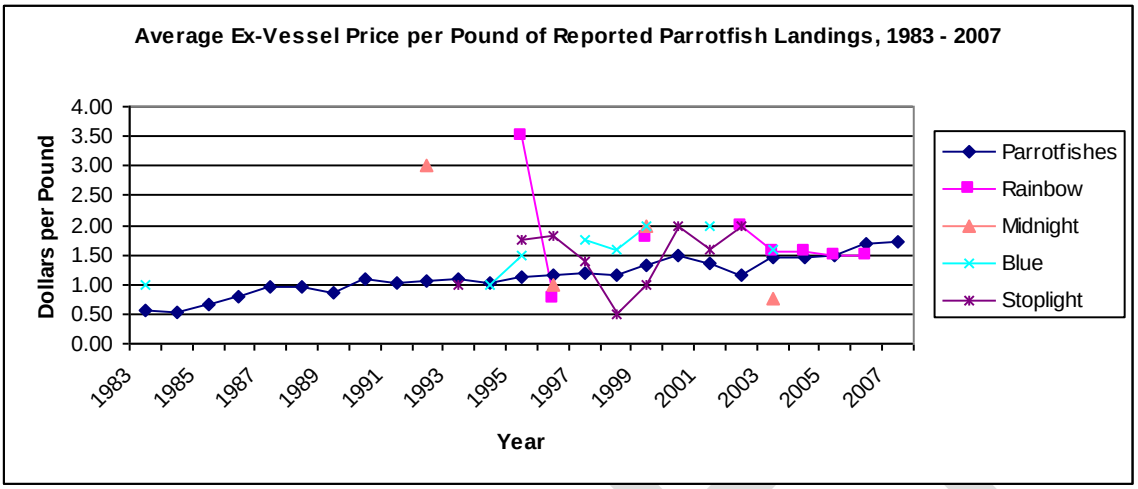


Figure 5.3.11. Average ex-vessel price per pound of reported parrotfish landings, 1983-2007.

A chart of the ex-vessel price index for the parrotfish unit in Puerto Rico from 1983 to 2007 shows an increasing trend after 1984 (Figure 5.3.12).

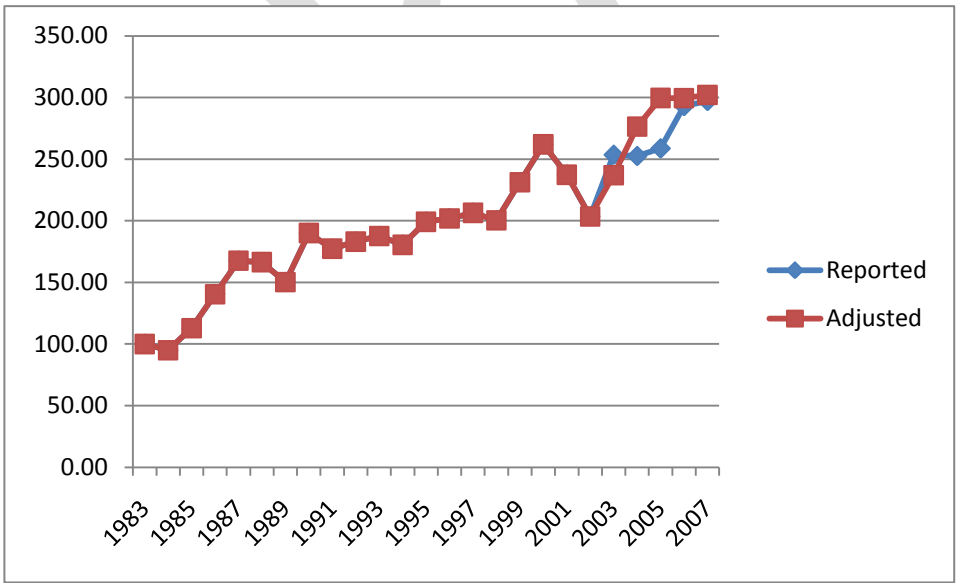


Figure 5.3.12. Ex-vessel price index for parrotfish in Puerto Rico, 1983-2007. 1983 = 100.

The south coast tends to have the highest parrotfish landings. From 1997 to 1999 and from 2004 to 2006, for example, the south coast's average annual share of the state's reported parrotfish commercial landings increased from 48.1 percent (1997 to 1999) to 57.5 percent (2004 – 2007). In second place was the west coast, with an average of 33.6 percent of reported annual parrotfish landings from 1997 to 1999 and 29.3 percent from 2004 to 2006.

From 1993 to 2003, parrotfish were the top species in commercial landings in the southern municipality of Arroyo, accounting for 15.1 percent of Arroyo's total landings (Griffith et al. 2007: 11). Parrotfish was the third most common species landed in the southern municipality of Patillas, representing 6.0 percent of its total landings.

Parrotfish are taken primarily by net gear. For example, most parrotfish commercially harvested during 1997-1999 and during 2004-2006 were taken with net gear, particularly trammel net and gill net. Historically, entanglement nets have been the preferred gear to take parrotfish. However, the use of trammel net has generally declined, and there has been increased use of fish traps to catch parrotfish. Griffith et al. (2007) state the use of trammel net to catch parrotfish is in sharp decline in some areas, particularly the southern municipality of Guánica because its use is considered outdated.

Since November 2005, federal regulations have prohibited the use of gill and trammel nets in the U.S. Caribbean EEZ to harvest Caribbean reef fish, including parrotfish. Also, water depth in the EEZ does not favor the use of these nets. Puerto Rico fishing regulations specify mesh and lengths limits for nets since 2004. The prohibition of the use of bottom tending gear in seasonally closed areas was implemented in both the state and federal waters.

Landings of parrotfish tend to rise during the Christian season of Lent. During the 3-year period from 2004 to 2006, for example, the months with the most commercial landings of parrotfish were February and March, averaging 10 percent and 11.1 percent of annual landings, which is consistent with the increase in demand for fish that typically occurs during those months. The least landings occurred in November to January.

Ojeda-Serrano et al. (2007) have identified 32 potential spawning aggregation sites for parrotfish. Twenty-three of these sites are along the southwest coast. These sites are also consistent with the majority of parrotfish commercial landings being on the west and south coasts.

5.3.2.9.5 Queen Conch Commercial Fishery

The Queen Conch FMU is composed of Caribbean queen conch (*Strombus gigas*), which is commonly known as carrucho in Puerto Rico. Under federal law, no person may fish for, or possess on board a fishing vessel, a Caribbean queen conch in or from the U.S. Caribbean EEZ off Puerto Rico (CFMC 2005).

Puerto Rico Fishing Regulation No. 6768 establishes a closed season from July 1 until September 30 of each year in territorial waters and a size limit of 9 inches (229 mm) shell

length or a lip thickness of 3/8 inches (9 mm). Sale of undersized queen conch and queen conch shells is prohibited. There are daily commercial catch limits of 150 queen conch per person and 450 per boat, and the use of hookah gear is prohibited.

Queen conch represents a significant portion of shellfish and all commercial landings. On average, queen conch landings have accounted for 43 percent of shellfish annual landings and about 8 percent of all commercial landings, by weight.

Reported and adjusted landings of queen conch have varied considerably since 1983, falling from 398,880 pounds reported and 655,541 adjusted pounds in 1983 to a low of 90,947 reported and 151,578 pounds in 1992, then rising with a general trend after that until 2006 (Table 5.3.24).

Table 5.3.24. Reported and adjusted commercial landings (pounds) of and revenues (dollars) from queen conch, 1983-2007.

	Annual Landings			Ex-Vessel Revenue of Landings		
Year	**Reported**	**Adjusted**	**Adj. Factor**	**Reported**	**Adjusted**	**Adj. Factor**
1983	399,880	655,541	1.64	516,171	846,182	1.64
1984	294,773	499,615	1.69	387,010	655,949	1.69
1985	260,825	465,759	1.79	379,932	678,451	1.79
1986	188,360	251,147	1.33	286,977	382,635	1.33
1987	142,994	190,659	1.33	234,247	312,329	1.33
1988	230,702	411,968	1.79	410,526	733,083	1.79
1989	160,247	314,210	1.96	298,930	586,137	1.96
1990	107,964	211,694	1.96	206,079	404,077	1.96
1991	108,084	211,930	1.96	214,112	419,828	1.96
1992	90,947	151,578	1.67	186,531	310,886	1.67
1993	164,590	274,317	1.67	336,146	560,243	1.67
1994	170,802	266,878	1.56	354,179	553,405	1.56
1995	214,231	301,733	1.41	456,212	642,552	1.41
1996	239,817	337,771	1.41	516,822	727,919	1.41
1997	238,619	305,922	1.28	589,189	755,370	1.28
1998	260,905	334,493	1.28	544,162	697,643	1.28
1999	214,044	274,415	1.28	464,327	595,290	1.28
2000	280,658	492,382	1.75	609,707	1,069,661	1.75
2001	244,806	360,008	1.47	577,500	849,265	1.47
2002	235,608	273,963	1.16	544,918	633,625	1.16
2003	188,021	346,654	1.84	451,727	814,832	1.80
2004	216,040	377,685	1.75	508,431	933,088	1.84
2005	175,957	698,335	3.97	450,757	1,978,212	4.39
2006	153,018	241,743	1.58	499,729	773,449	1.55
2007	144,156	258,501	1.79	546,028	931,675	1.71

DRAFT

Reported ex-vessel prices of queen conch have shown a general increasing trend since 1983, rising from an average of $1.29 per pound in 1983 to $3.79 per pound in 2007 for reported landings. The largest increase occurred from 2004 to 2007 (Figure 5.3.13).

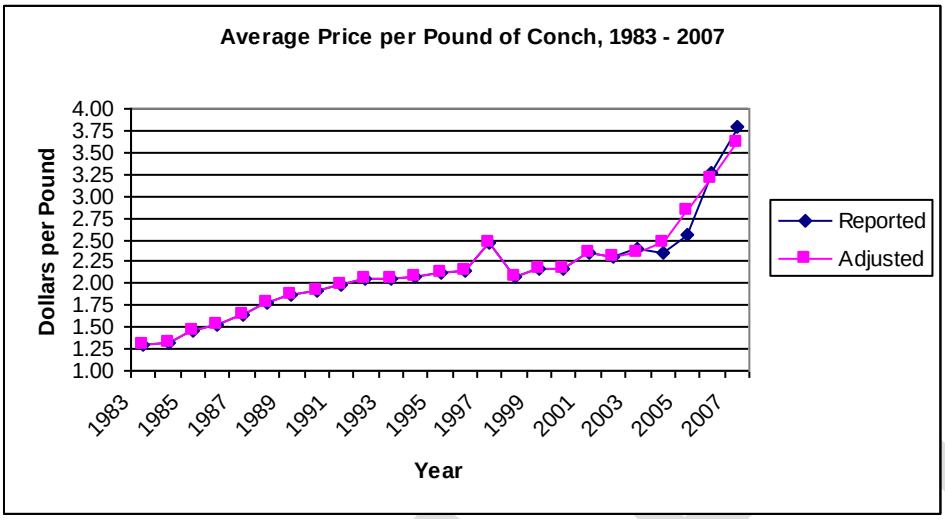


Figure 5.3.13. Average nominal ex-vessel price per pound of queen conch, 1983-2007.

The majority of Puerto Rico's commercial queen conch landings are on the west coast where the wide insular shelf provides extensive conch habitat. West coast landings represented an average of 53 percent of annual landings of conch from 1997 to 1999 and about 67 percent from 2004 to 2006, for example. The east coast also has a relatively wide insular shelf and its landings are second to those of the west coast. Because of its narrow insular shelf, north coast landings represented no more than one percent of annual commercial landings (in pounds) of conch from 1997 to 1999 and no more than 0.2 percent from 2004 to 2006. A 1999 survey of Puerto Rico commercial fishers found 209 conch fishers (Rivera 1999). Over half (108) of these fishers were on the south and southwest coasts, and only 18 harvested queen conch from the U.S. Caribbean EEZ. Since 2005, the EEZ off Puerto Rico has been closed to queen conch fishing.

Puerto Rican commercial fishers predominantly take conch by skin and SCUBA diving. During the 3-year period from 1997 to 1999, for example, from about 96.8 percent to 100 percent of total conch landings were harvested by SCUBA diving. From 2004 to 2006, skin and SCUBA diving accounted for 97.8 percent to 99.6 percent of annual landings of conch. According to Rivera (1999), the average conch fisher fished in a pair, with one fisher diving while the other tended the diver and handled the boat. SCUBA tanks were the main source of air for the diver who usually took 4 to 6 tanks per trip.

Monthly commercial landings of conch tend to vary considerably. For example, from January 2004 to December 2006, landings in July, August, and September combined represented an average of 0.5 percent of annual landings. The highest landings occurred, on average, in October, March, and June.

Table 5.3.25. Distribution of Puerto Rico queen conch fishers by fishing port in 1999. *Source*: Rivera (1999).

Coast	Fishing Center		Number of Fishers	Percent of Fishers
West	**Municipality**	**Port**	*73*	*34.9%*
	Anasco (AN)	Tres Hermanos	1	0.5%
	Cabo Rojo (CR)	Bahia Sucia	2	1.0%
	Cabo Rojo	Boqueron	7	3.3%
	Cabo Rojo	El Combate	20	9.6%
	Cabo Rojo	Pitahaya	2	1.0%
	Cabo Rojo	Puerto Real	33	15.8%
	Mayagüez (MG)	El Seco	8	3.8%
South	**Municipality**	**Port**	*50*	*23.9%*
	Guanica (GC)	Bahia	6	2.9%
	Guanica	Salinas	10	4.8%
	Guayanilla (GL)	Playa	12	5.7%
	Juana Diaz (JD)	Pastillo	1	0.5%
	Lajas (LJ)	La Parguera	3	1.4%
	Lajas	Papayo	3	1.4%
	Peuelas (PE)	Tallaboa	15	7.2%
East	**Municipality**	**Port**	*55*	*26.3%*
	Ceiba (CE)	Los Machos	9	4.3%
	Fajardo (FJ)	Las Croabas	2	1.0%
	Fajardo	Maternillo	5	2.4%
	Fajardo	Pto Real	3	1.4%
	Humacao (HU)	Punta Santiago	3	1.4%
	Naguabo (NG)	Hucares	20	9.6%
	Vieques (VQ)	Esperanza	2	1.0%
	Vieques	Morropo	11	5.3%
North	**Municipality**	**Port**	*31*	*14.8%*
	Arecibo (AC)	Jarealito	2	1.0%
	Carolina (CN)	Torrecilla	1	0.5%
	Dorado (DO)	Mameyal	3	1.4%
	Isabela (IS)	Bajura	6	2.9%
	Loiza (LZ)	Ancones	7	3.3%
	Manati (MT)	Pta Manati	4	1.9%
	Rio Grande (RG)	Mosquito	1	0.5%
	San Juan (SJ)	La Coal	6	2.9%
	San Juan	La Puntila	1	0.5%
TOTAL			***209***	***100.0%***

DRAFT

In 1999, 113 of 209 conch fishers were located in and between the southwestern municipality of Cabo Rojo (CR) and the southeastern municipality of Peñuelas (PA) (Table 5.3.25). Fifty-two conch fishers, the second largest group, were located in the east coast muncipalities of Naguabo (NG), Ceiba (CE), Fajardo (FJ) and Vieques (VQ). A smaller number of conch fishers were located on the north coast. No conch fishers were found in Rincon (RC), Aguada, and Aquadilla along the west coast. The east coast islands of Culebra (CU) and Vieques and the west coast islands of Desecheo, Mona, and Monito have been centers of distribution.

5.3.2.9.6 Commercial Snapper Unit 2 Fishery

Snapper Unit 2 is composed of queen (*Etelis oculatus*) and wenchman (*Pristopomoides aquilonaris*) snapper. Puerto Rican fishers and the PRDNER do not equate wenchman with *P. aquilonaris*. Instead, wenchman is the common name for cardinal snapper (*P. macrophthalmus*). Hence, landings of wenchman reported by Puerto Rico fishers are landings of cardinal snapper, which are not included in landings of SU2 species.

There are presently no regulations that limit commercial or recreational harvest or possession of queen snapper or wenchman (*P. aquilonaris*) snapper in the U.S. Caribbean EEZ. However, fishers cannot use either gillnet or trammel net to fish for these species in the EEZ.

There have been no reported landings of wenchman snapper (*P. aquilonaris*) from 1983 to 2007, which is consistent with a public comment made at the June 23 to 24, 2009 Council meeting in St. Croix. According to the commenter, there are no landings of *P. aquilonaris* in Puerto Rico.

Reported and adjusted commercial landings of queen snapper have increased during the 25-year period from 1983 to 2007, rising from zero to over one hundred thousand pounds every year since 2001, with the exception of 79,544 reported pounds in 2004 (Table 5.3.26). On average, queen snapper landings represent less than 3 percent of all finfish landings during the 25-year period; however, since 2000, queen snapper landings represent 7.2 percent of reported finfish landings and 5.6 percent of adjusted finfish landings. This increase coincides with declining landings of silk snapper.

The reported ex-vessel revenues received from queen snapper landings has similarly increased from 1987 to 2007, rising from less than $10,000 in 1987 to almost $400,000 in 2007. At the same time, queen snapper's contribution to reported ex-vessel revenues from finfish landings rose from less than half a percent in 1987 to over 19 percent reported in 2007 (almost 17 percent adjusted).

From 1987 to 2000, the average nominal ex-vessel price per pound of queen snapper was under $3 annually. Since 2001, the average annual nominal ex-vessel price has risen from $3.02 to $3.53 per pound.

From 1987 to 2007, the average reported ex-vessel price per pound of queen snapper tended to increase at a higher rate than the average reported ex-vessel price per pound of other species within the stock complexes experiencing overfishing. This increasing difference has made queen snapper a more attractive species to commercial fishers in Puerto Rico.

Table 5.3.26. Commercial landings (pounds) of Snapper Unit 2, associated ex-vessel vessel revenue (dollars) and average ex-vessel price (dollars per pound), 1987-2007.

	Landings		Ex-Vessel Revenue		Ave. Ex-Vessel Price	
Year	**Rep.**	**Adj.**	**Rep.**	**Adj.**	**Rep.**	**Adj.**
1987	4,378	5,837	9,179	12,239	2.10	2.10
1988	14,759	26,354	29,590	52,840	2.00	2.01
1989	15,405	30,205	33,014	64,733	2.14	2.14
1990	11,379	22,312	26,292	51,554	2.31	2.31
1991	17,763	34,829	39,518	77,487	2.22	2.22
1992	25,260	42,099	58,974	98,290	2.33	2.33
1993	32,310	53,850	79,671	132,785	2.47	2.47
1994	27,731	43,330	70,383	109,973	2.54	2.54
1995	34,114	48,047	93,188	131,250	2.73	2.73
1996	36,671	51,649	95,464	134,456	2.60	2.60
1997	38,770	49,705	109,120	139,897	2.81	2.81
1998	46,070	59,064	132,362	169,695	2.87	2.87
1999	66,682	85,489	197,583	253,312	2.96	2.96
2000	82,825	145,306	243,151	426,581	2.94	2.94
2001	102,137	150,201	308,027	452,981	3.02	3.02
2002	110,058	127,974	339,042	394,235	3.08	3.08
2003	126,999	283,702	407,133	909,728	3.21	3.21
2004	79,544	127,004	256,936	413,600	3.23	3.26
2005	127,879	205,604	422,405	682,245	3.30	3.32
2006	101,748	115,044	346,703	391,903	3.41	3.41
2007	111,125	171,217	391,961	601,490	3.53	3.51
21-yr Average	***57,791***	***89,468***	***175,700***	***271,489***	***2.75***	***2.75***
Ave. since 2000	***108,498***	***168,678***	***353,172***	***549,455***	***3.25***	***3.26***

Queen snapper was the top ranked commercial species landed in Rincón from 1999 to 2003, representing 28.6 percent of the west coast municipality's commercial landings during that period (Griffith et al. 2007). West coast fishers land substantially more queen snapper than fishers from the other coasts combined. West coast landings of queen snapper represented an average of about 94 percent of the commonwealth's annual landings of the species.

Queen snapper have been caught using long line, bottom line, and fish traps. Bottom line is the favored gear of fishers taking queen snapper. At least 99 percent of annual commercial landings of queen snapper were taken by bottom line from 2004 to 2006.

Reported commercial landings of queen snapper from 2004 to 2006 show a modest deviation by month on average, with June averaging the smallest share of yearly landings and March the greatest share. However, landings in January and February of 2005 were substantially lower than other months of that year and of the same months in 2004 and 2006.

Table 5.3.27. Commercial landings (pounds) of cardinal snapper and as percent of commercial finfish landings, 1983-2007.

Year	Cardinal Snapper Landings		Finfish Landings		Percent of Finfish Landings from Cardinal Snapper	
	Rep.	Adj.	Rep.	Adj.	Rep.	Adj.
1983	0	0	3,168,086	5,193,584	0.0%	0.0%
1984	0	0	2,543,721	4,311,392	0.0%	0.0%
1985	0	0	2,318,516	4,140,207	0.0%	0.0%
1986	0	0	2,117,790	2,823,720	0.0%	0.0%
1987	0	0	1,771,152	2,361,536	0.0%	0.0%
1988	0	0	1,615,805	2,885,366	0.0%	0.0%
1989	204	400	1,919,811	3,764,336	0.0%	0.0%
1990	84	164	1,873,948	3,674,407	0.0%	0.0%
1991	0	0	2,110,379	4,137,998	0.0%	0.0%
1992	288	480	1,775,341	2,958,902	0.0%	0.0%
1993	1	2	2,134,713	3,557,855	0.0%	0.0%
1994	0	0	2,303,526	3,599,259	0.0%	0.0%
1995	0	0	3,153,054	4,440,921	0.0%	0.0%
1996	0	0	2,994,132	4,217,087	0.0%	0.0%
1997	542	695	3,225,148	4,134,805	0.0%	0.0%
1998	2,302	2951	2,830,084	3,628,312	0.1%	0.1%
1999	3,644	4672	2,723,868	3,492,139	0.1%	0.1%
2000	4,952	8687	2,640,875	4,633,114	0.2%	0.2%
2001	7,165	10537	2,805,498	4,125,732	0.3%	0.3%
2002	6,197	7206	2,688,808	3,126,521	0.2%	0.2%
2003	7,233	12665	1,921,822	3,429,954	0.4%	0.4%
2004	6,278	11133	1,408,841	3,064,285	0.4%	0.4%
2005	10,066	21482	1,081,270	4,199,370	0.9%	0.5%
2006	3,887	6961	958,683	1,812,116	0.4%	0.4%
2007	4,760	8792	915,457	1,620,054	0.5%	0.5%
Average	**2,304**	**3,873**	**2,200,013**	***3,573,319***	***0.1%***	***0.1%***
Ave. Since 2000	***6,317***	***10,933***	***1,682,911***	***3,054,005***	***0.4%***	***0.4%***

5.3.2.9.7 Commercial Cardinal Snapper Fishery

Cardinal snapper (*P. macrophthalmus*) is a commercial species in Puerto Rico. There were no reports of landings of cardinal snapper prior to 1989, and from 1989 to 1996, there were 4 years with no landings. However, since 1997, there have been landings of the species every year and a general increase in those landings as illustrated in Table

5.3.27; however, the species continues to represent no more than half a percent of annual finfish, with the exception in 2005 when reported landings represented 0.9 percent of reported finfish landings. Nonetheless, the increase is evidence of fishers seeking alternative species to mitigate for reduced landings of other species, especially silk snapper.

Nominal ex-vessel revenues from landings of cardinal snapper similarly represent a very small percentage of ex-vessel revenues from all finfish landings. During the 25-year period from 1983 to 2007, cardinal snapper landings accounted for an average of 0.2 percent of nominal ex-vessel revenues of finfish; however, since 2000, ex-vessel revenues from landings of cardinal snapper have accounted for 0.6 percent of nominal ex-vessel revenues from finfish landings and 0.5 percent of adjusted finfish revenues.

The nominal ex-vessel price of cardinal snapper ranks high among the species discussed thus far, averaging $3.00 per pound of reported landings since 2000 (Figure 5.3.14). From 2005 to 2007, the average nominal ex-vessel price ranged from $3.18 to $3.30 per pound.

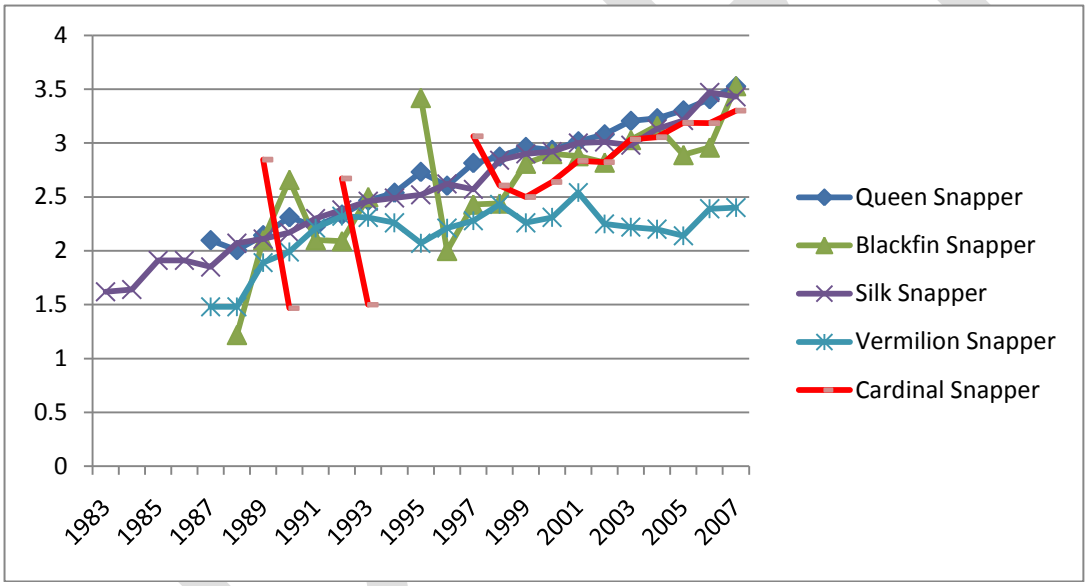


Figure 5.3.14. Average nominal prices (dollars) per pound of various species, 1983-2007.

The west coast accounted for the majority of cardinal snapper landings from 2004 to 2006, taking from about 71 percent to 83 percent of Puerto Rico's annual landings of the species.

The majority of cardinal snapper are harvested using bottom line. From 2004 to 2006, an average of approximately 90 percent of annual reported cardinal snapper landings (in pounds) were taken with bottom line. This is also the primary gear used to harvest silk, vermilion, blackfin, and queen snapper, as well as misty and Nassau grouper. Gill net ranked second with an average of 8 percent of cardinal snapper landings during the same time period. Long line and fish trap accounted for the remaining landings of the species.

5.3.2.9.8 Creole-Fish

Creole-fish (*Paranthias furcifer)* is within Grouper Unit 3. The species is widespread throughout its range, and is not targeted in any fishery.

5.3.2.9.9 Commercial Grouper Unit 2 Fishery

Grouper Unit 2 is composed of goliath grouper. Since 1993, no person may fish for or possess goliath grouper in or from the U.S. Caribbean EEZ. Puerto Rico has banned fishing for, possession of, or offering for sale goliath grouper since 2004. Hence, there is no commercial (or recreational) Grouper Unit 2 fishery.

5.3.2.9.10 Commercial Black Grouper Fishery

Black grouper is not a targeted species in Puerto Rico. During the 25-year period from 1983 to 2007, there were only four years with reported (adjusted) landings: 425 pounds in 1990, 12 pounds in 1992, 24 pounds in 1996, and 20 pounds in 2004.

5.3.2.10 Recreational Fishery

5.3.2.10.1 Introduction

The Magnuson-Stevens Act defines recreational fishing as fishing for sport or pleasure. According to Griffith et al. (2007: 18 f6), the term pescador deportivo (sport fisher) is more common in Puerto Rico than the term pescador recreativo (recreational fisher).

The Magnuson-Stevens Act defines commercial fishing as fishing to produce fish to sell, trade or barter. The definitions of commercial and recreational fishing are presumed to be mutually exclusive. Therefore, recreational fishers, as legally defined, do not sell, trade or barter their catch nor is commercial fishing an act of fishing for pleasure. Such definitions, however, contradict the experiences of fishers in Puerto Rico. Puerto Rican commercial fishers describe fishing as pleasurable, as therapeutic (Griffith et al. 1992). Also, it is a practice of sport fishers, especially of those who enter fishing tournaments, to sell what they catch. For example, according to a 2009 NMFS Highly Migratory Species scoping document, sport fishers sell billfish and coastal pelagics, such as "dorado", that they land in tournaments to cover the costs of entering the tournament and fuel: (http://www.nmfs.noaa.gov/sfa/hms/Amendment_4_Caribbean/01-15-09_A4_Scoping_Summary_Final.pdf). Enforcement to discourage such practices is compromised by the possibility of intimidation of PRDNER wardens by wealthy sport fishers who are economically and/or politically powerful. Billfish tournament anglers, for example, surveyed in 1993 had a median income of $70,000 to $79,999 if a resident of Puerto Rico and $90,000 to $99,999 if a non-resident (Ditton and Clark 1994).

Tournament fishing is not a new phenomenon in Puerto Rico, and it is central to sport fishing, particularly at prominent marinas and Club Nauticos (Griffith et al. 2007). The

Club Naútico de San Juan International Billfish Tournament, for example, began in 1958. The tournament attracts sport fishers from around the world.

There were 124 fishing tournaments visited by PRDNER staff from 1999 to 2002 (Rodríguez-Ferrer et al. 2005). During that 4-year period, the most targeted species were blue marlin (*Makaira nigricans*), mahi-mahi (*Coryphaerna hippurus*), and wahoo (*Acanthocybium solandri*). In 2005 and 2006 there were 24 and 28 fishing tournaments, respectively. The tournament season begins in January or February and ends in November. Most tournament fishing occurs on the north coast where billfish, such as blue marlin and sailfish, are the main target. Shore and bottom fishing tournaments are few in number.

Puerto Rican fishing tournament organizers add tourist activities, such as sightseeing, to increase the length of participants' stay and encourage non-participating family members to come to the island. For example, the Club Naútico of San Juan, which sponsored the 56th International Billfish Tournament, offered a sunset boat parade, fashion show, and multiple sightseeing trips (www.sanjuaninternational.com/schedule.damas.html) for non-participants. These activities increase non-tournament spending.

The MRFSS program began in 1979 and was implemented in Puerto Rico in 1979 and 1981, but was discontinued in 1982 because of lack of funding (Osborn and Lowther 2001). The survey was re-initiated in 2000 and has been ongoing since. Data collection targets, but is not restricted to, the FMUs directly affected by the proposed actions; however, there is no recreational data for queen conch. According to a NMFS HMS (2009) report, Puerto Rican recreational fishers that harvest HMS species do not report their recreationally landed fish because they are afraid they will get a fine.

New technologies, such as electronic navigational systems and more efficient gear, have become available to fishers and pose an increased fishing potential to both the resident fish stocks and pristine coral formations. For example, some recreational fishers are using a new deep jigging technique (La Regata) and fishing at depths of 600-800 ft. In an area such as Bajo de Sico, where the bottom is irregular often with high relief, such fishing gear may become entangled on the bottom (in sponges as well as in hard and soft corals), increasing the potential for damaging the coral reef and other EFH elements.

In 2006, there were an estimated 955,123 recreational fishing trips of which 507,026 were at the shoreline, 16,823 on a charter boat, and 431,274 on private boat (PRDNER 2008b). The following year there were an estimated 1,080,096 recreational fishing trips of which 615,454 were at the shoreline, 10,734 on a charter boat, and 453,908 by private boat (PRDNER 2009).

Most fish caught by recreational fishers are caught in territorial waters. For example, in 2006 and 2007, about 81 percent and 63 percent of recreationally caught fish were caught in territorial waters, respectively. There was a significant increase in the number of fish caught inland from 2006 to 2007. In both years, more fish were caught in territorial waters in May and June than any other location and two-month period.

A significant percentage of the fish caught are released alive. For example, in 2006, 23 percent (195,245) of the 846,998 fish reported to be caught by recreational fishers, were released alive. Of the 140,801 fish caught in the U.S. Caribbean EEZ, about 21 percent of those fish were released alive. Similarly, about 23 percent of the fish caught in territorial waters were released alive and 49 percent of the catch in inland waters was released alive. In 2007, about 17 percent of the fish caught were not kept.

The 2006 MRFSS data suggest that the ratio of fish caught and released alive to fish caught varies substantially through the year. For example, most of the fish caught in the EEZ during the months of May and June of 2006 were released alive, while none of the 9,059 fish caught in September and October were.

According to Griffith et al. (2007), Puerto Rico's recreational fishers come from a broad span of occupations and classes, ranging from skilled professionals to unskilled laborers and the self-employed. Also, the marital status of recreational fishers does not vary significantly relative to that of all fishers; however, while 66 percent of the interviewed fishers were married, 45 percent of males and approximately 40 percent of females in Puerto Rico are married.

Charter boats are used for purposes beyond providing fishing services to anglers. Most of the licensed charter-boat captains interviewed by Griffith et al. (2007) had a "Six-Pack for Hire" license, which enabled them to use their vessels as water taxis. Such a license allows them to offer a range of services, such as sunset cruises, taking divers out to coral reefs, and taking sightseers to phosphorescent bays. Such a wide range of services reduces the adverse impact of slumps in the demand for charter fishing services to these businesses.

5.3.2.10.2 Recreational Snapper Unit 1 Fishery

Two species of SU1 are reported to be caught by recreational fishers: silk and blackfin snapper. Federal fishing regulation has prohibited recreational fishing for silk, black, vermilion, and blackfin snapper in federal waters from October 1 to December 31 of each year since November 28, 2005. Local regulations establishing a seasonal closure for silk and blackfin snapper was implemented in 2007, changing the regulations of size limits that were established in 2004. Nonetheless, surveyed recreational fishers reported catching and keeping 4,530 silk snapper and 453 blackfin snapper that were taken in the U.S. Caribbean EEZ in November/December of 2006 (*Puerto Rico Marine Recreational Fisheries Statistics Program for the period of January 1, 2006 to December 31, 2006*).

From 2000 to 2007, an annual average of 101,730 individuals of SU1 species was caught by recreational fishers (Table 5.3.28). Silk snapper represents a dominant majority of recreational landings. The second most harvested species within the sub-unit is vermilion snapper. Note that no black snapper have been harvested by recreational fishers since 2002.

In 2006, 131,781 silk snapper were landed by recreational fishers. The following year 136,546 were landed. None of the recreational catches of the species in 2006 and 33 of those caught in 2007 were caught by recreational fishers on a charter boat. At least 90 percent of these silk snapper are caught in territorial waters (90.4 percent in 2006 and 96.4 percent in 2007). Silk snapper are caught during tournament fishing. For example, in 2007, 707.4 kg of silk and queen snapper were caught and boarded by tournament fishers according to the Puerto Rico Marine Recreational Fisheries Statistics Program for the period of January 1, 2007 to December 31, 2007 (p. 11).

Table 5.3.28. Recreational landings (number of fish) of Snapper Unit 1 species.

Year	Silk	Blackfin	Black	Vermilion	Total
2000	82,611	9,267	2,598	25,007	119,484
2001	65,991	4,534	1,381	42,657	114,562
2002	28,168	1,439	0	7,980	37,586
2003	115,176	16,719	0	16,907	148,802
2004	47,390	2,361	0	3,229	52,981
2005	27,804	4,735	0	10,224	42,762
2006	131,781	453	0	453	132,687
2007	136,546	2,838	0	25,594	164,978
Total	***635,466***	***42,345***	***3,979***	***132,051***	***813,842***
Ave.	***79,433***	***5,293***	***497***	***16,506***	***101,730***

Table 5.3.29. Estimated recreational landings (number of fish) of Snapper Unit 1 species within snapper category and adjusted total recreational landings of SU1.

Year	Snapper Category	% Snapper Unit 1	Added Snapper Unit 1	Reported Total	Adjusted Total
2000	21,898	33.79%	7,400	119,484	126,884
2001	25,005	38.67%	9,669	114,562	124,231
2002	15,259	29.16%	4,450	37,586	42,036
2003	924	45.09%	417	148,802	149,218
2004	476	39.38%	187	52,981	53,168
2005	0	25.39%	0	42,762	42,762
2006	0	53.31%	0	132,687	132,687
2007	18,990	51.32%	9,746	164,978	174,724
Total	***82,551***		***31,869***	***813,842***	***845,711***
Ave.	***10,319***		***3,984***	***101,730***	***105,714***

Many recreational landings of snapper are placed within a broad category of "Snappers". From 2000 to 2007, 10,319 snapper were landed by recreational fishers in that broad

category, and some of these were species of SU1. Estimates of SU1 species that were landed in the generic category are added to the above figures to estimate the adjusted total recreational harvest of SU1 (Table 5.3.29). For example, in 2004, approximately 39 percent of 476 individuals landed as Snapper are added to the total reported SU1 landings of 52,981 individuals to yield an adjusted figure of 53,168 individuals.

5.3.2.10.3 Recreational Grouper Unit 4 Fishery

Grouper Unit 4 is composed of red, misty, tiger, yellowedge and yellowfin grouper. In 2006, the only reported recreational landings of a GU4 species were 557 yellowfin grouper, which were caught by fishers on a private boat in territorial waters during the months of January and February (*Puerto Rico Marine Recreational Fisheries Statistics Program (Grant F-42.6 Annual Report for the period of January 1, 2006 to December 31, 2006*). The following year, 352 red grouper were caught off Puerto Rico in the U.S. Caribbean EEZ and kept; these were the only species in the unit to be caught by recreational fishers surveyed that year (Table 5.3.30).

Table 5.3.30. Recreational landings (number of fish) of Grouper Unit 4.

Year	Red	Misty	Tiger	Yellowedge	Yellowfin	Total
2000	0	445	449	0	0	893
2001	0	0	0	0	250	250
2002	0	0	0	0	0	0
2003	0	0	0	234	935	1,168
2004	0	1,417	0	0	0	1,417
2005	155	0	0	0	0	155
2006	0	0	0	0	557	557
2007	352	0	0	0	0	352
Total	***506***	***1,861***	***449***	***234***	***1,742***	***4,792***
Ave.	***63***	***233***	***56***	***29***	***218***	***599***

It is estimated that recreational landings of GU4 species are also contained within the broad category of "Sea Basses". Estimates of the recreational GU4 landings within this broad category are provided in Table 5.3.31.

5.3.2.10.4 Recreational Grouper Unit 1 Fishery

Despite the ban on fishing for or possession of Nassau grouper in Puerto Rico since 2004, recreational fishers are reported to have caught and not released the species in 2006 and 2007. According to Tables 2 and 3 in the Appendix of PRDNER (2008b), none of the 1,771 individual Nassau grouper were released alive. All were caught on private boats during the months of July and August (Table 5.3.31). Note that more Nassau grouper were landed in 2007 than any other year before the ban.

DRAFT

Table 5.3.31. Estimated recreational landings (number of fish) of Grouper Unit 4 species within the "Sea Basses" category and adjusted total recreational landings of GU4.

Year	Sea Basses Category	% Grouper Unit 4	Added Grouper Unit 4	Total Reported	Adjusted Total
2000	2,085	0	25	893	918
2001	316	0	1	250	251
2002	1,025	0	0	0	0
2003	583	0	7	1,168	1,176
2004	238	0	3	1,417	1,419
2005	0	0	0	155	155
2006	0	0	0	557	557
2007	0	0	0	352	352
Total	***4,247***		***35***	***4,792***	***4,827***
Ave.	***531***		***4***	***599***	***603***

5.3.2.10.5 Recreational Parrotfish Fishery

With the exception of midnight parrotfish, all 10 parrotfish species within the Parrotfish FMU were recreationally landed from 2000 to 2007. On average, 3,344 individuals within the FMU species were landed annually from 2000 to 2007 (Table 5.3.32). Stoplight parrotfish ranked first in landings, followed by queen and redtail. Not one of the 1,856 princess parrotfish caught in 2006 was released alive, and all were caught in territorial seas. None of the parrotfish in 2006 or 2007 were caught by anglers on charter boats.

Many recreational landings of parrotfish are described as being in the parrotfish family. Other parrotfish landings are added to those identified as species within the Parrotfish FMU to estimate recreational parrotfish landings from 2000 to 2007 (Table 5.3.33).

Table 5.3.32. Recreational landings of Grouper Unit 1 (Nassau grouper), 2000-2007.

Year	Nassau
2000	472
2001	402
2002	0
2003	2,100
2004	472
2005	0
2006	1,771
2007	2,102
Total	***7,320***
Ave.	***915***

DRAFT

Table 5.3.33. Recreational landings (number of fish) of parrotfish, 2000-2007.

Year	Blue	Midnight	Princess	Queen	Rainbow	Striped
2000	1,904	0	2,533	1,930	662	0
2001	128	0	2,783	7,839	0	928
2002	0	0	0	1,240	0	0
2003	3,326	0	1,099	12,194	550	0
2004	0	0	0	0	0	0
2005	0	0	3,199	0	0	0
2006	0	0	1,856	0	0	0
2007	0	0	0	0	0	0
Total	***5,358***	***0***	***11,471***	***23,204***	***1,211***	***928***
Average	***670***	***0***	***1,434***	***2,900***	***151***	***116***

Year	Redband	Redtail	Stoplight	Redfin	Total	Other*	All
2000	0	772	0	1,598	9,399	544	9,943
2001	1,769	2,584	22,336	6,034	44,402	6,848	51,250
2002	0	3,187	719	1,277	6,424	11,115	17,538
2003	4,902	8,782	20,003	4,702	55,558	0	55,558
2004	324	877	439	0	1,640	0	1,640
2005	0	0	0	0	3,199	4,274	7,474
2006	0	0	0	0	1,856	0	1,856
2007	0	1,261	2,970	0	4,231	3,968	8,199
Total	***6,995***	***17,464***	***46,468***	***13,611***	***126,709***	***26,748***	***153,457***
Average	***874***	***2,183***	***5,808***	***1,701***	***15,839***	***3,344***	***19,182***

*: Other includes parrotfish family, emerald, and greenblotch.

5.3.2.10.6 Recreational Queen Conch Fishery

Queen conch is not presently included in the recreational survey. Nonetheless, there are estimates of queen conch recreational landings in Puerto Rico. For example, recreational landings of queen conch in Puerto Rico are estimated at 140,157 pounds in 2000 and 124,085 pounds in 2001 (SEDAR 2007: 54). In comparison to commercial landings for those years, annual recreational landings represented 28.5 percent of estimated actual commercial landings of queen conch in 2000 and 34.5 percent of commercial queen conch landings in 2001.

DRAFT

Table 5.3.34. Recreational Snapper Unit 2 landings (number of fish), 2000-2007.

Year	Queen	Wenchman Snapper	Total	Snapper Category	% Snapper Unit 2	Added Snapper Unit 2	Adjusted Total
2000	5,718	0	5,718	21,898	1.62%	354	7,194
2001	17,489	0	17,489	25,005	5.90%	1,476	18,618
2002	9,537	0	9,537	15,259	7.40%	1,129	9,555
2003	6,587	0	6,587	924	2.00%	18	6,597
2004	2,822	0	2,822	476	2.10%	10	2,822
2005	13,347	0	13,347	0	7.92%	0	13,347
2006	557	0	557	0	0.22%	0	960
2007	6,824	0	6,824	18,990	2.12%	403	10,215
Total	***62,881***	**0**	***62,881***	***82,551***		***3,391***	***69,308***
Average	***7,860***	**0**	***7,860***	***10,319***		***424***	***8,664***

5.3.2.10.7 Recreational Snapper Unit 2 Fishery

Queen snapper was the only SU2 species landed by recreational fishers from 2000 to 2007. There were no recreational landings of wenchman. On average 7,860 queen snapper were taken annually by recreational fishers during this time period. Most or all queen snapper are taken in territorial waters. In 2006, for example, all 557 queen snapper were taken in territorial waters by anglers in private boats.

It is reasonable to expect that the generic snapper category includes queen snapper. Estimates of queen snapper landings contained in the generic category are included in Table 5.3.34 to obtain an adjusted total.

5.3.2.10.8 Puerto Rico's Subsistence Fishery

The MSA does not define subsistence fishing, and there are varying definitions used by U.S. Government agencies. The Environmental Protection Agency (EPA), which is charged with providing advisories for contaminated fish in federal waters, defines subsistence fishers as those "who rely on noncommercially caught fish and shellfish as a major source of protein in their diets" (U.S. EPA 2000: 1-6). NOAA Fisheries Strategic Plan (http://www.nmfs.noaa.gov/om2/glossary.html) defines subsistence fishing as "fishing for personal consumption or traditional/ceremonial purposes." NOAA's definition does not limit subsistence fishing to fishing with the purpose of acquiring a major source of protein for personal consumption. For example, for the Pacific halibut fishery of Alaska, NMFS defines subsistence halibut as that "caught by a rural resident or a member of an Alaska Native tribe for direct personal or family consumption as food, sharing for personal or family consumption as food, or for customary trade", where a rural resident is defined by residence in specific communities and Alaskan Native requires membership in specific federally recognized tribes with treaty rights to halibut (Clay et al. 2007).

Commercial, recreational, and subsistence fishing are not so easily divided because a fisher may have multiple reasons for fishing. For examples, a recreational fisher may fish both for food that is a major source of protein for personal or household consumption and as a hobby and social activity; a commercial fisher may fish for both personal or household consumption and the income that derives from sales of a portion of the catch; and a crew member/helper of a commercial vessel may fish solely for a share of the catch that is a major food source for the helper and/or the household.

Ethnographic work in Puerto Rico demonstrates that it is rare for a commercial fisher in Puerto Rico to sell all of his or her catch (Griffith et al. 2007). Part of the catch is kept for home and community consumption. Of 256 commercial fishers interviewed by Griffith et al. (2007), about 74 percent reported using some fish for household consumption. Directing part of one's fishing effort to personal or household consumption is a way to supplement and/or substitute for protein purchased in the marketplace.

The 2008 survey of Puerto Rican commercial fishers found that about 12 percent of the interviewed east coast fishers stated that fishing did not contribute to their household income (Matos-Caraballo 2009), which suggests they fished for subsistence. Similarly, about 5 percent of those on the north coast and 3 percent of those on the south coast stated that none of their household income derived from fishing. However, less than 1 percent of the commercial fishers interviewed on the west coast reported that fishing did not contribute to their household income. One interpretation of these responses is that fishing by these commercial fishers, who do not derive any income from fishing, is exclusively for subsistence.

Griffith et al. (2007) found that there is a difference between recreational fishers who self-identify as fishing exclusively or primarily for food and those that report that all of their catch provides food to their household. Fourteen of 68 recreational fishers identified themselves as fishing exclusively or primarily for food, while 68 recreational fishers stated that all of their catch provides food to their household. However, it can be argued that all 68 fishers engage in subsistence fishing.

Approximately 40 percent of the 68 fishers targeted snapper-grouper species, as well as a few pelagic species (Griffith et al. 2007). Both dorado (also called dolphin), which is a good tasting fish and fun to catch, and sierra/carite (king mackerel) were caught by these fishers. None of these fishers stated that they harvest queen conch and only one reported landing lobster, which suggests subsistence fishing in Puerto Rico is a finfish, not shellfish, fishery. Most of the 68 recreational fishers, who are subsistence fishers, use hooks and lines and cane pole.

5.3.3 U.S. Virgin Islands Fisheries

5.3.3.1 Brief Overview of U.S. Virgin Islands Geography and Fishing Areas

The fishery of the USVI is politically and administratively separated into two districts, St. Thomas/St. John and St. Croix. St. Croix is separated from the Puerto Rico-Virgin Islands

platform by the deep Anegada Passage, and a narrow shelf surrounds the island of St. Croix. The shelf descends gradually allowing for reef along most of the shoreline. This leaves areas of the insular shelf both north and south of St. Thomas/St. John as part of the U.S. EEZ.

The concentration of the USVI population in low-lying coastal areas, the island's confined harbors, and its Caribbean location make it vulnerable to natural disasters, such as hurricanes, tropical storms, earthquakes, flooding, mudslides, landslides, tsunamis, and drought.

5.3.3.2 U.S. Virgin Islands Commercial Fishers

Since 1974, the USVI has required all commercial fishers to have a commercial fishing permit. Helpers are not required to have a commercial fishing permit; however, each commercial fisher must obtain a helper's permit for each helper used or employed (V.I.C., Title 12, Chapter 9A §312). The permitted commercial fisher must be onboard when the "helper" is fishing. Commercial fishers must have the number of helpers indicated on their permit. Although legally defined as helpers, these individuals are also fishers.

In August 2001, the Commissioner of the VIDPNR issued a moratorium on the issuance of commercial fishing licenses. Those individuals that were licensed up to 3 years before August 2001 were allowed to renew their commercial fishing licenses (Holt and Uwate 2004). In 2008, there were 383 licensed fishers: 223 on St. Croix and 160 on St. Thomas/St. John (Figure 5.3.15). These estimates do not include helpers.

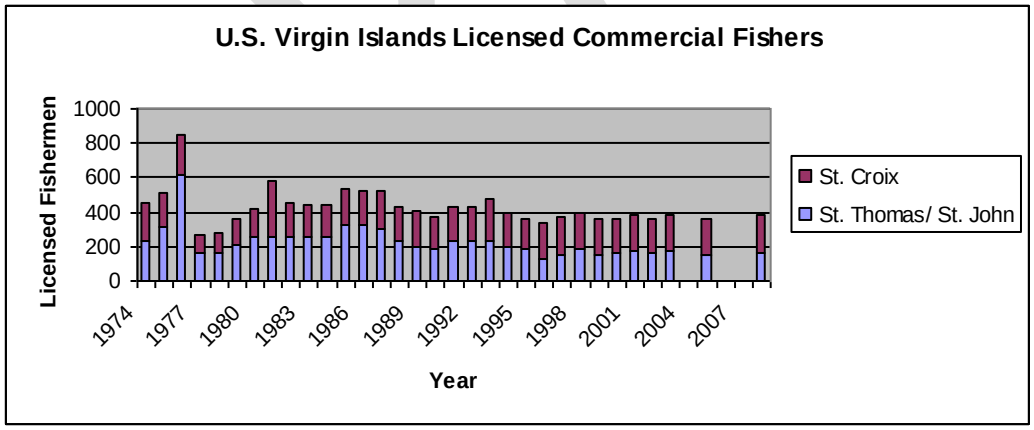


Figure 5.3.15. Number of USVI licensed commercial fishers. *Sources*: Holt and Uwate (2004) for estimates from 1974 to 2004, CFMC staff for 2005, 2008.

In 2003, a census was conducted of USVI commercial fishers. The following statistics are derived from that census. The average fisher in the St. Thomas/St. John District makes 2.6 fishing trips per week, each on average 8.3 hours long (with an average total of 21.6 hours per week). Similarly, the average St. Croix commercial fisher makes 3.3 trips per week, each of an average duration of 6.7 hours for an average weekly total of 22.1 hours (Kojis 2004). The range of the duration of trips varies substantially across districts.

While St. Croix commercial fishers report trips varying from one to 13 hours long, those in the St. Thomas/St. John District report trips varying from 2 to 60 hours long. According to Kojis (2004), none of the St. Croix fishers and only two of the St. Thomas/St. John fishers stated that they made overnight trips.

Two-thirds of commercial fishers in the USVI identified themselves as full-time fishers, devoting more than 36 hour per week to fishing and fishing-related activities, and one-third identified themselves as part-time (36 hours of less) or opportunistic fishers (Kojis 2004). None of the St. Croix commercial fishers identified themselves as charter-boat fishers, while almost one percent of those in St. Thomas/St. John did.

USVI commercial fishers spend hours selling fish and fixing their boats and gear. The average St. Thomas/St. John fisher devotes 8.1 hours to selling fish, 2.9 hours to boat repairs and maintenance, and 4.3 hours to repair gear each week. The average St. Croix fisher spends 6.6 hours selling fish, 3.3 hours fixing a boat, and 4.0 hours fixing gear each week (Kojis 2004). The ranges of hours for selling and fixing the boat and gear were greater in St. Croix than in St. Thomas/St. John, although the average number of hours spent selling fish was greater in St. Thomas/St. John than in St. Croix.

In 2003, none of the St. Thomas/St. John commercial fishers reported making seven trips per week, while 1.4 percent St. Croix fishers reported making seven trips per week (Kojis 2004). Of the St. Croix fishers, the most frequent rate of fishing is three trips per week, while more St. Thomas/St. John fishers make two trips per week than fishers who fish at any other rate. Stoffle et al. (2009) report that St. Croix commercial fishers, who said they fished full-time, stated that they fish roughly 53 percent of the days available for a month, while those that fished part-time fish approximately 40 percent of the days available for a month.

Commercial fishers in the USVI are, as of 2003, on average 50.5 years old, had fished almost 23 years, and planned to continue to fish for the rest of their lives. The average fisher from St. Thomas/St. John was 48.6 years old and had fished 24.8 years. The average fisher from St. Croix was 51 and had fished 21.7 years (Kojis 2004). The range in fishing experience was 2 to 67 years in St. Thomas/St. John and from 0 to 67 years in St. Croix. Almost half of the fishers in St. Thomas/St. John and about 42 percent of St. Croix fishers have 21 years or more of fishing experience.

Over half the commercial fishers in the USVI have not completed high school. The level of education of commercial fishers in St. Croix is significantly lower than in St. Thomas/St. John. More than half of the licensed commercial fishers in St. Croix have only completed elementary or junior high school.

More USVI commercial fishers are black than any other racial/ethnic group (Table 5.3.35). In St. Thomas/St. John, almost half of the commercial fishers have a French ethnic background, while in St. Croix, Hispanics (48.4 percent) and blacks (41.6 percent) represent 90 percent of the district's commercial fishers.

DRAFT

Table 5.3.35. Distribution of commercial fishers by ethnic group, 2003. *Source*: Kojis 2004.

Racial/Ethnic Group	Percent of Commercial Fishers (335 Respondents)		
	St. Thomas/St. John	St. Croix	U.S. Virgin Islands
French	49.1	0.0	16.7
Black French	6.1	0.0	2.1
White	8.8	7.7	8.1
Hispanic	3.5	48.4	33.1
Black	32.5	41.6	38.5
Black Hispanic	0.0	1.8	1.2
East Indian	0.0	0.5	0.3
Total	***100.0***	***100.0***	***100.0***

Most USVI commercial fishers do not fish alone. About 79 percent said they fish with helpers and about 17 percent with other commercial fishers. In St. Croix, 89 percent fish with helpers, and in St. Thomas/St. John, 59 percent have helpers (Kojis 2004). Some fishers vary if they fish alone or with others and if with others, who they fish with. If with others, they may be helpers or other commercial fishers.

Most USVI commercial fishers own one boat. In St. Croix, about 76 percent of the fishers own one boat, while about 60 percent of those in St. Thomas/St. John similarly own one boat. None of the fishers in St. Thomas/St. John own more than three boats, while 0.9 percent own four boats in St. Croix.

USVI commercial fishers tend not to derive all of their income from fishing. The average St. Thomas/St. John commercial fisher derives 74 percent of his/her income from fishing, while 60.2 percent of the average St. Croix fishers' annual income derives from fishing (Kojis 2004). Some of the commercial fishers stated that none of their income derives from fishing. This suggests these fishers may be participants in the subsistence fishery. Seventy-five percent of St. Thomas/St. John's commercial fishers (75 percent) obtain more than half of their income from fishing, while 54 percent of St. Croix commercial fishers are similarly reliant on fishing.

USVI fishers target reef fish more than any other category of fish. More St. Thomas/St. John fishers target reef fish (77.7 percent) than any other species group. The fewest target deepwater snapper (4.5 percent) (Table 5.3.36). The top ranked species group targeted by St. Croix fishers is reef fish (84.7 percent) followed by deepwater snapper (42.3 percent) and conch (39.1 percent).

USVI commercial fishers tend to target more than one category of fish. Of the eight categories of fish as shown in Table 5.3.36, about 70 percent of St. Thomas/St. John fishers and over 80 percent of St. Croix fishers-interviewed in 2003/04 and who responded to the question-target more than one species.

DRAFT

Table 5.3.36. Percent of USVI commercial fishers that target specific species. *Source*: Kojis 2004.

Targeted Species	Percent of Interviewed Commercial Fishers		
	St. Croix	St. Thomas/St. Croix	U.S. Virgin Islands
Reef Fish	84.7	77.7	82.3
Coastal Pelagic	37.2	53.6	42.8
Deep Pelagic	33.0	9.8	25.1
Deepwater Snapper	42.3	4.5	29.4
Bait Fish	14.4	29.5	19.6
Conch	39.1	8.9	28.7
Whelk	4.7	14.3	8.0
Lobster	40.5	35.7	38.8

Table 5.3.37. Percent of St. John commercial fishers by landing site, 2003. *Source*: Kojis 2004.

St. John Fishers' Landing Sites	Number of Fishers	Percent of Fishers
Cruz Bay	5	45.5%
Coral Bay	4	36.4%
St John	1	9.1%
Hansen Bay	1	9.1%
Trailered	1	9.1%
***Number of Respondents*[1]**	***11***	***109.2%***
Number of Responses	***12***	

1. Some fishers use more than one landing site.

About 82 percent of St. John commercial fishers land their catches at either Cruz Bay or Coral Bay (Table 5.3.37). No commercial fishers from St. John reported landing their catch outside the island. The top six landings sites in St. Thomas are Frenchtown, Hull Bay, Benner Bay, Seaside Inn at Benner Bay, Water Bay, and Krum Bay. Some St. Thomas commercial fishers land catch in St. John and Puerto Rico (Table 5.3.38).

St. Croix commercial fishers land their catch at 18 different sites on the island. In 2003, one of these fishers also landed fish on St. John (Table 5.3.39). The most popular landing sites in St. Croix are Altona Lagoon (aka Augusta Landing Site), Molasses Dock (aka Krauss Lagoon) and Frederiksted Fishers' Pier. Many St. Croix commercial fishers use multiple landing sites. Approximately 35 percent reported that they use two or more sites to land their catch.

DRAFT

Table 5.3.38. Number and percent of St. Thomas commercial fishers by landing site, 2003. *Source*: Kojis 2004.

St. Thomas Fishers' Landing Sites	Number of Fishers	Percent of Fishers
Frenchtown	31	33.0%
Hull Bay	15	16.0%
Benner Bay	8	8.5%
Seaside Inn, Benner Bay	7	7.4%
Water Bay	8	8.5%
Krum Bay	6	6.4%
Mandahl Pond	3	3.2%
Red Hook	3	3.2%
Coast Guard Dock	2	2.1%
Brewers Bay	2	2.1%
East Gregorie Channel	2	2.1%
Trailered	1	1.1%
Sapphire	1	1.1%
AYH	1	1.1%
Tropical Marine	1	1.1%
Fish Hawk Marina	1	1.1%
Piccola Marina Dock	1	1.1%
Coki Point	1	1.1%
Magens Bay	1	1.1%
Crown Bay Marina	1	1.1%
Cruz Bay, St. John	1	1.1%
Kill Bay, St. John	1	1.1%
Culebra, Puerto Rico	1	1.1%
Number of Respondents	***94***	***105.3%***
Number of Responses	***99***	

USVI commercial fishers use multiple methods to market their fish; however, the most popular methods are selling the fish whole, gutted or iced in a cooler. The top four methods used by St. Thomas/St John fishers include selling the fish whole, iced, gutted or scaled. Similarly, the top four methods used by St. Croix fishers include selling the fish whole, iced, cleaned, or gutted (Kojis 2004). Fishermen in the USVI generally market their product directly to the consumer or to restaurants (i.e., wholesale or quasi-retail), so it does not reflect a true ex-vessel value (CFMC 2005:379).

Many USVI commercial fishers sell their catch at their landing site. In St. Croix, 24 percent of the fishers sell their catches at the landing site, while 28 percent of those in St. Thomas/St. John similarly sell their catches (Kojis 2004). Significantly more St. Croix fishers (20 percent) bring their catch home than fishers in St. Thomas/St. John (5 percent). This suggests that significantly more St. Croix fishers than St. Thomas/St. John fishers may participate in the subsistence fishery.

DRAFT

Table 5.3.39. Landing sites of St. Croix commercial fishers, 2003. *Source*: Kojis 2004.

St. Croix Fishers' Landing Sites	Number of Fishers	Percent of Fishers
Altona Lagoon	75	37.5%
Molasses Pier	71	35.5%
Frederiksted Fishers' Pier	62	31.0%
Gallows Bay	17	8.5%
Castle Nugent	11	5.5%
Salt River Bay	11	5.5%
Christiansted	9	4.5%
Teague Bay	6	3.0%
Green Cay Marina	4	2.0%
Solitude	4	2.0%
Turner Hole	3	1.5%
Duggans Reef	2	1.0%
Great Pond	2	1.0%
All Landing Sites	1	0.5%
Cane Bay	1	0.5%
Carlton Beach	1	0.5%
Chabert Beach	1	0.5%
Halfpenny Bay	1	0.5%
St. Croix Marine	1	0.5%
St. John	1	0.5%
St. Croix	1	0.5%
***Number of Respondents*[1]**	***200***	***142.5%***
Number of Responses	***285***	

1. Some fishers land their catches at multiple sites.

St. Croix commercial fishers trailer their boats. They do so to have the flexibility to react to weather conditions and to make on-the-spot determinations about the types of species to target, the specific areas to fish, and the gear strategy to employ (Stoffle et al. 2009). Furthermore, it may give them other advantages, such as being able to more cheaply store/dock, repair, and protect their boats. Plus, it gives the fishers the ability to move their boats to areas closer to where they live (Figure 5.3.16).

DRAFT

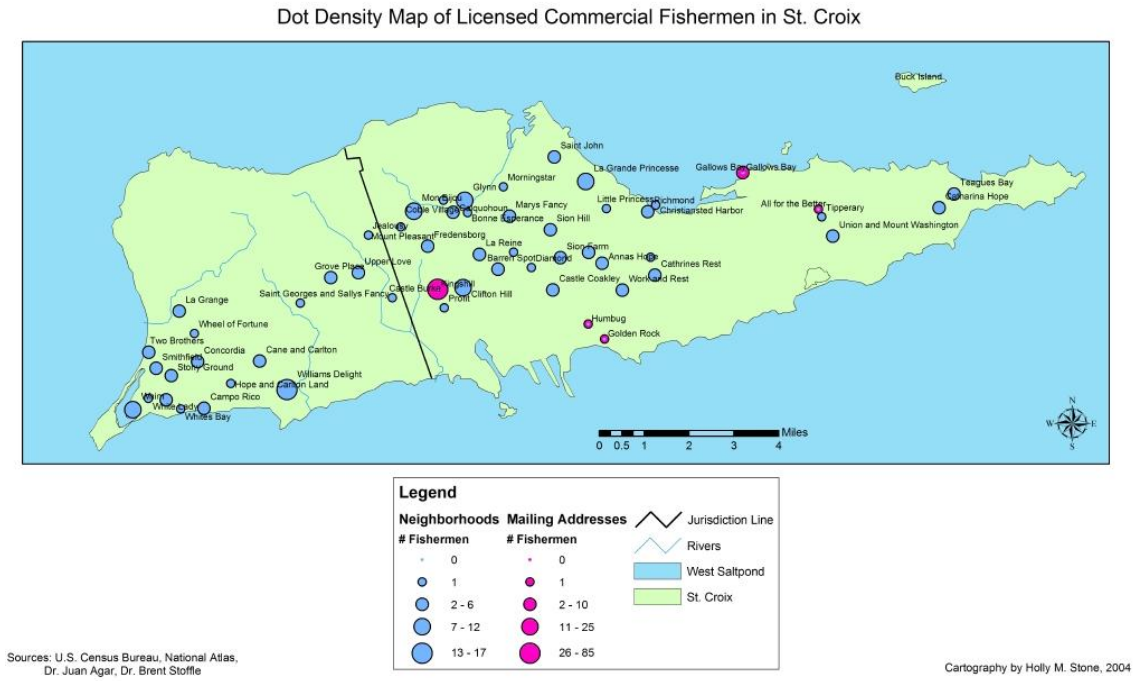


Figure 5.3.16. Dot density map of licensed commercial fishers in St. Croix. *Source*: Stoffle 2007.

5.3.3.3 U.S. Virgin Islands Commercial Fishing Fleet

In 2003, there were 360 registered boats owned by commercial fishers in the USVI; 135 in St. Thomas/St. John and 225 in St. Croix (Kojis 2004). About 94 percent of commercial fishers in St. Thomas/St. John and 94 percent in St. Croix own or co-own a fishing vessel.

Most USVI commercial fishers who were interviewed owned one boat; however, 6 percent of those on St. Thomas/St. John and 1.9 percent on St. Croix owned 3 vessels (Kojis 2004). One percent of fishers in St. Croix owned 4 vessels, while there were no fishers in St. Thomas/St. John with more than 3 vessels.

About 73 percent of St. Thomas/St. John and 93 percent of St. Croix commercial fishing boats are powered by an outboard motor, and of those with an outboard, most have one outboard engine under 76 horsepower. At least 55 percent of the vessels with an outboard motor have no more than 75 horsepower. Fishers normally use small fiberglass boats under 24 feet in length, and have motors that are generally no larger than 100 horsepower.

The primary fuel used is gasoline. About 83 percent of fishing boats in St. Thomas/St. John with an outboard engine are fueled by gasoline, while 65.7 percent of similar fishing vessels in St. Croix run on gasoline (Kojis 2004).

Most USVI commercial fishing vessels are no more than 25 feet long. Approximately, 91 percent of the fishing vessels of St. Croix, and approximately 74 of the fishing vessels of St. Thomas/St. John are 25-feet long or less.

5.3.3.4 Gears Used

According to Kojis (2004), there are distinct differences in the gears used in each district. St. Thomas/St. John fishers commonly use fish traps, modified lobster traps, and plastic lobster traps to target fish and lobster, and to a lesser extent vertical setlines, gill and trammel nets, and SCUBA. In St. Croix, instead of commonly using traps, fishers diversify into other gears such as multi-hook vertical setlines, gill and trammel nets, and SCUBA. Hand lines and rods and reels are also used. Presently, the use of all gill and trammel nets (single or multiple wall entanglement) are prohibited, with the exception of single-wall surface gillnets for the baitfish ballyhoo, gar, and flying fish (V.I.C., Title 12, Chapter 9A, §321-1). Surface gillnets must be tended at all times, may not be more than 1,800 feet long as measured by the float line, and may not be used within 20 feet from the bottom.

Nets have tended to be the dominant gear to target reef fish in St. Croix. The differences in commonly used gear reflect the differences in the insular shelf breaks. While the insular shelf break occurs in waters approximately 100 to 130 feet deep off St. Thomas, it occurs in waters approximately 60 feet deep off St. Croix.

Net fishing is a fairly new technique in the USVI that began in the 1990s as a result of declining catch rates of traps and other gear types during a prolonged economic recession on St. Croix. After Florida's net ban in 1994, gear suppliers, especially gill net producers, began promoting their equipment in the USVI (Rothenberger et al. 2008), and net fishing eventually accounted for a greater proportion of annual landings on St. Croix than traditional fishing gear (Toller and Tobias 2005). The use of gill and trammel nets was banned in July 2006; however, the ban was met with resistance by parrotfish and other species fishers who used one or both nets and continued to use the nets because the ban was not enforced:
(http://www.virginislandsdailynews.com/index.pl/article_home?id=17622664).
Enforcement of the ban did not begin until April 2008.

SCUBA diving has increased as a means of harvesting queen conch, and divers have been going into deeper waters to harvest conch. In 2007, the VIDPNR began seeing divers off St. Croix having serious decompression sickness as they ventured into these deeper waters (Associated Press, July 27, 2007).

Seine net fishing in St. Thomas is carried out by fishers of primarily French descent (MRAG Americas, Inc. 2006). These fishers track schools of fish and observe feeding patterns to surround the schools with nylon nets that they close by free diving in shallow waters from 15 to 40 feet deep (STFA 2008). Approximately 49 percent of the commercial fishers interviewed in 2003 identified themselves as French and 6 percent as Black French (Kojis 2004).

5.3.3.5 Combined Commercial Landings & Per-Capita Fish/Shellfish Consumption

During a 32–year period, commercial landings increased significantly, from 273,207 pounds in 1976 to over 2 million pounds in 2006, then fell to approximately 1.6 million pounds in 2007 (Table 5.3.40). Note that there is no adjustment factor applied to these landings. Reported landings and actual landings are presumed to be the same.

Table 5.3.40. Commercial landings (pounds) in the USVI, 1974-2007.

YEAR	Total Commercial Landings				
	St. Croix (SX)	St. Thomas/ St. John (ST/SJ)	USVI	Percent SX	Percent ST/SJ
1974		57,746			
1975		265,512			
1976	48,576	224,631	273,207	17.8%	82.2%
1977	66,511	253,010	319,521	20.8%	79.2%
1978	77,859	458,818	536,678	14.5%	85.5%
1979	78,419	477,641	556,060	14.1%	85.9%
1980	53,454	531,214	584,668	9.1%	90.9%
1981	109,993	518,385	628,377	17.5%	82.5%
1982	170,358	477,581	647,939	26.3%	73.7%
1983	245,306	570,492	815,798	30.1%	69.9%
1984	317,770	606,540	924,311	34.4%	65.6%
1985	192,998	618,118	811,115	23.8%	76.2%
1986	231,027	578,305	809,332	28.5%	71.5%
1987	414,620	539,376	953,997	43.5%	56.5%
1988	403,713	653,297	1,057,010	38.2%	61.8%
1989	289,453	593,318	882,771	32.8%	67.2%
1990	402,243	519,983	922,226	43.6%	56.4%
1991	570,221	587,562	1,157,783	49.3%	50.7%
1992	529,364	721,338	1,250,702	42.3%	57.7%
1993	641,162	784,441	1,425,603	45.0%	55.0%
1994	627,491	716,326	1,343,817	46.7%	53.3%
1995	485,215	662,656	1,147,871	42.3%	57.7%
1996	496,558	629,494	1,126,052	44.1%	55.9%
1997	660,188	732,043	1,392,230	47.4%	52.6%
1998	660,857	611,591	1,272,448	51.9%	48.1%
1999	683,516	599,488	1,283,004	53.3%	46.7%
2000	808,599	619,766	1,428,365	56.6%	43.4%
2001	1,005,010	755,323	1,760,333	57.1%	42.9%
2002	1,112,067	819,407	1,931,474	57.6%	42.4%
2003	992,460	813,652	1,806,112	55.0%	45.0%
2004	1,033,448	810,774	1,844,222	56.0%	44.0%
2005	1,149,330	741,897	1,891,227	60.8%	39.2%
2006	1,257,662	788,216	2,045,878	61.5%	38.5%
2007	877,589	716,110	1,593,699	55.1%	44.9%

DRAFT

The decline in landings in 2007 is most likely attributable to federal and state regulatory actions since 2005. Federal regulatory actions implemented since the 2005 Comprehensive SFA Amendment and by the USVI government in 2006 undoubtedly have resulted in reduced commercial landings of all species and reef fish in the territory, and especially St. Croix.

The share of USVI landings by each district has similarly changed significantly. While St. Thomas/St. John accounted for approximately 82 percent of the territory's landings in 1976, by 2006, those islands accounted for approximately 39 percent of combined landings. In 2007, St. Thomas/St. John's share of the territory's landings rose to approximately 45 percent.

The annual per capita consumption of fish and shellfish for human food is higher in the USVI than in Puerto Rico. During the three-year period from 2003 to 2005, it averaged 29.6 pounds, as opposed to 94.9 pounds in Antigua, 53.4 pounds in the U.S., 22.3 pounds in the Dominican Republic, and 1.8 pounds in Puerto Rico.

5.3.3.6 FMUs Directly Affected by Proposed Actions

5.3.3.6.1 Snapper Unit 1 Commercial Fishery

The USVI requires SU1 commercial fishers to report their landings; however, these landings are placed within the broader category of "snapper". Hence, commercial landings of silk, black, vermilion, and blackfin snapper are not differentiated from other snapper landings in the following summary table of snapper landings.

More snapper tend to be landed in St. Thomas/St. John (Table 5.3.41). During the period from 2000 to 2007, an average of 55 percent of the territory's annual commercial landings of snapper occurred in St. Thomas/St. John; however, in 2002, more snapper were landed in St. Croix and in 2005, landings were almost equally split between the two districts.

Table 5.3.41. Commercial landings of snapper and all species, 1998-2007.

	SX Commercial Landings			ST/SJ Commercial Landings			USVI Commercial Landings		
Year	**Snapper**	**All**	**Percent Snapper**	**Snapper**	**All**	**Percent Snapper**	**Snapper**	**All**	**Percent Snapper**
1998	60,654	660,857	9.2%						
1999	64,106	683,516	9.4%						
2000	80,817	808,599	10.0%	150,313	619,766	24.3%	231,130	1,428,365	16.2%
2001	124,056	1,005,010	12.3%	175,338	755,323	23.2%	299,394	1,760,333	17.0%
2002	169,748	1,112,067	15.3%	167,232	819,407	20.4%	336,980	1,931,474	17.4%
2003	133,652	992,460	13.5%	160,223	813,652	19.7%	293,874	1,806,112	16.3%
2004	125,127	1,033,448	12.1%	140,863	810,774	17.4%	265,990	1,844,222	14.4%
2005	150,288	1,149,330	13.1%	150,415	741,897	20.3%	300,702	1,891,227	15.9%
2006	143,828	1,257,662	11.4%	175,097	788,216	22.2%	318,925	2,045,878	15.6%
2007	117,344	877,589	13.4%	157,365	716,110	22.0%	274,709	1,593,699	17.2%
Average	***116,962***	***958,054***	***12.0%***	***159,606***	***758,143***	***21.2%***	***276,568***	***1,716,197***	***16.1%***

USVI fishers are not required to report the dollar values of their landings. Hence, the dollar value of snapper landings is estimated by multiplying the above reported landings by an estimated average annual price of that species category. Actual prices during the period from 1998 to 2007 are taken from Bennett (2007) and missing prices during the same period are estimated assuming a 2-period moving average.

The estimated ex-vessel revenues from snapper landings in St. Croix from 1998 to 2007 varied from a low of $242,616 in 1998 to a high of $791,055 in 2006 (Table 5.3.42). Ex-vessel revenues from snapper landings in St. Thomas/St. John from 2000 to 2007 varied from a low of $572,693 in 2000 to a high of $805,444 in 2006. Collectively, the value of snapper landings in the USVI ranged from approximately $0.9 million to $1.6 million during the 8-year period from 2000 to 2007.

Most landings of snapper in St. Croix and in St. Thomas/St. John are harvested by line fishing. From 1998 to 2007, line fishing accounted for an average of 66 percent of the pounds of snapper landed annually in St. Croix and approximately 49 percent in St. Thomas/St. John. When combined with other gear, line fishing accounted for 67.3 percent of all snapper landed in St. Croix and approximately 50 percent in St. Thomas/St. John. Traps were second in both districts, while diving ranked third in terms of landings of snapper in St. Croix and seine net ranked third in St. Thomas/St. John.

Table 5.3.42. Estimated ex-vessel revenue (dollars) from snapper landings (pounds) in the USVI, 1998-2007.

	SX Commercial Landings			ST/SJ Commercial Landings			USVI Commercial Landings	
Year	**Snapper Landings**	**Ave. Price per Pound**	**Total Revenue**	**Snapper Landings**	**Ave. Price per Pound**	**Total Revenue**	**Snapper Landings**	**Total Revenue**
1998	60,654	4.00	242,616					
1999	64,106	4.00	256,424					
2000	80,817	4.06	328,216	150,313	3.81	572,693	231,130	900,909
2001	124,056	4.12	511,421	175,338	3.72	651,382	299,394	1,162,803
2002	169,748	4.18	710,182	167,232	3.62	605,381	336,980	1,315,563
2003	133,652	4.25	567,352	160,223	4.21	674,538	293,874	1,241,889
2004	125,127	4.35	543,677	140,863	4.46	628,599	265,990	1,172,276
2005	150,288	5.00	751,438	150,415	4.16	626,102	300,702	1,377,540
2006	143,828	5.50	791,055	175,097	4.60	805,444	318,925	1,596,499
2007	117,344	6.00	704,066	157,365	5.00	786,823	274,709	1,490,888

5.3.3.6.2 Grouper Unit 4 Commercial Fishery

The USVI requires Grouper Unit 4 commercial fishers to report their landings; however, these landings are placed within the broader category of "grouper". Hence, commercial landings of red, misty, tiger, yellowedge, and yellowfin grouper are not differentiated from other grouper landings in the following summary table of grouper landings.

More grouper are landed in St. Thomas/St. John than St. Croix (Table 5.3.43). From 2000 to 2007, an average of 63 percent of annual territorial landings of grouper occurred in St. Thomas/St. John. From 1998 to 2007, an average of 32,580 pounds of grouper were landed in St. Croix, while from 2000 to 2007, an average of 59,970 pounds were landed in St. Thomas/St. John.

Estimated total ex-vessel revenue from landings of grouper species in St. Croix grew substantially during the 10-year period from 1998 to 2007. They also rose in St. Thomas/St. John. Combined, the ex-vessel revenues from landings of grouper species ranged from almost $300,000 to over $0.5 million.

Most grouper are harvested by commercial fishers using traps. In St. Thomas/St. John, approximately 95 percent of annual commercial landings of grouper are taken by traps and line fishing: 79 percent by traps and 16 percent by line. St Thomas/St. John commercial fishers also use traps in combination with line fishing or diving, seine net, diving with castnet, and diving without added gear, to take grouper.

St. Croix commercial fishers harvest more grouper by line fishing and diving than by using traps. Diving accounts for an average of approximately 40 percent of annual commercial landings of grouper, and line fishing accounts for the same percent. Traps rank a distant third.

Table 5.3.43. Estimated ex-vessel revenue (dollars) from grouper landings (pounds), 1998-2007.

	St. Croix (SX)			St. Thomas/St. John (ST/SJ)			USVI	
Year	**Grouper Landings**	**Ave. Price per Pound**	**Total Revenue**	**Grouper Landings**	**Ave. Price per Pound**	**Total Revenue**	**Grouper Landings**	**Total Revenue**
1998	18,204	4.00	72,814					
1999	20,573	4.20	86,405					
2000	23,807	4.40	104,749	49,282	3.96	195,155	73,088	299,904
2001	29,763	4.60	136,908	54,275	3.94	213,843	84,037	350,751
2002	44,291	4.80	212,596	55,196	3.92	216,370	99,487	428,965
2003	45,883	4.40	201,885	65,332	4.36	284,847	111,215	486,733
2004	46,776	4.50	210,490	75,730	4.53	342,676	122,505	553,166
2005	39,551	5.00	197,755	66,321	4.21	279,112	105,872	476,867
2006	33,188	5.50	182,533	60,351	4.73	285,669	93,538	468,202
2007	23,762	6.00	142,572	53,274	5.30	282,351	77,036	424,923

5.3.3.6.3 Grouper Unit 1 Commercial Fishery

Grouper Unit 1 is composed of Nassau grouper (*Epinephelus striatus*). The Nassau grouper fishery is closed in both territorial and federal waters of the USVI (FishWatch-U.S. Seafood Facts). Since 1990, no person may fish for or possess Nassau grouper in or from the U.S. Caribbean EEZ (50 CFR 622.32(b)(1)(ii)), and no person can fish for or

possess the species in the USVI (Virgin Islands Code, Title 12, Chapter 2, §104). Hence, none of the commercial landings of grouper species are expected to include Nassau grouper. Aggregations of Nassau grouper have been reported off St. Thomas and St. Croix (Sadovy and Eklund 1999).

5.3.3.6.4 Parrotfish Commercial Fishery

Parrotfish have been abundant on the reefs of the USVI, and in some areas they are a preferred food fish (CFMC 1985). There has been a general increase in commercial landings of parrotfish in both St. Croix and St. Thomas/St. John from 2000 to 2007 (Table 5.5.44). During these 8 years, St. Croix's landings accounted for approximately 87 percent of the territory's annual landings of the species, on average. In St. Thomas and St. John, parrotfish are called goo-too, and in St. Croix, they are called bluefish. Female stoplight parrotfish are called redbelly bluefish or Buck Island soldier, and male stoplight parrotfish are called green bluefish.

Parrotfish landings represent a substantial portion of St. Croix's annual commercial landings of all species. During the 10-year period from 1998 to 2007, an average of approximately 31 percent of St. Croix's annual commercial landings derived from parrotfish landings. Parrotfish landings are not so substantial in St. Thomas/St. John; they make up an average of approximately 6 percent of thsee island's annual commercial landings of all species.

Table 5.3.44. Commercial landings of parrotfish (pounds) and percent of all landings, 1998-2007.

	SX			ST/SJ		
Year	**Parrotfish Landings**	**All Landings**	**Percent Parrotfish**	**Parrotfish Landings**	**All Landings**	**Percent Parrotfish**
1998	213,459	660,857	32.3%			
1999	235,861	683,516	34.5%			
2000	260,474	808,599	32.2%	35,273	619,766	5.7%
2001	290,499	1,005,010	28.9%	50,260	755,323	6.7%
2002	307,591	1,112,067	27.7%	45,855	819,407	5.6%
2003	262,473	992,460	26.4%	52,854	813,652	6.5%
2004	319,250	1,033,448	30.9%	58,548	810,774	7.2%
2005	376,389	1,149,330	32.7%	50,305	741,897	6.8%
2006	416,074	1,257,662	33.1%	44,237	788,216	5.6%
2007	306,420	877,589	34.9%	40,819	716,110	5.7%
Average	***298,849***	***958,054***	***31.4%***	***47,269***	***758,143***	***6.2%***

The estimated average nominal price per pound of parrotfish ranged from $3.00 to $3.58 per pound from 1998 to 2007 in St. Croix and from $3.13 to $4.2 in St. Thomas/St. John from 2000 to 2007. The majority of ex-vessel revenues from landings of parrotfish in the USVI are attributable to landings in St. Croix. From 2000 to 2007, St. Croix parrotfish landings accounted for an average of 86 percent of the territory's ex-vessel revenues from

landings of parrotfish. Ex-vessel revenues from landings of parrotfish ranged from $747,106 to almost $1.5 million in St. Croix during the period from 1998 to 2007, while ex-vessel revenues in St. Thomas/St. John ranged from $119,046 to $202,840 (Table 5.3.45).

Table 5.3.45. Ex-vessel revenues (dollars) from landings (pounds) of parrotfish in the USVI, 1998-2007.

	SX			ST/SJ			USVI	
Year	**Parrotfish Landings**	**Ave. Price per Pound**	**Total Revenue**	**Parrotfish Landings**	**Ave. Price per Pound**	**Total Revenue**	**Parrotfish Landings**	**Total Revenue**
1998	213,459	3.50	747,106					
1999	235,861	3.38	797,210					
2000	260,474	3.28	854,354	35,273	3.38	119,046	295,747	973,400
2001	290,499	3.13	909,260	50,260	3.31	166,487	340,759	1,075,747
2002	307,591	3.00	922,772	45,855	3.25	149,029	353,446	1,071,801
2003	262,473	3.17	832,039	52,854	3.13	165,169	315,327	997,207
2004	319,250	3.27	1,043,948	58,548	3.46	202,840	377,798	1,246,787
2005	376,389	3.18	1,196,917	50,305	3.96	199,435	426,694	1,396,352
2006	416,074	3.58	1,489,545	44,237	4.10	181,373	460,311	1,670,918
2007	306,420	4.00	1,225,680	40,819	4.20	171,441	347,239	1,397,121

Diving has become an increasingly common method to harvest parrotfish in St. Croix. More than half of the species were harvested by diving in 2006 and 2007. Similarly, nets are commonly used to take the species in St. Croix. For example, in 2007, net gear, alone and in combination with other gear, was used to harvest approximately 45 percent of that year's annual landings of parrotfish. Gear used to harvest parrotfish has changed with time. After 1994, the use of gill and trammel nets increased as fishers switched from pots to the nets. The use of these nets in St. Croix to take parrotfish and other species was banned in July 2006; however, the ban was met with resistance by parrotfish and other species fishers who used one or both nets and continued to use the nets because the ban was not enforced:
(http://www.virginislandsdailynews.com/index.pl/article_home?id=17622664).
Enforcement of the ban did not begin until April 2008. Hence, landings of parrotfish by gear in St. Croix prior to 2008 do not reflect that enforcement.

From 1999 to 2007, the use of gill nets accounted for an average of approximately 31 percent of annual commercial parrotfish landings (pounds) in St. Croix, but in 2007, gill nets accounted for six percent of those landings. Trammel nets, used alone or in combination with other nets, accounted for an increasing percent of commercial landings in St. Croix after 2002, rising to approximately 16 percent in 2007. It is not yet known to what extent annual landings of parrotfish may have declined, if at all, since the enforcement of the net ban began in April 2008. However, that information will become available as 2008 and later landings data are processed, validated, and distributed. St. Croix commercial parrotfish fishers also dive and use seine nets to take significant

percentages of the annual landings of the species, and any fishers, who used the nets prior to the ban and its enforcement, may have shifted to seine net, traps or other allowed gear. In 2007, for example, there was a ten percent increase in landings attributed to the use of seine nets and an approximately 18 percent decrease in landings attributed to gill nets (Table 5.3.46).

Table 5.3.46. Percent of St. Croix and St. Thomas/St. John annual commercial parrotfish landings (pounds) that involved use of gill or trammel nets alone or with other gear.

	Percent SX Parrotfish Landings				Percent ST/SJ Parrotfish Landings		
Year	**Gillnet**	**Trammel net**		**Year**	**Gillnet**	**Trammel net**	
1999	37.59%	0.00%					
2000	30.20%	0.00%		2000	0.00%	0.00%	
2001	34.08%	0.00%		2001	0.00%	0.00%	
2002	34.55%	0.00%		2002	0.00%	0.00%	
2003	35.02%	5.31%		2003	0.12%	0.00%	
2004	32.83%	4.94%		2004	0.00%	0.00%	
2005	25.56%	6.45%		2005	0.00%	0.00%	
2006	23.72%	8.55%		2006	0.00%	0.69%	
2007	6.00%	15.63%		2007	0.00%	0.00%	

The large majority of parrotfish harvested in St. Thomas/St. John are caught in traps. From 2000 to 2007, an average of approximately 95 percent of the district's annual parrotfish landings was attributable to traps used alone and in combination with line fishing and diving. Diving, alone and in combination with other gears, accounts for approximately four percent of St. Thomas/St. John's annual landings of parrotfish, which differs significantly from diving's contribution to annual parrotfish landings in St. Croix, which is approximately 41 percent.

5.3.3.6.5. Queen Conch Commercial Fishery

Prior to 2000, landings of queen conch were placed in the broader category of conch, whelk, and other mollusks in St. Thomas/St. John, and similarly queen conch was included in the broader category in St. Croix prior to 1998. Landings of conch, whelk, and other mollusks in the territory increased significantly from 1976 to 1997, rising from 802 pounds in 1976 to 52,594 pounds in 1997. The greatest increase occurred in St. Croix with landings rising from 657 pounds to 47,478 pounds over that period.

Commercial landings of queen conch rose significantly in St. Croix from 2000 to 2006, increasing approximately 288 percent during that time. Similarly, conch landings in St. Thomas/St. John also increased during that six-year period, rising approximately 368 percent; however, landing on both island groups significantly declined in 2007 (Table 5.3.47). From 2000 to 2007, landings of queen conch in St. Croix represented, on average, approximately 99 percent of the territory's landings of the species. The average nominal price tends to be higher in St.Thomas/St. John than in St. Croix.

Conch landings represented, on average, approximately 12 percent of all species landed, in pounds, in St. Croix and approximately 0.2 percent of those landed in St. Thomas/St. John during the years from 2000 to 2007.

Table 5.3.47. Estimated ex-vessel revenues (dollars) from conch landings (pounds) in the USVI, 2000-2007.

	SX			ST/SJ			USVI	
Year	**Conch Landings**	**Ave. Price per Pound**	**Total Revenue**	**Conch Lnadings**	**Ave. Price per Pound**	**Total Revenue**	**Conch Landings**	**Total Revenue**
2000	76,999	4.70	361,893	1,083	5.00	5,415	78,082	367,308
2001	113,444	4.55	516,168	1,847	5.00	9,236	115,291	525,404
2002	116,492	4.40	512,565	2,172	5.00	10,860	118,664	523,425
2003	108,174	4.95	535,459	3,339	5.10	17,029	111,513	552,488
2004	125,258	5.15	645,079	1,022	5.85	5,979	126,280	651,057
2005	161,452	4.90	791,112	429	6.05	2,595	161,881	793,708
2006	221,966	5.50	1,220,813	3,989	5.80	23,136	225,955	1,243,949
2007	76,086	6.00	456,516	1,124	6.00	6,744	77,210	463,260
Average	***124,984***	***5.02***	***629,951***	***1,876***	***5.48***	***10,124***	***126,859***	***640,075***

Estimated ex-vessel revenues from conch landings ranged from under $400,000 to over $1.2 million during the period from 2000 to 2007 in the USVI (Table 5.3.47). Ex-vessel revenues from conch landings in St. Croix dominate those in St. Thomas/St. John.

According to an article in the July 30, 2007 issue of the St. Thomas Source (Lohr 2007), over-harvest has been attributed to the export of conch from St. Croix to Puerto Rico. St. Croix queen conch fishers have benefited from higher, and sometimes substantially higher, prices they receive by exporting conch to Puerto Rico's west coast (Lohr 2007).

The queen conch fishery around St. Croix is artisanal. Most commercial vessels are outboard powered, fiberglass constructed, and less than 26 feet in length (Kojis 2004). In St. Croix, approximately 97 percent of the conch annually landed (pounds) is taken by diving with and without additional gear.

Diving also ranks first in terms of commercial conch landings in St. Thomas/St. John. Queen conch tend to be an incidental catch for St. Thomas/St. John fishers (Valle-Esquivel 2003).

In July 2008, a 50,000-pound annual quota took effect in both St. Croix and St. Thomas/St. John. Within each island group, the queen conch fishery closes when the 50,000-pound limit is met and the season remains closed until November 1. On April 7, 2009, the VIDPNR announced that the St. Croix season would close April 30, 2009, and remain closed until November 1, 2009, because conch landings had exceeded the annual limit of 50,000 pounds (Virgin Islands Daily News, April 8, 2009). According to the

DRAFT

VIDPNR, much of the over-harvest of conch has been attributed to the export of conch from St. Croix to Puerto Rico.

All queen conch must be landed and reported in the island group from which they are harvested. Throughout the USVI, there is a size limit of nine inches (229 mm) shell length or a lip of 3/8 inches (9 mm). Since April 1994, queen conch must be landed whole in the shell and live (subchapter 316-4) and harvest or sale of undersized conch is prohibited. There is presently a commercial harvest quota of 150 conch per person per day.

The requirement to land conch in the shell created extensive controversy on St. Croix as conch shells piled up at landing sites and on beaches (Gordon 2002). According to Gordon (2002), the landed-in-the-shell requirement was considered the only way to effectively enforce size restrictions; however, because of the controversy and lack of enforcement, regulations have often been ignored, particularly on St. Croix where the conch fishery is larger by comparison to the conch fishery in St. Thomas/St. John (Valle-Esquivel 2003, Gordon 2002).

All conch fishing trips are made on a daily basis, and the fishers return to sell their catch by early afternoon in five-pound plastic bags of cleaned conch (Valle-Equivel 2003, Rivera 1999). In 1999, the price of such a bag was $20; however, the price tends to vary from $4 to $5 per pound (CFMC 2001). On average, conch fishers make 3.2 trips per week and have two fishers on board (Valle-Esquivel 2003). Most conch are harvested in waters from 17 to 79 feet deep; however, most commercial fishers that target conch use SCUBA gear at depths greater than 120 feet (CMFC 2001).

Rosario (1995) identified 25 fishers in the commercial conch fishery from St. Croix in 1995. In 1999, there were 16 full-time and 12 part-time conch fishers in St. Croix and 23 part-time conch fishers in St. Thomas/St. John (Rivera 1999). Kojis (2004) reported that 215 commercial fishers were registered in St. Croix during the fishing year of July 2003 to June 2004, and 84 fishers (39.1 percent) reported harvesting conch. Assuming the 84 conch fishers were the number that harvested conch in the calendar year of 2003, there was a 200 percent increase in the number of conch fishers from 1999 to 2003. Rivera (1999) reported that two of the 28 conch fishers in St. Croix harvested conch from the Caribbean EEZ.

St. Croix queen conch fishers did not fish exclusively for conch. According to Valle-Esquivel (2003), a large majority of conch fishers in St. Croix target lobster and a relatively small percent target octopus as well. Other species harvested by conch fishers are reef fish and coastal pelagic species.

5.3.3.7 U.S. Virgin Islands Recreational Fisheries

Recreational fishing is a popular past time in the USVI (Jennings 1992, Eastern Caribbean Center 2002, Toller et al. 2005). In 1999, an estimated 11 percent of USVI residents

participated in recreational fishing (Mateo 1999), and in the 1990s, $25 million was added to the USVI economy annually from recreational fishing (Hinkey et al. 1994).

In St. Croix, most recreational fishing activities take place on the shoreline, whereas in St. Thomas and St. John most recreational fishermen use boats. The number of shore- and boat-based fishers was estimated to be approximately 11,000 in 2000, and of those fishers, approximately 2,509 were estimated to be boat-based (Eastern Caribbean Center 2002). According to the Eastern Caribbean Center (2002), approximately 53 percent of recreational fishers in the USVI fish in territorial waters. However, as of March 1, 2010, only 12 fishers were registered with the National Saltwater Angler Registry.

The USVI does not require a permit for recreational fishing; however, there are restrictions. Sale of catch by recreational fishers is prohibited, and recreational fishers are not allowed to use the following gears: pots, traps, haul seines, and set-nets, the latter of which are a type of gill net consisting of a wall of fine mesh held up by a float line and anchored on the sea floor. There is also a recreational bag limit of six conch per person per day, not to exceed 24 per boat per day.

The VIDPNR defines recreational fishing as fishing for the sole purpose of providing food for oneself or one's family or to catch and release fish. Included in this definition are both subsistence fishing and sport fishing. The major participants in sport fishing are tourists who target migratory species, and sportfishing tournaments are popular. Toller et al. (2005) distinguish five types of USVI sportfishing tournaments: shore-based handline, boat-based handline, offshore coastal pelagic, offshore pelagic, and marlin. The numbers and types of fishing tournaments tend to differ between the islands of St. Thomas and St. Croix.

Among non-sport-fishing anglers, the most popular species are snapper (Lutjanidae) and grouper (Serranidae) (Jennings 1992, Eastern Caribbean Center 2002, Toller et al. 2005). A 1986 telephone survey of non-charter boat anglers found grouper and snapper to be the primary target species for 64 percent of anglers on St. Thomas/St. John and for 62 percent of those on St. Croix (Jennings 1992: 345). According to Matter (2007), there were no reports of recreational catch of yellowfin grouper, a member of GU4, from 2000 to 2005.

There are significant differences in the offshore fisheries of St. Thomas and St. Croix. First, the numbers of charter boat operations across the islands differ greatly. In 2002, for example, there was one charter-and-party-boat operation in St. Croix and 12 in St. Thomas and St. John combined, for a total of 13 operations in the USVI (2002 Economic Census). That number has since declined by three. In 2007, there were 10 charter-and-party boat operations in the USVI (2007 Economic Census). Second, the sizes of the offshore recreational fleets are very different. Mateo et al. (2000) estimate the St. Thomas offshore recreational fishing fleets is approximately 150 vessels, of which 40 are seasonal vessels that come from the U.S. mainland for marlin season. In contrast, St. Croix's offshore recreational fishing fleet is comprised of approximately 30 vessels.

The MRFSS program began in 1979 and was conducted in 1979 and 1981 in the USVI; however, it was discontinued in 1982 because of lack of funding. MRFSS was re-initiated in the USVI in 2000, but subsequently has not been continued. Nonetheless, the VIDPNR's Division of Fish and Wildlife conducted a recreational fisheries assessment during the 5-year period from October 1, 2000, to September 20, 2005. The assessment included: 1) a telephone survey of boat-based angling, 2) interviews and logbook records of recreational fishers, 3) intercept surveys of shoreline recreational fishers, 4) a survey of recreational fishers to determine impacts of national monument expansion on St. Croix, 5) collection of pertinent bibliographic materials, and 6) sampling from sportfishing tournaments. For the survey results of sportfishing tournaments, see Toller et al. (2005).

Additional information about St. Croix's and St. Thomas/St. John's recreational fisheries can be found in Stoffle et al. (2009), and Impact Assessment, Inc. (2007), respectively.

5.3.3.8 U.S. Virgin Islands Subsistence Fishery

Subsistence fishing has been and remains an important part of fishing in the USVI. According to Impact Assessment, Inc. (2007), based on observation and discussions with residents, it is clear that extensive subsistence-oriented fishing is conducted by persons living in relatively less affluent communities throughout St. Thomas, and in the small communities throughout St. John. However, data is lacking for both islands. Additional discussion about the subsistence fishery of St. Croix and of St. Thomas/St. John can be found in Stoffle et al. (2009) and Impact Assessment, Inc. (2007), respectively.

5.3.4 Brief Economic History and Overview

5.3.4.1 Puerto Rico

Puerto Rico's economy reflects its relationship to the United States, which in turn can be divided into four periods. First is the period of agrarian capitalism from 1898 to the economic crisis of the 1930s; second, the period of state-driven reforms from the early 1940s to the early 1950s; third, the period of industrialization from the early 1950s to the early 1970s; and last, the period of slow economic growth and an increasing state presence from the 1970s to the present (Toro Tulla 2007). A U.S.-dominated plantation system developed and characterized the first period.

Puerto Rico's economic relationship with the U.S. did not begin with the 1898 Spanish-American War. The northeastern U.S., where U.S. sugar refineries were located, received cane sugar produced from Spain's Caribbean colonies, which included Puerto Rico, for decades. In fact, the U.S. became the principal consumer of sugar from Puerto Rico and Cuba in the nineteenth century, as the U.S. consumption of sugar increased from 12.5 pounds to 65 pounds per capita between 1830 and 1900 (Ayala 1999: 17, 30). The relationship between Puerto Rico and the U.S. was so strong that, according to Picó (2006: 233), it was said that "Spain administered [both Puerto Rico and Cuba] for the economic benefit of the United States." Puerto Rico's economy was export-driven.

A discussion of Puerto Rico's economic history should include mention of the doctrine of Manifest Destiny. Manifest Destiny promoted forcible American expansion based on Divine right and racial superiority, and the doctrine referred to two major military events: the 1848 war against Mexico and the 1898 Spanish-American War (Herman 2009: 25). Coupled with the science of Social Darwinism, it was argued that the U.S. was acting in accord with Divine will and the best interests of Puerto Ricans in 1898 by invading the island and overthrowing its government because the ruling Spanish were not benefiting the islanders and both the Spanish and Puerto Ricans, unlike Anglo-Saxons, were incapable of creating a civilized society. The war, and war in general, was also touted as "the one great socializer" of American young men because it was argued that they were elevated physically, morally, and socially by becoming soldiers (Quint 1958: 138). The military action, however, ultimately served U.S. economic interests, especially the American Sugar Trust, which by 1892 controlled 98 percent of sugar refining in the United States, and the American Tobacco Trust.

During the 1898 Spanish-American War, the U.S. invaded the island and set up a blockade, which exposed the colony's inability to feed itself because of extreme reliance on export crops, particularly coffee, sugar, and tobacco. Whereas in 1830, 28.9 percent of the island's cultivated land was devoted to export crops, in 1862, 51.3 percent of cultivated land was so devoted. That trend continued and in 1897, about 63 percent of the island's cultivated land was devoted to coffee (40.9 percent), sugarcane (20.6 percent), and tobacco (1.4 percent) (Dietz 1986: 28). During the U.S. blockade, Spanish ships were kept out and although some ships were allowed to enter, there were shortages of flour, salted meats, potatoes, rice, and many types of canned food. Even plantains were rationed.

By 1898, coffee was Puerto Rico's principle export crop. It was grown in the mountainous regions of the island, which had been until 1800 the site of a subsistence farm economy (Ayala and Bernabe 2007). After 1800, many of those who had been subsistence farmers were forced to work for others, and small neighboring coffee growers became indebted to larger producers by virtue of buying on credit at the larger producers' country stores (ibid). At the same time, the larger producers continuously incurred debt with merchants who sold them processing equipment as they expanded their areas of cultivation. However, coffee was in high demand in Europe and prices were high at the time. The sugar industry, on the other hand, was in disarray. World prices of sugar plummeted after the 1850s with the increase in supply caused by beet sugar producers. From 1870 to 1900 more sugar was produced from beets than from cane sugar, and by 1900, 65 percent of the world's sugar came from beets (Ayala 1999: 27). In 1876, sugar exports represented 62.5 percent of Puerto Rico's total value of exports while coffee exports represented 17.6 percent. By 1896, coffee exports represented 76.9 percent of the island's total value of exports and sugar exports only 20.7 percent (Dietz 1986: 27, 177 as stated in Ayala 1999: 198).

Puerto Rico's cane sugar producers could not compete with the lower cost competition without modernizing their mills, and at that time, there was insufficient financial capital in Puerto Rico to do so. If they did borrow, it was from merchants or merchant houses, who

would charge exorbitant interest rates as high as 1.5 to 2 percent per month (Dietz 1986: 29). Moreover, during the Spanish-American War, the island's principal buyer of sugarcane was on the opposite side. U.S. imports of cane sugar dropped substantially, which encouraged the fast U.S. development of the beet sugar industry.

The transfer of Puerto Rico from Spain to the U.S. was welcomed by sugar mill owners, cane growers, and others involved in the sugar trade because they hoped to gain access to the tariff-protected U.S. sugar market (Ayala and Bernabe 2007: 17). Sugar consumption in the U.S. was continuing to expand. Coffee interests on the island were not similarly hopeful. Although coffee was the island's principal export crop by 1898, Puerto Rican coffee had been sent to Europe, where it received higher prices. While Puerto Rican sugar would be protected in the U.S. market, the island's coffee would have to compete with cheaper Brazilian coffee.

Puerto Rican tobacco farmers also welcomed the new trade status. Puerto Rican tobacco was similar to Cuban tobacco, which was popular in U.S. mainland markets, and the new protected import status meant Puerto Rican tobacco was now less expensive than Cuban tobacco (Levy 2007). In 1899, the Porto Rican American Tobacco Company, a subsidiary of the American Tobacco Company, was incorporated in New Jersey. It formally established the American presence in Puerto Rico's tobacco sector when it purchased two tobacco manufacturing companies in Ponce and San Juan.

After 1898, U.S. horizontally consolidated sugar refining corporations, who were members of the American Sugar Trust, established and operated vertically integrated plantations in Puerto Rico (Ayala 1999). The Sugar Trust oligopoly was formed in 1897 through the alliance of 15 companies, and one of its first acts was to raise the price of refined sugar and reduce the price of unrefined sugar. During the 5-year period from 1897 to 1901, 2 percent of the crops used to produce the U.S. supply of sugar came from Puerto Rico, and that increased to 5 percent from 1902 to 1906.

A general survey of Puerto Rico's fisheries was conducted in 1899 immediately after the U.S. occupation of the island. That was followed by a second survey in 1902 by William Wilcox, an agent of the U.S. Fisheries Commission (Pérez 2005). However, according to the U.S. Department of Commerce's Bureau of Fisheries (1933), no data on catch, fishers, and gears employed were secured from these surveys. Wilcox's report includes a statement that illustrates the movement of individuals from fishing to wage labor (in Pérez 2005):

> During the past few years a steady demand for labor on shore at increased wages has induced the most enterprising of the fishermen to give more time to shore work at the expense of the fisheries.

Sugarcane production, which was expanding in coastal valleys, was likely drawing individuals from fishing to wage labor. According to Pérez (2005), Wilcox suggested that the higher wages may have contributed to the decrease in the importation of dried and

canned fish from approximately 17.87 million pounds in 1899 to about 16.76 million pounds in 1902.

The Foraker Act of 1900 allowed for the free trade of Puerto Rican goods into the U.S. market. However, in response to pressure from the beet lobby, who feared large-scale cane production on the island, Congress included in the act a 500-acre limit on the amount of property that could be owned by a corporation in Puerto Rico; however, there were no penalties for non-compliance, which pleased sugar interests in the U.S. northeast (Ayala and Bernabe 2007: 37).

The first colonial Governor of Puerto Rico was Charles H. Allen. During his governorship, the Hollander Act of 1901 was implemented which charged a 2 percent tax on the value of rural land (Ayala 1999, Ayala and Bernabe 2007). According to Ayala and Bernabe (2007: 37), the tax was to force rural peasants and others, who owned land suitable for sugarcane production, to sell their land or either engage in small-scale production or work as laborers to pay the tax. However, there was a wave of protests, which resulted in the tax being reduced to 1 percent. Nonetheless, Allen later became president of the American Sugar Refining Company (1912-1915). By 1910, sugar exports accounted for 64.3 percent of the total value of the island's exports, which was more than a threefold increase from 1896 (Ayala and Bernabe 2007: 198). Sugar production rose from 81,000 tons in 1900 to 349,000 tons in 1910, a 331 percent increase (Ayala and Bernabe 2007: 38). However, real wages of sugarcane workers remained about the same from 1900 to 1914 (ibid, 39).

Unlike what happened in the sugar sector, American investment in tobacco was mostly in manufacturing, not growing tobacco (Levy 2007).

By World War I, Cuba was providing almost half of the U.S. supply of sugar and Europe was producing 50 percent of the world's sugar supply (Hollander 2008). While the U.S. supply of sugar was primarily from sugarcane, the majority of Europe's production was from beets. However, European beet production dropped dramatically between 1914 and 1919 because of World War I, causing European sugar refineries and other sugar interests to demand sugarcane. With the drop in supply, the price of sugar rose substantially. In 1917, the Jones Act replaced the Foraker Act, kept the 500-acre limit, limited the amount of sugar it could refine, and ordered a study of the holdings that violated the acre limit. According to Ayala and Bernabe (2007: 37), 477 partnerships or corporations had more than the limit. Although the study was submitted to the Committee on Pacific Islands and Puerto Rico, the committee took no action.

During World War I, the U.S. was cut off from its sources of embroidered clothe. In response, the needlework industry rose and increased rapidly in Puerto Rico. By the early 1930s, the industry employed more than 60,000 mostly female workers, which was a figure surpassed only by the sugar industry during the harvest period (Ayala and Bernabe 2007: 46, 47). These women worked in their homes, small to large shops, and larger establishments. According to a report for the U.S. Department of Labor by Manning (1934), 40,000 families, not individuals, were employed in home needlework in 1933.

DRAFT

By the late 1920s, the Aquirre Sugar Company, Fajardo Sugar Company, South Porto Rico Sugar Company, and United Porto Rico Sugar Company were producing about 60 percent of the island's sugar (Ayala 1999: 108). These four companies were vertically integrated with U.S. sugar refineries (Ayala and Bernabe 2007: 38). It was during the 1920s that the island experienced its greatest amount of sugar production. During that decade the Jones Act's limits on the amount of sugar that could be refined on the island acted as a break on further development of sugarcane fields. Another limitation was the Costigan-Jones Act passed by the U.S. Congress in 1934, which established a quota system for all exports of sugar into the U.S. and thereby restricted sugar exports from Puerto Rico to the mainland (Toro Tulla 2007).

Tobacco expanded as well; however, it was largely a small producer's crop. Tobacco can be cultivated on small parcels of land. Consequently, it does not significantly reduce the amount of farmland available for food crops (Toro Tulla 2007). The average tobacco farm in 1909 had 2.7 acres devoted for tobacco and in 1929 that rose to 3.1 acres (Ayala and Bernabe 2007: 42). Cigar and cigarette production, however, expanded substantially after 1900 with the establishment of large-scale machinery. At the same time, regulations were imposed that penalized traditional cigar makers, who used to work at home (Picó 2006). These laws increased the concentration of tobacco manufacturing in urban factories, many of which were owned by external interests. By 1910, there were more workers in cigar and cigarette production than in the centrales (sugarcane grinding plants) of the sugar industry. The cigar and cigarette factories employed an increasingly larger female labor force. In 1910, 30 percent of the 11,118 workers in the tobacco industry were female, and by 1935, 73 percent of 14,712 workers were female. According to Picó (2006: 245), the despalilladoras who stripped the stems from the leaves were the vanguard of the new female working class. Pounds and value of leaf tobacco and cigars exported increased significantly from 1900 to 1920. Subsequently, pre-manufactured tobacco became increasingly important, rising from 22 percent of the value of all tobacco exports in 1910 to 77 percent by 1930 (Ayala and Bernabe 2007: 45). The value of cigar exports declined, however, after the 1920s, which coincided with a switch in the U.S. and island's market to cigarettes produced with North American tobacco (Garcia Colon 2002). By 1940, tobacco leaf represented all tobacco exports. The quantity and value of leaf tobacco by 1939-40 was approximately 17 million pounds with a value of approximately $6 million (Figure 5.3.17).

.

DRAFT

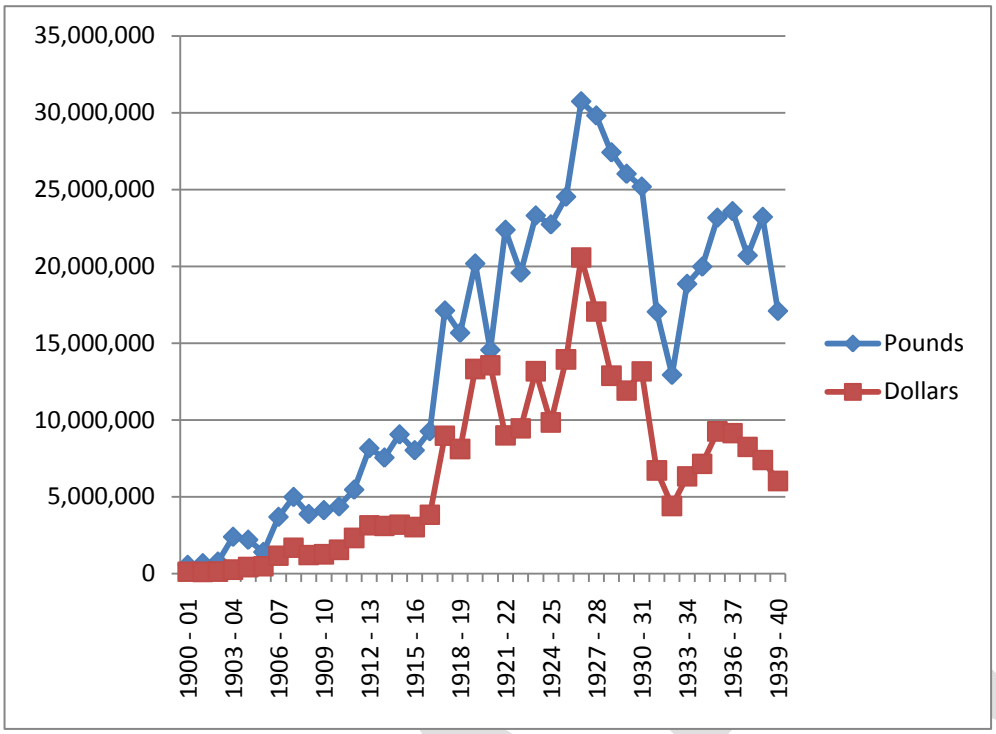


Figure 5.3.17 . Quantity and value of leaf tobacco exports from Puerto Rico to the United States, 1900-1940. *Source*: Toro Tulla 2007: 54.

Two major hurricanes in 1928 and 1932 contributed to a growing economic crisis by destroying crops, mostly tobacco and coffee, in the eastern central part of the island. The hurricane of 1932 killed 225 people and caused $30 million in damages (Garcia Colon 2002: 47).

It is estimated that the fish catch in Puerto Rico in 1930 was over 3 million pounds with a value of $207,085 (U.S. Dept. of Commerce, Bureau of Fisheries 1933: 429). That same year about 21.5 million pounds of fishery products, mostly dry salt cod, were imported. The annual per capita consumption of fish was about 14 pounds in the "edible portion" as compared to the Virgin Islands' annual per capita fish consumption of 32 pounds (ibid: 111). By comparison, the average per capita consumption of fish and shellfish from 1997 to 1999 was 1.5 pounds and from 2003 to 2005 was 1.8 pounds (live weight).

The Bureau of Fisheries' (U.S. Dept. of Commerce, Bureau of Fisheries 1933: 429) survey conducted from July 15 to November 19, 1931, is "the first statistical and marketing survey made of the fisheries of Puerto Rico." Motivating the call for the survey was a belief that the island's fisheries were inadequate as illustrated by the ratio of pounds landed of fish versus the pounds imported (3 million to 21.5 million) and the following statement (ibid: 110):

> Believing that the fishery resources of Puerto Rico were largely undeveloped and that methods of preserving and marketing fish in the island were inefficient, Gov.

> Theodore Roosevelt requested the Bureau of Fisheries to make an economic survey of the situation and to suggest procedures leading toward fuller development.

N.D. Jarvis, who conducted the survey, visited 34 fishing localities reported in Puerto Rico and interviewed 80 percent of the fishers who owned boats and gear. The resulting report described the fishing methods and gears used by the fishers, the natural and ecological conditions that limited development of a fishing industry, and ways the fishers marketed their catches (Pérez 2005). Jarvis stated there were three forms to distributing fish after landing: (1) sell the catches to central fish markets in the island's three largest cities (San Juan, Ponce and Mayagűez), (2) peddle the fish on the streets of major coastal towns, and (3) peddle the fish in the countryside (Pérez 2005).

Jarvis also described the methods of handling fish as primitive and unsanitary and the use of ice as almost unknown. Jarvis reported that fish were not gutted or cleaned, and retailers were reluctant to accept dressed fish because of the assumption that gutting was a method to conceal inferiority (Bureau of Fisheries 1933: 111). Much of the fish was stale, and fresh fish was not sold in interior towns and only in small amounts along the coast. It was not surprising that consumption was low because of the fear of food poisoning from eating stale or tainted fish. Also, "considerable amounts of fish" were thrown away because of spoilage, which begged the question, "Why weren't there any fish-reduction plants to take advantage of fish that was otherwise thrown away?" According to the Bureau of Fisheries, there was apparently insufficient catch to operate such a plant profitably.

Jarvis recommended actions be taken to 1) improve the construction of fishing boats and gear, 2) improve fish handling and marketing by using ice to prevent spoilage, 3) improve the display of fish in local markets, 4) create a fish buying and marketing system, and 5) utilize a cash surplus to promote a fish curing industry (Pérez 2005: 82). It was argued that these actions, especially the second and fifth, would reduce Puerto Rico's imports of fish. In response to those recommendations, instruction was given to fishers and others in the proper handling and icing of fresh fish, the preparation of dry-salt fish, the construction of a smokehouse, and the preparation of smoked fish (Bureau of Fisheries 1933: 106).

By 1932, 15 percent of the crops used to produce the U.S. supply of sugar came from Puerto Rico (Ayala and Bernabe 2007: 38). As sugar prices fell substantially during the Depression that started in 1929, so too did Puerto Rico's employment and income, which were so heavily dependent upon sugar exports. With so much land and labor devoted to export, by the early 1930s, 80 percent of the island's food was imported, while per capita income fell about 30 percent from 1930 to 1933 (Ayala and Bernabe 2007). This emphasis on exports contributed to the cost of basic necessities costing 8 to 14 percent more in Puerto Rico than in New York City, while wages in New York City were 4 to 10 times higher (Boris 1996).

DRAFT

The deprivation on the island that resulted from the disastrous reduction in sugarcane exports to the mainland motivated the U.S. government to create the Puerto Rico Emergency Relief Administration (PRERA) in 1933 and the Puerto Rico Reconstruction Agency (PRRA) two years later. Both were extensions of the New Deal from the mainland to alleviate deprivation and poverty.

Largely in response to Jarvis' 1933 report, in 1934 the Puerto Rican government created the Department of Fisheries and Wildlife under the jurisdiction of the Department of Agriculture and Commerce. Pérez (2005) suggests it was the belief that the economic hardships of fishers tended to be much like those of rural coastal agricultural workers that motivated the inclusion of the Department of Fisheries and Wildlife within the Department of Agriculture and Commerce.

By 1935, a third of all cultivated land was devoted to producing sugarcane and another third to coffee and tobacco (Ayala and Bernable 2007: 35). Only the remaining third was kept for domestic food production. The emphasis on agricultural production resulted in large-scale forest conversion to agriculture. By the late 1940s, forest cover reached a low of 6 percent of the island's area (Helmer 2004).

In 1936, the Puerto Rican Legislature passed Law 83, the Fisheries Law. The purpose of Law 83 was to "'protect and promote the raise of fish stocks, to regulate the fisheries so as to increase their productivity and to develop the resources in the waters surrounding Puerto Rico'" (Pérez 2005: 82).

During the period from 1930 to 1940, the population of the island increased by 21.1 percent, while employment increased by only 1.7 percent (Garcia Colon 2002). By the end of the 1930s, an estimated 60 to 70 percent of the workforce was unemployed.

The economic, social, and political turmoil of the 1930s resulted in the emergence of a new coalition of ruling groups. This coalition led the territorial government to take the first steps to modernize the island. One of the first actions was the Land Law of 1941 and Title V of that law. The intent of the law was to create modern urban communities with the infrastructure and services preferred by factories and suitable for housing of factory workers, while diversifying crop cultivation (Garcia Colon 2002: 9-10). The Water Resources Authority was created in 1941, followed by the Public Transportation Authority, Development Corporation, Development Bank, and Planning Board, which were created the following year. In January 1944, the Puerto Rico Water Resource Authority took over the Puerto Rico Railway Light and Power Company and the Mayagüez Light Power and Ice Company, bringing all electric power utilities in Puerto Rico under its control (Bel 2009).

During World War II (1939-1945), the island experienced many shortages of imported goods caused by the U.S. shifting to war-related production. This illustrated Puerto Rico's ongoing problem of having a one-sided economy: it could not economically sustain itself.

On May 13, 1941, Puerto Rico Law 157 was established, which provided an annual sum of $25,000 to conduct biological and physical surveys of Puerto Rican marine waters, to patronize fishing cooperatives, and to establish refrigeration facilities (Rodríguez-Perez 2005, Pérez 2005). That same year the Laboratory for Fisheries Research was created by the Puerto Rican government with assistance from the U.S. Department of Interior. The Lab's first tasks were to increase commercial fish landings, assess the potential for development of an industrial fishing fleet, explore the possibility of "freezing, canning and salting fish in a semi-commercial scale" and initiate research for the improvement of fishing handling and marketing (Pérez 2005: 87).

The Puerto Rico Planning Board was created in 1941, and its role was to guide economic and physical development, establish state-owned industries to demonstrate local production, improve the territory's infrastructure, restructure the University of Puerto Rico, and establish a government structure capable of implementing development plans (Lapp 1995). Both the Planning Board and Development Corporation initiated the implementation of an Import Substitution Industrialization program that established state-owned industries to produce for the local market.

Other public corporations were established: the Aquaduct and Sewer Authority (1945), Communications Authority (1946), and Agricultural Company (1945). One was to provide electricity throughout the island and the other to provide drinking water to Puerto Rican homes (Píco 2006: 268). The Metropolitan Bus Authority was also created to provide urban public transportation in the San Juan area. In addition, a Community Education Division was created; health programs were created and extended to rural areas; and other government services were developed for the general population.

Under Law 157 and the Import Substitution Industrialization program, two fishing centers were created, one in Cabo Rojo in 1943 and another in Fajardo in 1944. The purposes of these centers were to purchase and freeze fishers' catches and sell modern commercial fishing gear at affordable prices. On April 26, 1945, the state-owned company, the Puerto Rican Agricultural Company (PRACO), was founded and it operated the two fishing centers. According to Pérez (2005: 88), it was "considered by many government officials to be the precursor of supermarket chains in Puerto Rico." This is illustrated by the fact that in 1946 PRACO sold about $30,000 of fish produced by the two fishing centers and in turn sold 70 percent of it to Plaza PRACO and the remainder to private merchants (Pérez 2005). By the mid 1940s, PRACO had acquired a modern fishing vessel capable of fishing far from Puerto Rican waters and with a capacity for 40 tons of frozen fish. It also owned three other vessels for fishing in Puerto Rican waters.

Many Puerto Ricans were unable to find jobs in the mid 1940s. Consequently, beginning in 1945-46 a large number of Puerto Ricans left for the U.S. in search of jobs and higher wages (Ayala and Bernabe 2007: 179).

In 1947, the Corporación para el Desarrollo de Puerto Rico (Puerto Rico's Development Corporation) was renamed Formento Económico and placed under the command of University of Chicago economist Harvey Perloff, who was also directing Puerto Rico's

Planning Board (Rodríguez-Perez 2005: 80). Under Perloff's command, the Development Corporation ended its promotion of state ownership and control of capital and began an aggressive campaign to attract foreign investment and control of Puerto Rico's industrialization in 1947 (ibid). This has been called "industrialization by invitation," which involved tax exemptions and subsidies for companies from 10 to 30 years and improved infrastructure (ibid and Colón-Warren & Alegría-Ortega 1998). According to Rodríguez-Perez (2005: 80), this action made Puerto Rico the first territory or "country in the capitalist periphery to actively adopt 'industrialization by invitation' as its development strategy" and it "became the U.S. 'showcase for development' to the rest of the capitalist periphery."

State-owned enterprises, such as PRACO, were privatized or dismantled within a one-year period to foster development in accord with an Export Promotion Development Model (Rodríguez-Perez 2005). When PRACO was dismantled in 1947, some of its responsibilities were transferred to the Department of Agriculture and Commerce. The Lab, which had been under PRACO, was closed and its facilities transferred to the University of Puerto Rico's Mayagüez campus.

The Industrial Incentives Act of 1947 exempted qualifying firms from property, excise, and municipal taxes and fees. It also authorized laws that prohibited workers from forming unions in the new manufacturing and government sectors, although as agricultural workers many had been unionized (Rodgriguez-Perez 2005: 84). The number of U.S. firms that took advantage of the subsidies rose from 9 in 1947 to 83 by 1953 (Dietz : 211). With these subsidies and with labor costs that were lower than on the mainland, Puerto Rico became especially attractive to labor-intensive industries such as the textiles and garment industries. However, dismantling of the agricultural sector did not come with guarantees that agricultural workers would find comparable or any jobs in the new manufacturing plants or expanding government sector.

During the 1940s, the primary goals of the fisheries development program were to: 1) procure and distribute materials needed for the construction and replacement of fishing gear and equipment; 2) establish a loan system to enable fishers to purchase boats and fishing gear; 3) construct refrigeration, warehouse and docking facilities in the most important fishing centers of the island; 4) establish modern fish handling, transportation, preservation, and marketing techniques, 5) institute a government fish marketing and distribution system; 6) organize fishers' cooperatives; and 7) educate fishers so as to improve fishing practices and consumers and to increase fish consumption (Pérez 2000).

In the 1940s and 1950s the majority of fishers sold their catches to fish peddlers who walked or rode bicycles or horses in coastal areas but without refrigeration to keep the fish fresh (Pérez 2005: 148). Fishers tended to sell their catches on the beaches where they landed. Only a few middlemen had facilities with refrigeration, but like the peddlers, both middlemen and peddlers bought fish at about 5 or 6 cents per pound and sold it for 15 to 18 cents per pound (ibid). According to Pérez (2005), in some regions, such as Puerto de la Corona and Playa de Guáyanilla, the middlemen controlled the means of production by owning fishing vessels and gear and dictated marketing by means of owning cars and

trucks that physically distributed the catch during those decades. That control began to erode in the late 1940s, however, as fishers began to acquire their own vessels and gear by using their savings earned from working in both sugar mills and fishing.

Puerto Rico's tourism industry began in 1950 with the construction of the Caribe Hilton. Its success motivated hotel chains to build luxury buildings in El Condado in Santurce and Isla Verde in Carolina (Píco 2006). The number of guests registered in hotels increased substantially from 1950 then peaked in 1980, and with that increase so too was there an increase in employment in the tourism sector (Table 5.3.48).

Table 5.3.48. Number of registered hotel guests, 1950-1984. *Source*: Píco 2006: 282.

Year	Number of Registered Guests
1950	57,721
1960	207,638
1970	734,981
1975	778,366
1980	817,061
1984	637,944

The Fishermen's Credit Agency was founded in 1958 and placed under the jurisdiction of the Department of Agriculture. Its purpose was to provide loans with the intent of industrializing commercial fishing. In 1959, the Fishermen's Credit Agency, the Economic Development Bank, and the Agricultural Credit Corporation began extending loans to commercial fishers to shift the commercial fleet from open wooden sailboats and open rowboats to boats with an outboard or inboard motor. Territorial-sponsored programs continued to encourage and subsidize the use of small outboard motors in the 1970s (García-Quijano 2009). By 1979, 75 percent of commercial fishing boats had an outboard motor. However, if the primary intent of the loan programs was to industrialize fisheries by eliminating yolas and substituting them with vessels and gears designed for specialized fisheries, they generally failed (Pérez 2005). Puerto Rican fishers' yolas are flexible because they can be used to target multiple species and deploy multiple gears. García-Quijano (2009: 12) found an "emphasis on flexibility and the ability to harvest a variety of species" to be an important theme in interviews with southeastern Puerto Rican fishers.

Heavy industrialization significantly changed Puerto Rico's coastline, especially the construction of petrochemical plants and refineries from the 1950s to the 1970s. These plants required large ships to enter Puerto Rico's bays. In 1958, the Puerto Rico Towing and Boat Service, Inc. started operations and in the early 1960s constructed a small shipyard where the first maritime tugboat to operate in Puerto Rico was built. Tug boats were necessary to guide bigger ships into the bays to service oil refineries and petrochemical plants. In 1959, Union Carbide opened its first plant in the territory to produce ethylene glycol. The emphasis on economic growth through industrialization, especially the construction of petrochemical plants, from the 1950s into the 1970s marked

the territory's third economic period. By 1977, there were 51 petrochemical plants on the island, and 27 (53 percent) were operated by CORCO and Union Carbide. By 1978, CORCO was the island's largest employer and it supplied 80 percent of the island's petroleum products. It also was the largest contributor to government revenues among all industrial plants in Puerto Rico.

In 1963 the Program of Minimum Facilities in Fishing Villages was created, which increased fishers' dependence on economic and institutional assistance provided by government agencies (Pérez 2005: 149). Prior to that time, fishers had fished and marketed their catches independently. The construction of fish houses, docks, and lockers for fishers to store gear benefited fishers.

The Agency for Community Action was founded in the early 1970s. One of its primary goals was the creation of a sense of community among the fishers, which it was believed would encourage fishers to experiment with new technologies. The agency gave fishermen's associations that were founded in the early 1970s larger vessels with refrigeration systems, radio and radar, and other technologies. Together, the 1963 program and the Agency for Community Action began to concentrate fishers geographically and politically under a modernist regime of controlling the means of production and levels and distribution of production (Pérez 2005).

In the pursuit of modernizing territorial fishing practices, the Corporation for the Development and Administration of the Lake, River and Marine Resources of Puerto Rico (CODREMAR) with the help of federal and other territorial agencies built landing, storage, marketing, and meeting facilities for commercial fishers all along the coast of Puerto Rico in the early 1980s (Griffith and Valdés Pizzini 2002). The territorial government also gave low interest loans for fishers to purchase and improve fishing equipment and trained them in the use of modern fishing technologies at these sites (Pérez 2005), and CODREMAR established fishers' associations at these official fishing centers.

The fishers' associations linked fishers and fishing communities to government agencies and at the same time, helped bring together a labor force that had traditionally worked independently and separately. These associations were a spatial and political construction that fell under the sphere of the state's modernizing discourse, which promoted centralization, surveillance, and attempts to control fishers' level of production and relations of production (Pérez 2005). At these fishing centers, the government could monitor landings and sales, which were essential to managing Puerto Rico's commercial fisheries. However, fishers were and are not required to be a member of an association. Also, they were and are not required to land their catch at these official landing centers.

CODREMAR was the government organization that monitored fishing activity in Puerto Rico until 1989, and the "official" landing centers were CODREMAR-sanctioned associations. Presently, DNER monitors fishing activities and the official landing centers.

Puerto Rico's economy can be divided into two broad categories; its formal economy and its informal economy. The formal economy is composed of the documented flow of

goods and services and employment, and the health of the formal economy is assessed with economic indicators, such as Gross Domestic Product (GDP), Gross National Income (GNI), and the unemployment rate.

Puerto Rico's informal economy (or shadow economy) is composed of those economic activities, both legal and illegal, that are not documented. Schneider (2004) estimates Puerto Rico's shadow economy represented 28.4 percent of its official GDP in 1999/2000, 29.4 percent of GDP in 2001/02, and 30.7 percent in 2002/03.

Per capita food production has declined in Puerto Rico since 1960, while total food production has declined since 1990. The decline in the production of metric tons of cereals has been the most dramatic, falling 84 percent from 1979-81 to 1999-2001 (World Resources Institute 2006). The per capita loss of food production suggests a growing importance of imported food and/or subsistence production.

Over 40 percent of Puerto Rico's domestic income from the mid-1980s to 2006 was derived from manufacturing. Pharmaceuticals accounted for about 40 percent of total value added in manufacturing in 1987 and that share rose to over 70 percent by 2002 (GAO 2006). However, since the 1990s, there has been an increased shift towards a service economy.

Tilapia, shrimp, and other aquaculture products are produced in Puerto Rico. Total sales rose substantially from 1992 to 2002 then declined substantially after peaking in 2002. Tilapia and shrimp sales fell dramatically after 2002. Puerto Rico was the site of an offshore aquaculture operation. Snapperfarm, Inc., which was founded in 1998 and grew cobia, ended operations in 2006.

In 2007, the largest industrial sector by paid employees was retail trade, followed by manufacturing. Of the 13 establishments with paid employees in the forestry, fishing, hunting, and agriculture support sector (Industry Code 11), none of them were in the fishing sector, specifically. The largest industry within the manufacturing sector by number of paid employees and annual payroll for 2007 was chemical manufacturing, and pharmaceutical and medicine manufacturing dominated that subsector (Table 5.3.49).

DRAFT

Table 5.3.49. Puerto Rico business patterns, 2007. *Source*: U.S. Census Bureau, County Business Patterns.

Industry code	Industry code description	Paid employees	First-quarter payroll ($1000)	Annual payroll ($1000)	Total establish-ments
------	Total	767,247	4,165,403	16,849,370	47,340
11----	Forestry, fishing, hunting, and agriculture support	20 - 99	140	640	13
21----	Mining	1,011	5258	23947	53
22----	Utilities	250 - 499	Withheld*	Withheld*	25
23----	Construction	58,455	234,261	1,000,163	2,911
31----	Manufacturing	109,935	935,836	3,607,428	2,104
42----	Wholesale trade	36,250	292,844	1,188,462	2,330
44----	Retail trade	135,703	493,381	2,074,238	11,196
48----	Transportation & warehousing	16,738	98,909	410,410	1,089
51----	Information	22,459	209,247	819,292	532
52----	Finance & insurance	40,004	400,864	1,491,822	2,159
53----	Real estate & rental & leasing	15,109	74,059	307,023	1,753
54----	Professional, scientific & technical services	31,662	234,683	976,202	4,246
55----	Management of companies & enterprises	5,423	54,905	215,439	99
56----	Admin, support, waste mgt, remediation services	74,893	261,108	1,096,021	1,783
61----	Educational services	34,804	154,910	662,119	768
62----	Health care and social assistance	78,522	361,296	1,537,840	6,993
71----	Arts, entertainment & recreation	4,035	16,316	66,184	445
72----	Accommodation & food services	75,595	229,968	925,693	4,321
81----	Other services (except public administration)	24,590	96,455	397,634	3,631
99----	Unclassified establishments	1,668	5,929	31,139	889

*: Withheld to avoid disclosing data for individual companies.

On December 31, 2005, federal tax incentives for U.S. corporations in Puerto Rico were eliminated with the end of the 10-year phase-out period of Sections 936 and 30A of the U.S. Internal Revenue Code. Under Section 936, U.S. corporations with subsidiaries in Puerto Rico could repatriate profits with no net federal tax liability; however, the Puerto Rican government imposed a maximum 10 percent "tollgate tax" on any repatriated earnings (Dietz 2003). This tax could be reduced significantly by corporations if they deposited their retained earnings within the Puerto Rican banking system for specific periods of time. The belief behind this tax reduction was that it would increase the volume of available loanable funds in Puerto Rico, and the deposits did increase. By 1980, 936 funds represented one-third of all deposits in Puerto Rican commercial banks,

DRAFT

and by 1985, over 40 percent. By 2000, the finance, insurance and real estate sector was the largest sector of the economy, accounting for 23.9 percent of GNP.

With the tax repeal, however, went incentives for capital-intensive production of chemicals and pharmaceuticals (Bram *et al*. 2008). U.S. corporations claiming the tax credit have subsequently left the territory.

In August 2009, Puerto Rico Governor Luis Fortuno signed the "Law for the Promotion and Development of Agricultural Biotechnological Businesses in Puerto Rico." The law preempts any local authorities from attempting to regulate agricultural biotechnology. As of that date, there were 11 biotech companies in Puerto Rico. According to Ruiz-Marrero (2004), most genetically engineered corn and soybean seed that is planted in the U.S. comes from Puerto Rico. Puerto Rico offers biotechnology companies benefits such as: no federal income tax; a low corporate income tax rate from 2 to 7 percent, which can be lower than 2 percent in some cases; and, fast-tracking of government and other permits (PRIDCO 2009). As of January 2005, there were 3,483 field tests of genetically modified (GM) crops on the island. Most GM crops are planted in the southern plains between Juana Diaz and Guayama, and they are concentrated in the area between the towns of Santa Isabel and Salinas (Ruiz-Marrero 2009). GM crops are also found in the northern town of Isabela. There is concern that the recent law may encourage biotech companies to use more fertile lands, which could further decrease domestic food production and increase the island's dependence on imported foods.

On September 25, 2009, the Puerto Rican government announced it would be dismissing 16,970 public workers across many agencies and departments to reduce government spending and the public deficit. The more than 16,000 workers adds to the already 7,816 public workers (6,796 temporary workers, 210 "irregular" and 809 "regular" employees) laid off in May (Baltimore Sun, September 25, 2009; CaribbeanBusinesspr.com, September 25, 2009). Most of those laid off in May were temporary clerical workers in the Education, Treasury, and Health Departments (National Conference of State Legislatures: http://www.ncsl.org/?tabid=17244). Up to 30,000 government workers may eventually lose their jobs.

Because of its commonwealth status, once a shipment of a product reaches Puerto Rico, it may not be subjected to further United States Customs Service inspection en route to the U.S. mainland. This fact coupled with its Caribbean location, makes Puerto Rico an excellent gateway for drugs destined for the east coast of the U.S. mainland. According to Taylor (2000), Puerto Rico is the largest staging area in the Caribbean for smuggling Columbian cocaine and heroin into the United States.

Smugglers intentionally travel up the island chains and along the coasts to blend in with other vessel traffic, which minimizes opportunities for detection. Vessels sometimes off-load to Puerto Rican fishing vessels that are positioned from 40 to 150 nautical miles off the coast of Puerto Rico, the Dominican Republic, or in the Leeward Islands. The small, shallow-draft yolas then head back to the east coast of the island where the cocaine is offloaded (Taylor 2000). The yolas can avoid radar detection and venture into shallow

coastal waters that large Coast Guard and other law enforcement vessels cannot enter, which is why law enforcement agencies have begun to deploy smaller vessels. See: http://www.uscg.mil/LANTAREA/cgcVenturous/Shoreties04.pdf for a 2009 article on a U.S. Coast Guard cutter deploying a small boat to approach a yola off Puerto Rico that was hauling cocaine from the Dominican Republic. According to Griffith et al. (2007) , in "some rural and isolated communities, the links between fishing, contraband trade, smuggling, and other uses of coastal environments continue to the present, undermining the extent to which fishing has been able to develop as a legitimate (i.e. officially recognized) occupation."

The unemployment rate in August 2009 was 15.8 percent, and it was expected to rise because of continuing layoffs of private and public sector employees by the end of the year, which it did. In January 2010, the unemployment rate was 16.1 percent (http://www.gdb-pur.com/economy/documents/PREI031210.pdf). On August 21, 2009, the Puerto Rico Planning Board announced its preliminary estimate of a decline in the territory's real Gross National Product (GNP) from July 1, 2008, to June 30, 2009, ranging from 4.8 to 5.5 percent. Estimated GDP per capita fell from $18,500 in 2007 to $17,100 in 2009: (http://www.theodora.com/wfbcurrent/puerto_rico/puerto_rico_economy.html). The prolonged and deep recession is the territory's worst economic downturn since the Great Depression.

By April 2010, Puerto Rico had spent $2.55 billion of the nearly $6.5 billion it was slated to receive in the American Recovery and Reinvestment Act (ARRA). ARRA infrastructure funding included $180 million to improve public housing projects, $126 million to improve highways and transportation, $91.3 million in drinking water and wastewater projects, $70 million to improve public schools, and $15.5 million in port improvements (Caribbean Business, April 1, 2010).

The Puerto Rico Planning Board projected a 3.6 percent contraction of the island's economy for fiscal 1010, which ends June 30 (Caribbean Business, April 1, 2010). That follows previous contractions.

5.3.4.2 U.S. Virgin Islands

St. Croix, St. Thomas, St. John, Water Island, and approximately 50 smaller islets and cays were acquired by the U.S. government in 1917 from the Danish government for a price of $25 million ($390 million in 2010 dollars). Motivating the U.S. government's purchase of the islands was its fear that if Germany conquered Denmark during World War I, Germany would attempt to extend its control to Denmark's territories in the Caribbean. Although promised citizenship in 1917, most residents of the USVI did not receive U.S. citizenship until 1927, and it was not until 1932 that citizenship was extended to all U.S. Virgin Islanders.

From 1917 to 1968, the USVI was under direct control of the U.S. Navy (1917 to 1931) and Department of Interior (1931 to 1968), which appointed a governor. In 1969, U.S.

Virgin Islanders elected their first governor and in 1972 their first non-voting delegate to the U.S. Congress. The Department of Interior transferred control of Water Island to the USVI government in 1996. In 2005, the USVI government announced plans to further develop Water Island, and to increase the amount of residential housing to deal with chronic shortages on St. Thomas. In 2000, there were 161 residents of Water Island.

The Fishermen's Loan Revolving Fund was created in 1972 with the purpose of providing small, short-term loans to fishers "in order to encourage and promote limited capital commercial fishing operations in the Virgin Islands" (Act No. 3330). Loans could not exceed $1,500 to any individual.

In the 1990s, the U.S. economy grew substantially and had the lowest child poverty rate in 20 years. In the USVI, however, economic conditions for children and families deteriorated during those years (Annie E. Casey Foundation 2002). In 1989, 23.2 percent of all USVI families had incomes below poverty level (29.5 percent in St. Croix, 11.6 percent in St. John, and 17.7 percent in St. Thomas). By 1999, 28.7 percent of all families had incomes below poverty level (34.8 percent in St. Croix, 14.8 percent in St. John, and 23.2 percent in St. Thomas). In 1999, 42.1 percent of families with children in St. Croix had incomes below poverty level, while 18.4 percent of such families in St. John and 23.2 percent of such families in St. Thomas had incomes below poverty level (U.S. Census Bureau 2000). The highest child poverty rates were in the St. Croix towns of Frederiksted (68 percent) and Christiansted (61 percent) and the lowest in West End, St. Thomas (14 percent) (Annie E. Casey Foundation 2002). From 2000 to 2006, 31 percent to 42 percent of children lived in poverty annually and averaged 35 percent (Annie E. Casey Foundation 2002).

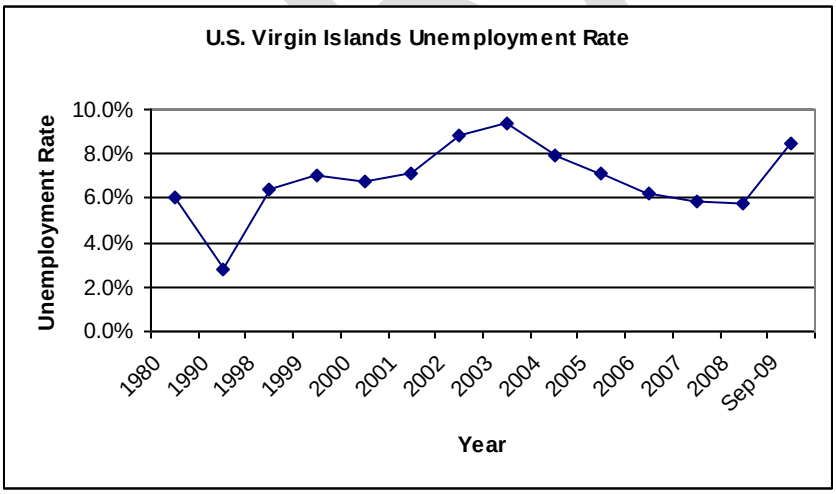


Figure 5.3.18 . USVI unemployment rate, 1980-September 2009. *Sources*: USVI Bureau of Economic Research for 1980 to 2008, USVI Department of Labor for September 2009.

Also like Puerto Rico and the U.S. mainland, the USVI has been experiencing an economic downturn. Unemployment rose from 6.0 percent in September 2008 to 8.5 percent in September 2009 (USVI Department of Labor). Unemployment in St. Croix was 9.9 percent in St. Croix and 7.4 percent in St. Thomas/St. John in September 2009 (Figures 5.3.18 and 5.3.19).

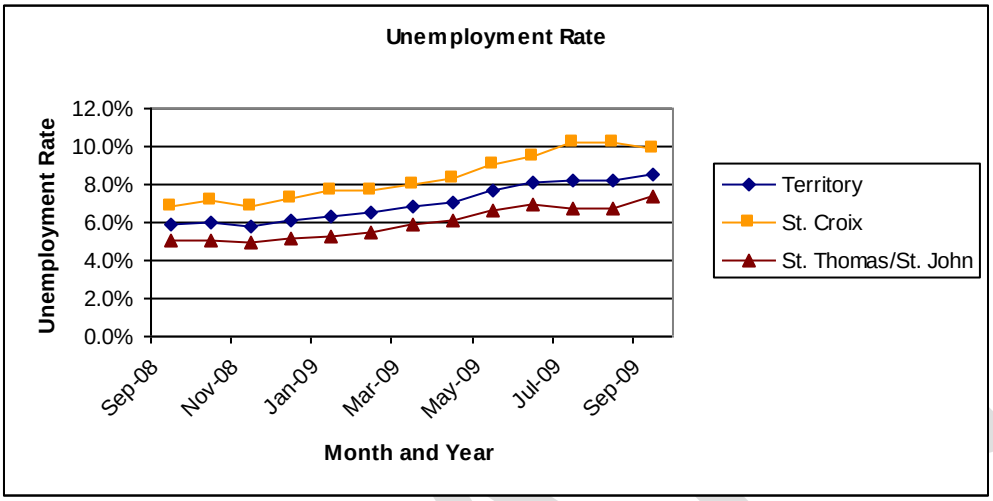


Figure 5.3.19. Unemployment rate, September 2008-September 2009. *Source*: USVI Department of Labor, Virgin Islands Labor Force Estimates.

Table 5.3.50. USVI supplemental nutrition assistance program participation, fiscal year 2003 to March 2009. *Source*: USDA, Food and Nutrition Service (www.fns.usda.gov).

Supplemental Nutrition Assistance Program				
FY/Month	**Households (Monthly)**	**Persons (Monthly)**	**% Change Households**	**% Change Persons**
2003	4,394	12,938		
2004	4,532	13,372	3.1%	3.4%
2005	4,633	13,550	2.2%	1.3%
2006	4,671	13,375	0.8%	-1.3%
2007	4,761	13,281	1.9%	-0.7%
2008	5,036	13,613	5.8%	2.5%
Mar-08	4,957	13,345		
Feb-09	5,864	15,406		
Mar-09	6,184	16,103	24.8%	20.7%

The number of persons and households participating in the Supplemental Nutrition Assistance Program (formerly, the Food Stamp Program) has increased significantly in the past year in comparison with previous fiscal years. Household participation increased by 24.8 percent and participation by persons by 20.7 percent from March 2008 to March

2009 (Table 5.3.50). Such an increase suggests there could be a significant increase in the number of persons and households engaged in subsistence fishing within the same time period.

Table 5.3.51. USVI selected economic characteristics, 2000. Source: U.S. Census Bureau 2000.

	USVI	St. Croix	St. John	St. Thomas
POPULATION & LABOR FORCE				
Population	108,612	53,234	4,197	51,181
Civilian Labor Force (CLF)	50,933	22,483	2,530	25,920
CLF - Employed	46,565	19,924	2,459	24,181
CLF - Unemployed	4,368	2,559	71	1,739
Percent of unemployed persons	8.6	11.3	2.8	6.7
INDUSTRY OF EMPLOYED PERSONS (16 years and over)				
Agriculture, forestry, fishing and mining	324	177	14	133
Construction	4,900	2,537	318	2,045
Manufacturing	2,754	2,184	52	518
Wholesale trade	912	366	10	536
Retail trade	6,476	2,301	251	3,924
Transportation and warehousing & utilities	3,321	1,088	195	2,038
Information	931	355	25	551
Finance, insurance, real estate, rental & leasing	2,330	976	169	1,185
Professional, scientific, management, etc.	3,058	1,279	181	1,598
Educational, health, and social services	6,742	3,375	207	3,160
Arts, entertainment, recreation, accomodation & food services	7,351	2,262	760	4,329
Other services (except public services)	2,535	1,032	147	1,356
Public administration	4,931	1,992	131	2,808
OTHER SOCIOECONOMIC CHARACTERISTICS				
Mean travel time to work (minutes)	20.3	18.6	16.1	22.1
Persons who work in area of residence	45,456	18,983	2,249	22,654
Per capita Income (dollars)	13,139	11,868	18,012	14,061
Median Household Income (dollars)	24,704	21,401	32,482	26,893
Individuals below poverty level	34,931	20,371	775	13,785
Percent of Individuals below poverty level	32.5	38.7	18.5	27.2

More workers in the USVI were employed in the arts, entertainment, recreation, accommodation, and food services sector in 2000 than any other sector (Table 5.3.51).

This is consistent with the territory's tourism economy. Tourism is the primary economic activity, accounting for 80 percent of GDP and employment. The islands normally host two million visitors a year. Tourism is the primary economic activity, accounting for 80 percent of GDP and employment.

The USVI is a popular tourist and excursionist destination and visitors come to the territory by air and water to significantly increase the number of persons on the islands. From 2000 to 2007, an average of 2,503.7 thousand persons visited the territory annually, and there was an annual average of 22.6 visitors for each USVI resident during that time period (Table 5.3.52). In St. Croix, more workers are employed in the educational, health, and social services than any other sector (Table 5.3.51).

More visitors go to St. Thomas/St. John than St. Croix, and most visitors arrive by cruise ship. The number of cruise ships has declined since 1990, but not consistently (Table 5.3.53). In 2008, 756 cruise ships arrived in the USVI and during the first 5 months of 2009, 370 ships arrived as opposed to 426 ships that arrived in 2008 during the same 5 months.

Table 5.3.52. Annual visitors to USVI, 1980, 1990, 1997-2007. *Source*: USVI Bureau of Economic Research.

Year	Visitor Arrivals (in thousands)			Resident Pop.	Visitors/ Res. Pop.
	Total Visitors	Tourists	Excursionists		
1980	1,217.4	380.0	837.4	96,569	12.6
1990	1,811.5	462.5	1,349.0	101,809	17.8
1997	2,128.0	392.9	1,735.1	106,525	20.0
1998	2,138.9	422.3	1,716.6	107,216	19.9
1999	1,964.3	483.8	1,480.5	107,912	18.2
2000	2,395.8	545.9	1,849.9	108,612	22.1
2001	2,497.4	527.2	1,970.2	109,403	22.8
2002	2,336.6	520.2	1,816.4	110,026	21.2
2003	2,392.6	537.9	1,854.4	110,740	21.6
2004	2,619.7	543.6	2,076.1	111,459	23.5
2005	2,601.9	582.1	2,019.8	111,470	23.3
2006	2,574.3	570.0	2,004.3	112,139	23.0
2007	2,611.3	510.5	2,100.8	112,812	23.1
Ave. 2000-07	2,503.7	542.2	1,961.5	110,833	22.6

The manufacturing sector consists of petroleum refining, textiles, electronics, pharmaceuticals, and watch assembly. The agricultural sector is small, with most food being imported. International business and financial services are a small but growing component of the economy. One of the world's largest petroleum refineries, HOVENSA, is on St. Croix.

Most individuals work on their island of residence, and all have average commutes of less than 25 minutes (Table 5.3.51).

Table 5.3.53. USVI cruise ship arrivals, 1980-2007.

Year	St. Croix Visitor Arrivals (in 1,000s)			St. Thomas/St. John Visitor Arrivals (in 1,000s)		
	Air Visitors (tourists & excursionists)	Cruise Passengers	Actual Number Cruise Ships	Air Visitors (tourists & excursionists)	Cruise Passengers	Actual Number Cruise Ships
1980	133.2	56.4	62	392.7	635.1	821
1990	181.4	13.1	14	510.5	1,117.2	1,140
1997	140.8	178.0	107	368.0	1,560.2	941
1998	135.2	154.3	96	388.2	1,547.1	902
1999	132.4	164.6	89	428.2	1,363.3	776
2000	147.0	232.4	139	480.8	1,719.8	949
2001	136.4	237.4	138	469.6	1,790.5	909
2002	126.8	120.5	71	471.2	1,671.3	812
2003	114.9	23.0	25	505.9	1,751.9	878
2004	130.8	25.0	11	524.2	1,960.9	922
2005	144.5	54.5	48	544.8	1,910.2	814
2006	135.3	35.2	25	535.5	1,901.3	776
2007	132.1	7.1	6	561.3	1,917.4	750

The annual per capita consumption of fish and shellfish for human food is higher in the USVI than in Puerto Rico. During the three-year period from 2003 to 2005, it averaged 29.6 pounds (Figure 5.3.20).

DRAFT

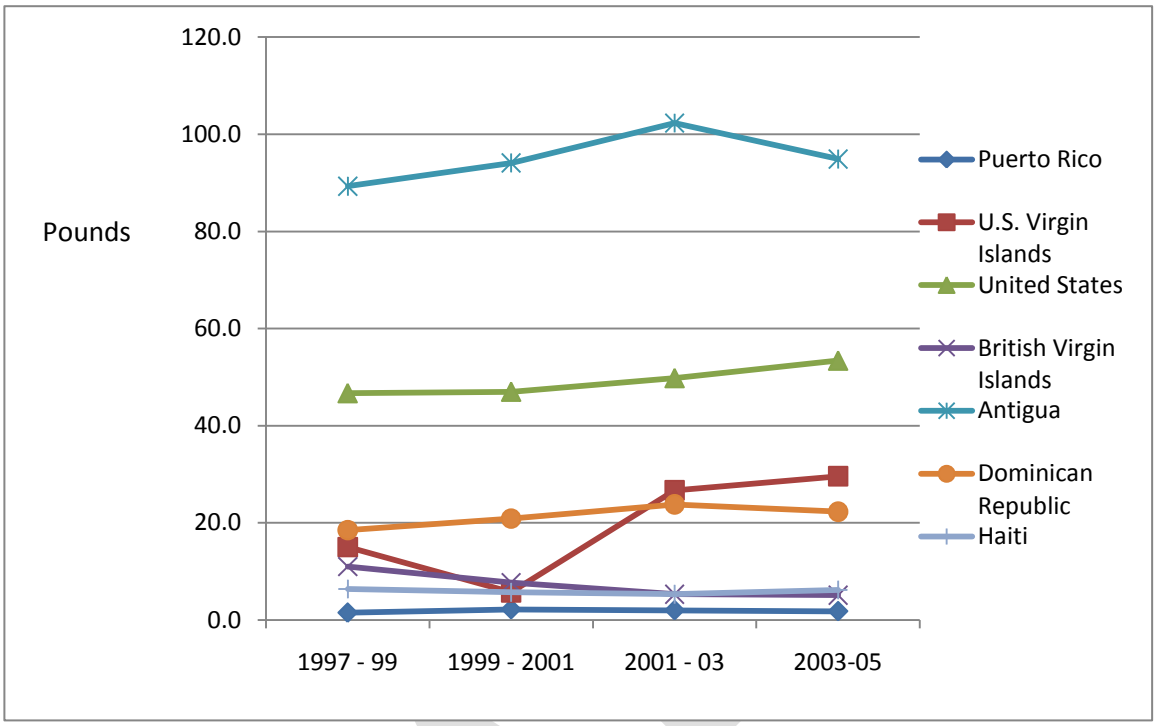


Figure 5.3.20. Average annual per capita consumption of fish and shellfish for human food for four 3-year periods (pounds of estimated live weight equivalent).

5.3.5 Demographics

5.3.5.1 Puerto Rico

The population of Puerto Rico in 2000 was about 3.8 million persons, and as of July 2009, it is estimated to be 3.97 million (CIA-The World Fact Book 2009). In 2000, approximately 24 percent of the population was 14 years and younger, 65 percent from 15 to 64 years of age, and about 11 percent were 65 years and older. The median age was 32 years. Approximately 52 percent of the population is female.

A large majority of Puerto Rico's population identify themselves as white (about 81 percent). Approximately 8 percent are black or African American and less than half a percent are American Indian and Alaska Native. Similarly, less than quarter of a percent are Asian. A dominant majority (almost 99 percent) of the population is Hispanic or Latino (of any race), and 95 percent self-identify as Puerto Rican.

Puerto Rico has one of the highest population densities in the world. As of 2008, there were 1,151 persons per square miles (44 per square kilometer), up from 1,109 persons/ mi^2 in 2000. In 2000, it ranked third in the U.S. behind the District of Columbia (9,378 persons/mi^2) and New Jersey (1,138 persons/mi^2). According to www.siteatlas.com, Puerto Rico ranks 27th in the world in population density: (http://www.sitesatlas.com/Thematic-Maps/Population-density.html).

According to the CIA-The World Factbook (2009), 98 percent of the population lives in urban areas, and the urbanization rate is 0.8 percent.

High poverty rates have been persistent in Puerto Rico. In 2007, 45.5 percent of the territory's population for whom poverty status could be determined lived in families with income below the poverty level (U.S. Census Bureau, Puerto Rico Community Survey). To place that in comparison to the 50 States, Mississippi's 20.6 percent poverty rate was the highest among the States, followed by Louisiana (18.6 percent), New Mexico (18.1 percent), Arkansas (17.9 percent), and Kentucky (17.3 percent). The top five states with the lowest poverty rates were New Hampshire (7.1 percent), Connecticut (7.9 percent), Hawaii (8.0 percent), Maryland (8.3 percent), and New Jersey (8.6 percent). The territory's high poverty rate in 2007 is not unusual. Its poverty rate was 45.3 percent for 2006-08, 44.9 percent in 2005, 48.2 percent in 2000, percent in 1990, 57 percent in 1980 and 63 percent in 1970.

During the three-year period from 2006-08, an estimated 56.1 percent of children under 18 years of age lived below the poverty level (U.S. Census Bureau, Puerto Rico Community Survey). Also, an estimated 262,175 (21.6 percent) of the 1,213,446 persons that comprised the employed civilian labor force 16 years and older lived below poverty level. During the same time period, 66.2 percent of the unemployed civilian labor force 16 years and over lived below poverty level.

It is well known that most Puerto Ricans move between Puerto Rico and the United States in significant numbers (Aranda 2007, Rodríguez 1989). In 2007, there were 4,120,205 Puerto Ricans living in the United States, while Puerto Rico's population for that year was 3,942,375 (U.S. Census Bureau, American and Puerto Rico Community Surveys).

According to the CIA-The World Factbook (2009), approximately 94 percent of the population 15 years of age or older is literate. An increasing percent of Puerto Rico's 25 years and older population has some college or a college degree.

5.3.5.2 Puerto Rico Municipalities

This section divides the territory by coastline and lists the municipalities that have significant landings in one or more of the species or species grouper that are the focus of this amendment. These municipalities are described in Griffith et al. 2007.

5.3.5.2.1 West Coast

The west coast accounts for the majority of annual silk and blackfin snapper (SU1) and misty grouper (GU4) commercial landings. During the three-year period from 2004 to 2006, 70 to 75 percent of annual silk snapper landings (in pounds) and 47 to 69 percent of annual blackfin snapper landings were on the west coast. During the same period, 80 to 91.7 percent of annual misty grouper commercial landings (in pounds) occurred on the west coast (Matos-Caraballo 2007). These landings are consistent with the fact that four

silk snapper and two blackfin snapper spawning aggregation sites are found on the southwest coast.

On the west coast of Puerto Rico are the coastal municipalities of Cabo Rojo, Mayagüez, Añasco, Rincón, Aguada, and Aguadilla. Silk snapper represents the top species landed in three of these 6 municipalities and the second most landed species in another (Table 5.3.54). In Rincón, queen snapper (SU2) is the most landed species, and it represents 28.6 percent of the municipality's annual landings from 1999 to 2003.

Table 5.3.54. West coast municipalities where snapper, grouper, parrotfish and/or queen conch were top three species or species groups by pounds, 1999-2003. *Source*: Griffith et al. 2007.

Municipality	1st Species	2nd Species	3rd Species
Cabo Rojo	Lobster 17.8%	Boxfishes 9.8%	***Lane Snapper 6.7%***
Mayagüez	***Yellowtail Snapper 12.6%***	***Lane Snapper 11.1%***	King Mackerel 7.5%
Añasco	***Silk Snapper 14.1%***	***Lane Snapper 9.6%***	Lobster 6.0%
Rincón	***Queen Snapper 28.6%***	***Silk Snapper 25.1%***	Dolphin 5.1%
Aquada	***Silk Snapper 13.0%***	Skipjack Tuna 8.5%	King Mackeral 7.6%
Aguadilla	***Silk Snapper 12.9%***	Skipjack Tuna 10.0%	King Mackerel 9.9%

The west coast tends to dominate landings of misty and yellowfin grouper, which are part of GU4. Seven yellowfin grouper spawning aggregation sites are along the west coast.

The majority of Puerto Rico's commercial landings of conch are on the west coast where the wide insular shelf provides extensive conch habitat. West coast landings represented an average of 53 percent of annual landings of conch from 1997 to 1999 and about 67 percent from 2004 to 2006, for example. Rivera's survey of commercial fishers found 73 of the territory's 209 conch fishers were from Cabo Rojo (64 fishers), Mayagüez (8) and Anasco (1).

The west coast ranks second among the four coasts in parrotfish landings, with an average of 33.6 percent of annual parrotfish landings from 1997 to 1999 and 29.3 percent from 2004 to 2006.

The west coast has substantially more queen snapper landings than the other coasts combined. West coast landings of queen snapper represented an average of 94 percent of Puerto Rico's annual landings of the species. The west coast also accounts for the largest

share of cardinal snapper landings. From 2004 to 2006, from 71 to 83 percent of Puerto Rico's annual cardinal snapper landings were on the west coast.

More detailed socioeconomic information for each municipality can be found in Griffith et al. (2007).

5.3.5.2.2 East Coast

The east coast takes a large share of the annual vermilion snapper (SU1) landings, ranking from second to first by coast (Table 5.3.55). From 2004 to 2006, from 27.6 to 50.3 percent of the vermilion snapper landed were on the east coast.

Table 5.3.55. East coast municipalities where snapper, grouper, parrotfish, and/or queen conch were top three species or species groups by pounds, 1999-2003. *Source*: Griffith et al. 2007.

Municipality	1st Species	2nd Species	3rd Species
Fajardo	***Yellowtail Snapper 17.9%***	Lobster 7.7%	King Mackerel 5.4%
Vieques	Lobster 15.4%	***Yellowtail Snapper 8.7%***	Triggerfish 6.5%
Culebra	***Nassau Grouper 17.2%***	Lobster 15.4%	Triggerfish 15.1%
Humacao	Lobster 13.7%	***Yellowtail Snapper 9.3%***	White Grunt 7.8%
Yabucoa	***Yellowtail Snapper 12.7%***	***Lane Snapper 10.8%***	White Grunt 10.8%
Maunabo*	***Lane Snapper 12.3%***	White Grunt 11.9%	Lobster 9.3%
Naguabo	Lobster 18.7%	1st class fish 16.1%	3rd class fish 13.7%
Ceiba	***White Grunt 12.5%***	Lobster 7.7%	Boxfishes 5.4%

*Actually on the southeast coast. For purposes here, it is included in the municipalities on the east coast.

In 2005 and 2006, approximately 68 and 62 percent of the territory's landings of yellowfin grouper were on the east coast. Ten yellowfin grouper spawning aggregation sites are along the east coast.

Yellowtail snapper (SU4) is the top species landed in Fajardo and Yabucoa and second most landed species in Vieques and Humacao.

Nassau grouper was the top species landed in Culebra from 1999 to 2003, before the closing of that fishery in 2004. Approximately 26 percent of Puerto Rico's 209 commercial conch fishers in 1999 were from the east coast (Rivera 1999), and 20 were

from Naguabo, 13 from Vieques, ten from Fajardo, nine from Ceiba and three from Humacao.

The eight east coast municipalities are: Fajardo, Vieques, Culebra, Humacao, Yabucao, Maunabo, Naguabo, Ceiba,

For more detailed information about each of these east coast municipalities, see Griffith et al. (2007.

5.3.5.2.3 South Coast

The south coast tends to have the largest parrotfish landings. From 1997 to 1999 and 2004 to 2006, the south coast's average annual share of the territory's commercial parrotfish landings ranged from 48.1 percent (1997 to 1999) to 57.5 percent (2004 to 2006). Parrotfish was the top species landed in Arroyo and third highest species landed in Patillas from 1999 to 2003 (Table 5.3.56). Thirty-two potential spawning aggregation sites are along the southwest coast.

Table 5.3.56. South coast municipalities where snapper, grouper, parrotfish, and/or queen conch were top three species or species groups by pounds, 1999-2003. *Source*: Griffith et al. 2007.

Municipality	1st Species	2nd Species	3rd Species
Ponce	***Yellowtail Snapper 18.1%***	***Lane Snapper 13.5%***	***Snapper (generic) 9.1%***
Guayanilla	White Grunt 12.1%	***Mutton Snapper 8.6%***	***Lane Snapper 8.4%***
Guanica	Lobster 14.0%	***Yellowtail Snapper 12.0%***	Hogfish 9.0%
Juana Diaz	Lobster 32.2%	***Lane Snapper 17.5%***	Other fishes 7.5%
Santa Isabel	***Lane Snapper 22.2%***	Lobster 9.3%	***Yellowtail & Mutton Snapper 8.7%***
Salinas	***Lane Snapper 15.7%***	***Yellowtail & Mutton Snapper 9.5%***	White Grunt/Lobster 9.0%
Guayama	Lobster 9.0%	White Grunt 8.4%	***Lane Snapper 8.3%***
Patillas	Lobster 11.8%	***Lane Snapper 6.8%***	***Parrotfish 6.0%***
Arroyo	***Parrotfish 15.1%***	Lobster 10.4%	Ballyhoo 7.0%
Peñuelas	Lobster 26.0%	Hogfish 16.3%	Octopus 11.8%
Lajas	Lobster 8.2%	White Grunt 7.8%	***Lane Snapper 6.5%***

Lane snapper was the top species landed in Santa Isabel and Salinas, the second most frequently landed species in Ponce, Juana Diaz and Patillas, and third most commonly

landed species in Guayanilla, Guayama and Lajas. Lane snapper is not one of the species in the fisheries experiencing overfishing; however, if an ACL were established for all snapper, lane snapper fishers could be affected.

Approximately 24 percent (50 fishers) of Puerto Rico's commercial conch fishers in 1999 were from the south coast (Rivera 1999). Sixteen were from Guanica, 15 were from Peuelas, 12 from Guayanilla, 6 from Lajas, and one from Juana Diaz.

The 11 south coast municipalities are Lajas, Guánica, Juana Díaz, Ponce, Guayama, Salinas, Guayanilla, Peñuelas, Santa Isabel, Arroyo, and Patillas. For more detailed information about each of these south coast municipalities, see Griffith et al. (2007.

Table 5.3.57. North coast municipalities where snapper, grouper, parrotfish, and/or queen conch were top three species or species groups by pounds, 1999-2003. *Source*: Griffith et al. 2007.

Municipality	1st Species	2nd Species	3rd Species
San Juan	***Yellowtail Snapper 15.0%***	Jacks 8.0%	***Lane Snapper 6.4%***
Isabela	Lobster 20.7%	***Nassau Grouper 14.1%***	***Silk Snapper 12.1%***
Camuy	***Yellowtail Snapper 18.1%***	***Mutton Snapper 10.5%***	King Mackerel 9.2%
Arecibo	***Silk Snapper 32.9%***	King Mackerel 8.7%	Lobster 8.0%
Barceloneta	***Silk Snapper 14.3%***	Triggerfish 8.8%	***Lane Snapper 7.1%***
Vega Baja	***Silk Snapper 10.2%***	***Red Hind 7.4%***	Bar Jack 5.7%
Vega Alta	***Silk Snapper 10.3%***	Bar Jack 6.4%	***Red Hind 6.2%***
Dorado	***Silk Snapper 10.0%***	Triggerfish 6.8%	***Schoolmaster 6.4%***
Carolina	Jacks 8.0%	White Mullet 7.6%	***Yellowtail Snapper 7.6%***
Loiza	***Silk Snapper 10.5%***	***Vermilion Snapper 8.5%***	***Yellowtail Snapper 6.6%***
Rio Grande	***Yellowtail Snapper 11.1%***	***Vermilion Snapper 9.9%***	White Grunt 9.3%
Luquillo	White Grunt 10.3%	***Lane Snapper 7.2%***	King Mackerel 6.2%
Cataño	Jacks 7.9%	Mojarras 6.9%	White Grunt 5.5%
Toa Baja	Jacks 7.9%	Mojarras 6.9%	White Grunt 5.5%
Manatí	Herrings 5.7%	White Mullet 5.6%	Jacks 4.9%
Hatillo*			

*: Griffith et al. (2007) suggest there were little to no commercial landings in Hatillo during this period.

DRAFT

5.3.5.2.4 North Coast Municipalities

From 2004 to 2006, the north coast landed, on average, 42 percent of all vermilion snapper commercially landed annually. Silk snapper was the top most landed species in six north coast municipalities and the third most landed species in another from 1999 to 2003 (Table 5.3.57). Vermilion snapper, which is also part of SU1, was the second most landed species in Loiza and Rio Grande. Nassau grouper (GU1) was the second most landed species in Isabela from 1999 to 2003, which was before the fishery closed in 2004. Approximately 15 percent (31 individuals) of Puerto Rico's commercial conch fishers in 1999 were from the north coast (Rivera 1999). Seven of these north coast fishers were from Loiza, seven were from San Juan, six were from Isabela, four were from Manati, and the others were from Dorado (3) Arecibo (2), Carolina (1), and Rio Grande (1).

There are 15 municipalities on the north coast. They are Arecibo, Loiza, Vega Baja, Cataño, Rio Grande, Carolina, Barceloneta, Vega Alta, Dorado, Manatí, Isabela, Luquillo, Camuy, Hatillo, and Toa Baja. More detailed descriptions of north coast municipalities can be found in Griffith et al. 2007.

5.3.5.3. U.S. Virgin Islands

The resident population of the USVI has grown from 96,569 in 1980 to an estimated 112,812 persons in 2007. The population of St. Thomas/St. John tends to be slightly larger than that of St. Croix. With a total land area of 82.88 square miles, the population density of the USVI in 2007 was 843.6 persons per square mile (667.1 persons per square mile in St. Croix, 222.3 persons per square mile in St. John and 1,701.7 persons per square mile in St. Thomas). When compared to the population density of states/territories of the mainland U.S., the USVI ranks behind the District of Columbia (9.581.3 persons per square mile), New Jersey (1,171 persons per square mile), and Rhode Island (1,012.3 persons per square mile).

In 2000, the total number of households in the USVI was 40,648. Sixty-six percent of these were family households, and of these, 36 percent were two-person and 25 percent were three-person households. These percentages were generally the same across all counties. About 88 percent of non-family households contained only one person.

There were a total of 50,202 housing units in the territory in 2000. Of the total housing units, 37 percent were owner occupied, 44 percent were renter occupied, and 18 percent were reported as vacant. St. John County contained the fewest units (5 percent of the total), while St. Croix and St. Thomas each accounted for about half of the remaining 95%.

Also in 2000, in 68 percent of the households the primary language spoken in the home was English, followed by Spanish or Spanish Creole spoken in 20 percent, French or French Creole spoken in 10 percent, and other languages spoken in two percent of the homes.

Of the total population, 48 percent were born in the USVI, 34 percent were born in a foreign country, 14 percent were born in the United States, and 4 percent were born in Puerto Rico or another U.S. island area. Of the three counties (St. John, St. Thomas, and St. Croix) the county with the highest number of individuals born in the USVI was St. Croix with 23 percent.

In 2000, 26 percent of the adult population (25 years of age and over) had a high school diploma. Approximately 18 percent had some college or an associate's degree and 17 percent held a bachelor's degree or higher. In all education attainment categories, females outnumbered males excluding those that have not received a high school diploma.

The median household income in the territory was approximately $26,925 in 2000 ($21,401 in St. Croix, $32,482 in St. John, and $26,893 in St. Thomas). Like Puerto Rico, the USVI has a significantly higher poverty rate than any of the 50 States. In 1999, 32.5 percent of the territory's population was living below the poverty level (38.7 percent in St. Croix, 18.5 percent in St. John, and 27.2 percent in St. Thomas). Ten years earlier, 27.1 percent of the territory's population had incomes below poverty level.

In the 1990s, the U.S. economy grew substantially and had the lowest child poverty rate in 20 years. In the USVI, however, economic conditions for children and families deteriorated during those years (Annie E. Casey Foundation 2002). In 1989, 23.2 percent of all USVI families had incomes below poverty level (29.5 percent in St. Croix, 11.6 percent in St. John, and 17.7 percent in St. Thomas). By 1999, 28.7 percent of all families had incomes below poverty level (34.8 percent in St. Croix, 14.8 percent in St. John, and 23.2 percent in St. Thomas). In 1999, 42.1 percent of families with children in St. Croix had incomes below poverty level, while 18.4 percent of such families in St. John and 23.2 percent of such families in St. Thomas had incomes below poverty level (U.S. Census Burearu 2000). The highest child poverty rates were in the St. Croix towns of Frederiksted (68 percent) and Christiansted (61 percent) and the lowest in West End, St. Thomas (14 percent) (Annie E. Casey Foundation 2002). From 2000 to 2006, 31 percent to 42 percent of children lived in poverty annually, averaging 35 percent (Annie E. Casey Foundation and the Population Reference Bureau 2002).

The number of persons and households participating in the Supplemental Nutrition Assistance Program (formerly, the Food Stamp Program) has increased significantly in recent years in comparison with previous fiscal years. Household participation increased by 24.8 percent and participation by persons by 20.7 percent from March 2008 to March 2009. Such an increase suggests there could be a significant increase in the number of persons and households engaged in subsistence fishing within the same time period.

Tourism is the primary economic activity, accounting for 80 percent of GDP and employment. The islands normally host 2 million visitors a year. The manufacturing sector consists of petroleum refining, textiles, electronics, pharmaceuticals, and watch assembly. The agricultural sector is small, with most food being imported. International business and financial services are a small but growing component of the economy. One of the world's largest petroleum refineries is at St. Croix. Most workers are employed in

the arts, entertainment, recreation, accommodation, and food services sector, which is consistent with the territory's tourism economy.

5.3.5.4. Islands of USVI

5.3.5.4.1. St. Croix

The top ranked species group targeted by St. Croix fishers is reef fish (84.7 percent) followed by deepwater snapper (42.3 percent) and conch (39.1 percent). St. Croix commercial fishers land their catch at 18 different sites on the island. The most popular landing sites in St. Croix are Altona Lagoon (aka Augusta Landing Site), Molasses Dock (aka Krauss Lagoon), and Frederiksted Fishers' Pier. Many St. Croix commercial fishers use multiple landing sites. Approximately 35 percent reported that they use 2 or more sites to land their catch.

Stoffle et al. (2009) argue that the island of St. Croix may be a fishing community because of its dependency on marine resources and the long cultural connection the people and the island of St. Croix have with fishing. However, Valdez-Pizzini et al. (2010) agree with Stoffle et al. only if the definition of a fishing community includes network-based communities. Current federal definitions do not include network-based communities. The MSA specifically limits fishing communities to place-based communities.

According to Valdes-Pizzini et al. (2010: viii), "In St. Croix placed-based fishing communities do not exist. The whole island may be classified as a fishing community based on network relations among fishers. The historical pattern of population dispersal scattered fishers and their families throughout the island. Gallows Bay is in appearance a [place-based] fishing community, but the data state otherwise."

More detailed socioeconomic descriptions of St. Croix and fishing there can be found in Stoffle et al. (2009) and Valdes-Pizzini et al. (2010) and are incorporated by reference.

5.3.4.2.2 St. John

About 82 percent of St. John commercial fishers land their catches at either Cruz Bay or Coral Bay. No commercial fishers from St. John reported landing their catch outside the island. More St. Thomas/St. John fishers target reef fish (77.7 percent) than any other species group. The fewest target deepwater snapper (4.5 percent).

Impact Assessment Inc. (2007) identified two areas of St. John that may qualify as fishing communities under federal definitions and guidelines. These are the East End and West End districts where Coral Bay and Cruz Bay are located.

More detailed socioeconomic descriptions of St. John and fishing there can be found in Impact Assessment, Inc. (2007).

5.3.4.2.3 St. Thomas

Impact Assessment, Inc. (2007) identified three areas of St. Thomas that may qualify for fishing community status under federal definitions and guidelines. These are the Northside, East End, and Southside districts. Forty-one fishers were located in estates on the East End, 51 were located in estates on the Northside, and 53 were located throughout Southside district.

More detailed socioeconomic descriptions of St. Thomas and fishing there can be found in Impact Assessment, Inc. (2007).

5.4 Administrative Environment

5.4.1 Federal Fishery Management

Federal fishery management is conducted under the authority of the Magnuson-Stevens Act (16 U.S.C. 1801 et seq.), originally enacted in 1976 as the Fishery Conservation and Management Act. The Magnuson-Stevens Act claims sovereign rights and exclusive fishery management authority over most fishery resources within the U.S. EEZ, an area extending from the seaward boundary of each coastal state to 200 nautical miles from shore, 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 Secretary of Commerce (Secretary) and eight regional fishery management councils that represent the expertise and interests of constituent states/territories. Regional councils are responsible for preparing, monitoring, and revising management plans for fisheries needing management within their jurisdiction. The Secretary is responsible for promulgating regulations to implement proposed plans and amendments after ensuring management measures are consistent with the Magnuson-Stevens Act and with other applicable laws summarized in Appenix 4. In most cases, the Secretary has delegated this authority to NMFS.

The Caribbean Fishery Management Council is responsible for fishery resources in federal waters of the U.S. Caribbean. These waters extend to 200 nautical miles offshore from the nine-mile seaward boundary of the Commonwealth of Puerto Rico and the three-mile seaward boundary of the territory of the USVI.

The Council consists of seven voting members: four public members appointed by the Secretary, one each from the fishery agencies of Puerto Rico and the USVI, and one from NMFS. Public interests are also 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. In addition, the regulatory process is in accordance with the Administrative Procedures Act, in the form of "notice and comment" rulemaking, which provides extensive opportunity for public scrutiny and comment, and requires consideration of and response to those comments.

Regulations contained within FMPs are enforced through actions of NOAA's Office of Law Enforcement, the United States Coast Guard, and various territorial authorities. To better coordinate enforcement activities, federal and territory enforcement agencies have developed cooperative agreements to enforce the Magnuson-Stevens Act. But enforcement in the Caribbean region is severely underfunded. Because personnel and equipment are limited, enforcement depends largely on voluntary compliance (The Heinz Center 2000).

5.4.2 Territory Fishery Management

The governments of the Commonwealth of Puerto Rico and the Territory of the USVI have the authority to manage their respective state fisheries. As a Commonwealth, Puerto Rico has an autonomous government, but is voluntarily associated with the United States. The USVI is an unincorporated territory with a semi-autonomous government and its own constitution (OTA 1987).

Puerto Rico has jurisdiction over fisheries in waters extending nine nautical miles from shore. Those fisheries are managed by the Fisheries Research Laboratory of Puerto Rico's Department of Natural and Environmental Resources. Section 19 of Article 6 of the Constitution provides fishery rules and regulations.

The USVI has jurisdiction over fisheries in waters extending three nautical miles from shore, with the exception of about 5,650 acres of submerged lands off St. John, which are owned and managed by the National Park Service (Goenaga and Boulon 1991). The VIDPNR is the USVI's fishery management agency.

Each state fishery management agency has a designated seat on the Council. The purpose of territory representation at the council level is to ensure territory participation in federal fishery management decision-making and to promote the development of compatible regulations in territory and federal waters. The territorial governments have the authority to manage their respective territorial fisheries. Each of the territories exercises legislative and regulatory authority over their territories' natural resources through discrete administrative units. Although each agency is the primary administrative body with respect to the territories' natural resources, all territories cooperate with numerous territory and federal regulatory agencies when managing marine resources.

Additional information regarding fishery management in territorial or federal waters can be found in Section 2.1 of the Comprehensive SFA Amendment (CFMC 2005).

DRAFT

6.0 ENVIRONMENTAL CONSEQUENCES

6.1 ACTION 1: Amend the Stock Complexes in the Reef Fish Fishery Management Units (FMU)

6.1.1 Direct and Indirect Effects on the Physical, Biological, and Ecological Environment

Action 1(a) Grouper units

Alternative 1 is the no action alternative. As such, it would have no direct or indirect effects on the physical, biological, or ecological environment beyond the baseline. **Alternative 2** proposes to remove creole-fish from the FMU, a change that will have minimal consequences because creole-fish are rarely caught in either the commercial or recreational fisheries. However, **Alternative 2** also proposes to add black grouper to GU4, and this fish is frequently caught by recreational fishers in Puerto Rico waters. Adding black grouper to the FMU will allow for closer monitoring of the harvest of this constituent reef predator, potentially stabilizing the black grouper population and its role in the reef ecosystem. Black grouper tend to include more pelagic fish in their diet relative to other grouper species that specialize on benthic prey (Jory and Iversen 1989) and thereby occupies a unique niche relative to its congeners. Because black grouper occupy caves and crevices on the reef when not feeding, they also provide an important role in the transfer of materials and energy from the pelagic to the benthic realm. Black grouper are faithful to their home reef, with the result that harvest of individual black grouper may leave a relatively long-term functional void in the reef fish ecosystem from which the individual is harvested. For these reasons, it is important to monitor harvest of black grouper as will be facilitated by actions contained within **Alternative 2**.

Actions contained within **Alternative 2** will also move yellowedge and misty grouper from GU4 to a new GU5 populated by only these two species. Both yellowedge and misty grouper occupy deep-water habitats relative to the other, more shallow-dwelling, members of GU4 so this rearrangement of grouper management units is appropriate. Direct physical, biological, and ecological effects will be minimal although indirect effects may be important. Those indirect effects would stem from better tracking of the harvest of these deep-water species, resulting in more careful and responsive management. Because these deep-water species exhibit slow growth, large asymptotic size, and low natural mortality rates (Manickchand-Heileman and Phillip 2000), it is important and necessary to closely monitor harvest to ensure against overexploitation.

Action 1(b) Snapper units

No action **Alternative 1** will result in no direct or indirect effects on the physical, biological, or ecological environment. Anticipated direct and indirect effects resulting from **Alternative 2**, which proposes to move wenchman from SU2 into SU1 and to add cardinal snapper to SU2, will be minimal. Because wenchman is only being moved from one FMU to another, no direct or indirect effects are anticipated. No direct effects are anticipated as a result of adding cardinal snapper to SU2. Indirect effects may result from

better monitoring of the harvest of this species, resulting in more careful and responsive management.

6.1.2 Direct and Indirect Effects on the Economic and Social Environments

Action 1(a) Grouper units

Alternative 1 is the no action alternative and would have no added economic or social impacts. **Preferred Alternative 2** is an administrative action and would not directly affect the economic and social environment. Its indirect effects are dependent upon subsequent regulatory actions.

Action 1(b) Snapper units

Alternative 1 is the no action alternative, which would have no added economic or social impacts. **Preferred Alternative 2** is an administrative action and would not directly affect the economic and social environment. Its indirect effects are dependent upon subsequent regulatory actions.

6.1.3 Direct and Indirect Effects on the Administrative Environment

Action 1(a) Grouper units

Choosing no action **Alternative 1** would cause little immediate effect on the administrative environment because nothing would change. However, long-term negative effects may be realized. In the case of creole-fish, continued monitoring for this species despite its absence from commercial or recreational harvest increases the burden on law enforcement officers, data managers, and data analysts by requiring their attention to the presence of creole-fish, their continued inclusion of a slot for creole-fish in the data framework, and their continued inclusion of creole-fish in analytical models although the likelihood of creole-fish actually appearing in the catch is very small. These concerns potentially could divert attention from those species actually caught in U.S. Caribbean commercial and recreational fisheries. For those same reasons, **Preferred Alternative 2** would tend to reduce the administrative burden by removing creole-fish from consideration as a member of the grouper FMU, although a one-time burden resulting from the effort required to remove creole-fish from commercial and recreational catch recording forms would be realized.

The effects of choosing no action **Alternative 1** would be negligible with respect to yellowedge, misty, and black grouper.

Balancing the reduction in administrative burden due to the removal of creole-fish, **Preferred Alternative 2** would increase the administrative burden by adding black grouper to GU4. Law enforcement activities would have to take account of the presence of black grouper particularly in the recreational catch, and the addition of this species to the grouper FMU would require modification of data collection, management, and analysis protocols and procedures. While the burden on law enforcement would continue

for the long-term, data recording, management, and analysis burdens would be short-term phenomena that would pass as the collection, management, and analysis procedures are adapted. Moreover, effective management and administration of U.S. Caribbean fisheries would be enhanced, thereby reducing confusion, conflict, and challenge.

The administrative effect of moving yellowedge and misty grouper into a newly created GU5, as proposed in **Preferred Alternative 2**, would be minor. Both of these fish already are included in the grouper FMU so only minor reprogramming of collection, management, and modeling procedures would be required. As with the black grouper, effective management and administration of U.S. Caribbean fisheries would be enhanced, thereby reducing confusion, conflict, and challenge.

Action 1(b) Snapper units

Alternative 1 maintains the status quo and no change in the administrative environment would be expected. Effects on the administrative environment as a result of **Preferred Alternative 2** would be negligible and would emanate primarily from the addition of cardinal snapper to SU2. Addition of cardinal snapper will require modification of data collection, management, and analysis protocols, but this will be a short-term event. The burden on law enforcement will change only minimally because both of these closely related species (wenchman and cardinal snapper) will be included in the FMU so no distinctions will be required. The burden on port samplers will increase because they will be required to distinguish between wenchman and cardinal snapper, two species that have proven to be difficult to properly identify. It is probable that training in procedures to accurately identify the two species will be required, and this effort will continue in response to a constantly changing universe of port samplers.

6.2 ACTION 2: Management Reference Points

Specifying the MSY, overfishing threshold, OY, and ACL of snapper, grouper, parrotfish, and queen conch would not have direct environmental impacts because these parameters (or proxies) simply provide fishery managers with targets and thresholds to use in evaluating fishery status and performance. However, this action would indirectly impact the physical, biological, ecological, social, economic, and administrative environments by influencing the development of fishery management actions to prevent overfishing and optimize yield. Potential indirect impacts are described below.

6.2.1 Direct and Indirect Effects on the Physical, Biological, and Ecological Environment

Most fishery interactions with the physical environment are caused by fishing gear impacts to bottom habitat. Management reference points can influence the extent of these interactions by guiding decisions regarding appropriate catch levels. However, the management measures implemented to manage catches (e.g., bag limits, trip limits, gear restrictions) have a much more substantial impact on the number, nature, and extent of habitat interactions than do the catch levels themselves.

The primary gear types used in federal snapper, grouper, parrotfish, and queen conch fisheries are described in Section 3.0. These include vertical line gear, traps, spear fishing, and hand harvest. Vertical line gear has the potential to snag and entangle bottom structures, which can result in breakage and abrasions (Barnette 2001). Traps can break and damage vulnerable corals, which offer significant benthic structure in the U.S. Caribbean (Barnette 2001). And the cumulative effects of repeated anchoring by fishermen using any harvest method, including spear guns and hand harvest, also can damage (e.g., reduce vertical relief) hard bottom areas where fishing occurs (Barnette 2001).

The management reference point effectively limiting catch levels and, therefore, having the greatest indirect impact on these habitat interactions is the ACL. ACLs effectively limit the total catch of a species, species group or complex that may be taken in any given year without requiring fishery managers to impose additional management controls. As a result, larger ACLs are likely to support less restrictive management controls and increased habitat interactions relative to smaller ACLs.

While the Council did not explicitly specify ACLs for snapper, grouper, parrotfish, and queen conch in the Comprehensive SFA Amendment, the ABC estimates derived from the Council's MSY control rule could be considered to represent the ACLs of these species, species groups or complexes if no additional action were taken through this amendment to revise management reference points (Table 4.2.2). These ABC values are lower than the ACL alternatives considered here for snapper, grouper, and parrotfish and consequently would be expected to best benefit the physical environment by supporting lower catch levels than the action alternatives.[2]

Excluding consideration of sub-alternatives, the range of ACL values specified by **Preferred Alternative 2** and **Alternatives 3** and **4** for the snapper, grouper, parrotfish, and queen conch complexes do not differ enough to notably effect habitat interactions to varying degrees (Table 4.2.2). The ACL values specified by **Sub-alternatives (c)** through **(f)**, including **Preferred Sub-alternative 2(e)** become progressively smaller as the precautionary buffers they propose become increasingly larger, whereas the values associated with **Sub-alternative (g)** and **Preferred Sub-alternative (h)** are the same across all alternatives.

Sub-alternatives (f) through **(c)** would progressively increase habitat interactions, with **Sub-alternative (c)** supporting the highest catch levels and, thus, the largest number of interactions. Selecting **Preferred Sub-alternative (h)** for Nassau grouper, goliath grouper, and queen conch would maintain the current benefits to the physical environment provided by the current Nassau grouper and goliath grouper prohibitions and eliminate any negative environmental impacts of the queen conch fishery. **Sub-alternative (g)** would benefit the physical environment relative to the no action alternative if selected for queen conch but would increase habitat impacts if selected for the parrotfish complex.

[2] The Comprehensive SFA Amendment did not generate an ABC estimate for queen conch.

Action 2(a) Snapper, grouper, and parrotfish complexes

Management reference points impact the biological and ecological environments by defining fishery management objectives regarding the amount of fish that can or should be removed from a population. MSY represents the largest average catch that can be temporally sustained under average environmental conditions. The overfishing threshold (specified as MFMT or OFL) represents the fishing rate or catch level above which overfishing is occurring, meaning the fishery's ability to produce MSY is at risk. ACL represents the annual catch level specified by the Council to prevent overfishing and avoid the implementation of AMs. And OY is the catch level that provides the greatest overall benefit to the Nation, taking into account food production, recreational opportunities, and the protection of marine ecosystems.

Together, these parameters provide fishery managers with reference points against which to measure fishery performance. When data are insufficient to specify these parameters, the NS1 guidelines direct regional fishery management councils to estimate them using reasonable proxies, like long-term average catch, and to consider scientific and management uncertainty in determining the appropriateness of alternative proxies.

Uncertainty is inherent in the fishery management process and stems from a variety of sources, including but not necessarily limited to: catch, abundance, and other parameter estimates; development and parameterization of descriptive population models; and prediction of future environmental conditions affecting fish populations, as well as fisheries' response to changing regulations and anticipated economic, political, and social conditions (Hilborn and Peterman 1996). While it is generally difficult to quantify the degree of uncertainty surrounding specific scientific and/or management decisions, accounting for this uncertainty is essential to effective management particularly in U.S. Caribbean fisheries that are considered to be data poor.

The management reference point alternatives considered here incorporate various degrees of precaution to account for the scientific and management uncertainty underlying fishery management decision-making in the U.S. Caribbean. Their potential biological and ecological impacts on snapper, grouper, parrotfish, and queen conch are described below.

Snapper

The parameter estimates defined by the no action **Alternative 1** proxies for snapper species/species groups are generally the lowest of all those considered under scenarios that incorporate a moderate amount of precaution (Table 4.2.2). Consequently, this alternative would be expected to support relatively low snapper catch rates relative to the action alternatives.

The primary differences between the reference points (or proxies) defined by the no action **Alternative 1** and those evaluated under the action alternatives are: (1) the no action reference points require estimates of catch, stock biomass, and fishing mortality rates, whereas alternatives require only catch estimates; and (2) the no action alternative

estimates reference points at a smaller scale/finer resolution (i.e., for four distinct units within the snapper complex), whereas alternatives estimate aggregate reference points or proxies for the snapper complex as a whole.

Theoretically, the biomass based and fishing-mortality-rate based reference points specified by the no action alternative would be more precise and more effective in preventing overfishing. However, because data are insufficient to estimate biomass and fishing mortality rates in the U.S. Caribbean, these reference points must be calculated based on informed judgment regarding stock status in relation to MSY. As a result, the actual values associated with the present definitions are highly uncertain. In some cases (i.e., MFMT), such values have not even been estimated.

The present practice of defining management reference points at the finest resolution possible could also be considered the ideal approach to monitoring fishery performance. Aggregate reference points would make it more difficult for fishery scientists and managers to monitor the status of individual snapper species. Snapper Unit 1 (silk, black, vermilion and blackfin snapper) is currently classified as subject to overfishing in NMFS' report to Congress on the status of U.S. Fisheries. While NMFS took action to address this overfishing determination through the 2005 Comprehensive SFA Amendment, the response of individual snapper species within these units to this regulatory action would be less apparent if reference points were redefined at the aggregate level. However, over 5% of snapper landed by Puerto Rico fishers and all snapper landed by USVI fishers in recent years (2006-2007) were not identified to species, making it difficult to effectively monitor fishery performance at the species- or unit-level.

Additionally, the proxies defined by no action **Alternative 1** average catches over the longest time period during which data were considered to be relatively reliable at the time the Council approved the Comprehensive SFA Amendment. The NS1 guidelines support using data collected over a long time series to capture the fishery's response to changing conditions. Because fewer years of catch data were available at that time, those proxies incorporated Puerto Rico and USVI catch data prior to 1999. The proxies evaluated in **Alternatives 2-4** do not propose using these data in average catch calculations because the Council no longer considers USVI data collected prior to 1999 to be reliable and favors using a relatively consistent baseline across all islands.

Finally, in contrast to the no action **Alternative 1**, **Preferred Alternative 2** and **Alternatives 3** and **4** do not attempt to incorporate information on recreational snapper catches in the USVI because the MRFSS does not provide this information and no alternative data are available to reliably estimate these landings. As a result, the MSYs specified by these alternative proxies are expected to be underestimated to some degree. According to MRFSS, recreational fisheries landed about 28% of the total snapper catch in Puerto Rico, on average, during 2006-2007, the two years for which data are available following implementation of current management controls to end overfishing.

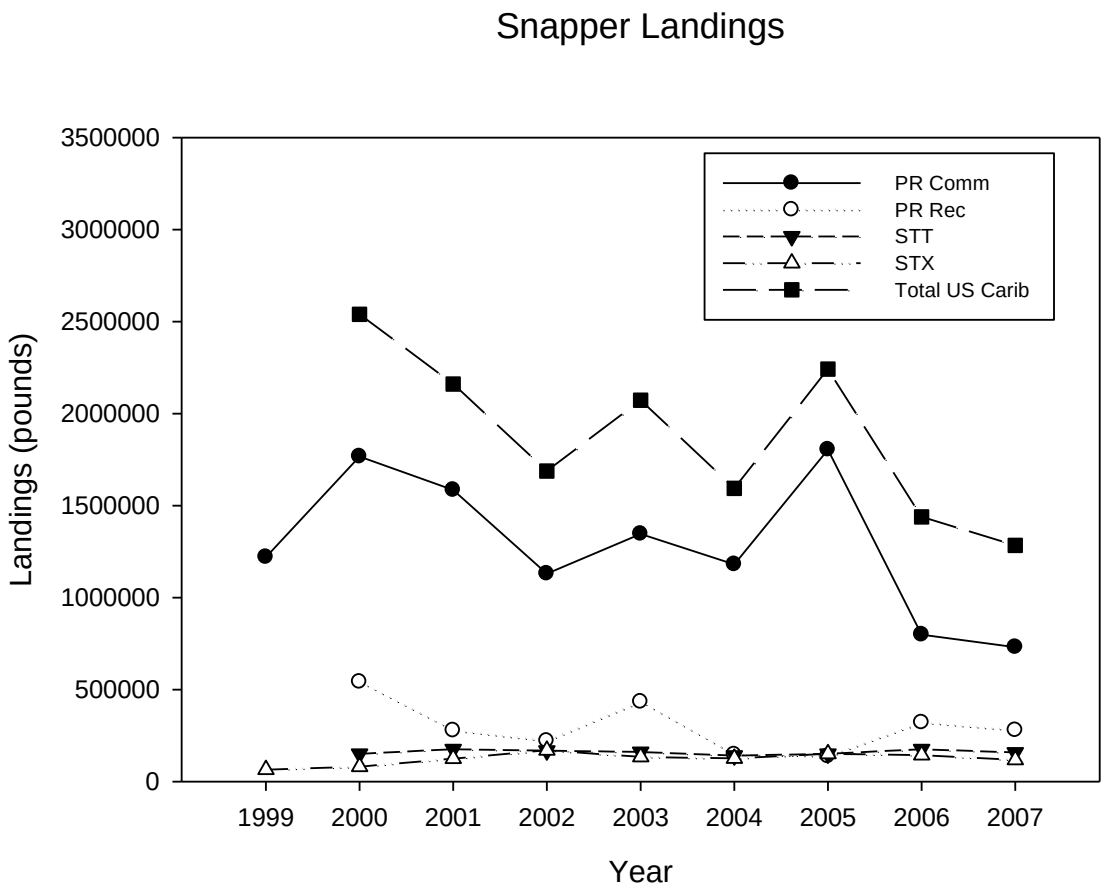


Figure 6.2.1. U.S. Caribbean snapper landings during 1999-2007.

The primary difference between alternative reference point (or proxy) definitions is the time series of catch data on which they are based. **Preferred Alternative 2** would average catches over the longest time period, prior to the 2006 implementation of current management controls, for which the Council considers data to be consistently reliable across all islands. **Alternative 3** would average catches over the longest time period during which landings data are consistently reliable across all islands, including recent years in which harvest was further constrained by management controls. **Alternative 4** would average catches over just the last five years for which data are available (2003-2007), two of which are characterized by the more restrictive management controls in place today.

Preferred Alternative 2 would specify the highest MSY for the snapper complex (2,004,003 lbs), followed by **Alternative 3** (1,861,538 lbs), then **Alternative 4** (1,725,798 lbs) (Table 4.2.2). The MSY values specified by these alternatives differ by no more than 14%, indicating the choice of MSY proxy is not likely to have a substantial impact on current management controls or long-term yield. Figure 6.2.1 illustrates annual snapper landings from 1999 through 2007, the last year for which data are available. The landings

trend appears relatively stable between 1999 and 2005, averaging 2,004,003 pounds annually, before declining to a lower average level in 2006-2007 (1,360,996 lbs).

The overfishing threshold defined by no action **Alternative 1** is an MFMT equal to the fishing mortality rate at MSY. Because this fishing mortality rate is unknown for U.S. Caribbean species, the Comprehensive SFA Amendment adopted natural mortality rate as a proxy for this parameter. However, data are insufficient to evaluate the sustainability of current fishing mortality rates relative to this proxy and make a determination as to whether overfishing is or is not occurring.

Preferred Alternative 2 and **Alternatives 3** and **4** would specify a catch-based overfishing threshold, called the OFL, and annual catches would be evaluated relative to the OFL to determine whether overfishing is or is not occurring. This approach is consistent with the NS1 guidelines, which provide fishery managers the flexibility to determine if overfishing occurs based on either fishing mortality rates or actual annual catch.

Both the ranking and range of the OFL values specified by **Preferred Alternative 2** and **Alternatives 3** and **4** is equal to that described for MSY values as these alternatives would set OFL equal to MSY (Table 4.2.2). Based on recent landings data, the snapper complex would be classified as not subject to overfishing under any of these alternative OFL definitions. Recent landings also are below the current MSY and ABC for the snapper complex in aggregate, indicating actions implemented through the Comprehensive SFA Amendment to end overfishing may have successfully reduced snapper catches to sustainable levels. However, as previously noted, monitoring overfishing at the complex level could mask overfishing of individual species/species groups. Additionally, the recent decline in landings may be attributable to a decline in stock abundance.

While the no action **Alternative 1** does not explicitly define snapper ACLs, the ABC estimates specified by the Council's MSY control rule and detailed in Table 4.2.2 could be considered to represent ACLs if no additional action were taken through this amendment to revise management reference points. However, these ABC values are very uncertain as they were calculated using natural mortality rate as a proxy for the fishing mortality rate that would produce MSY and informed judgment regarding stock biomass. The aggregate value is generally intermediate to those ACL values specified by **Preferred Alternative 2** and **Alternatives 3** and **4**, and would prevent the fishery from achieving OY as currently defined, even though recent data indicates management controls appear to have effectively reduced aggregate catches below the overfishing threshold.

The current OY provides a slight precautionary buffer between catch targets and limits. Restrepo et al. (1998) indicate fishing at that level under equilibrium conditions will reduce the risk of overfishing by 20-30% and will result in equilibrium yields at 94% of MSY or higher. **Preferred Alternative 2** and **Alternatives 3** and **4** would set the OY and ACL as equal values, requiring the Council to consider the socioeconomic and ecological components of OY when determining how far ACLs should be reduced below the

overfishing threshold to account for scientific uncertainty in estimating the OFL and management uncertainty in effectively constraining harvest over time.

The relative ranking of the OY/ACL values specified by **Preferred Alternative 2** and **Alternatives 3** and **4** is equal to that described for the MSY alternatives as most of the OY/ACL values are derived in part from the MSY proxy (Table 4.2.2). Excluding consideration of sub-alternatives, **Preferred Alternative 2** would specify the highest OY/ACL values for the snapper complex, followed by **Alternative 3**, then **Alternative 4**.

Preferred Alternative 2 and **Alternatives 3** and **4** propose essentially the same suite of OY/ACL sub-alternatives for snapper. These sub-alternatives are distinguished from one another by the level of risk (and associated tradeoffs) each would assume. **Sub-alternative (c)** is the most risk prone, proposing to set the OY/ACL equal to the OFL (Table 4.2.2). Preferred **Sub-alternative (e)** and **Alternatives (d)** and **(f)** are progressively more precautionary, incorporating increasingly larger buffers between the OY/ACL and OFL, which are recommended in fisheries characterized by scientific and management uncertainty. **Sub-alternative (f)** would define the OY/ACL to equal 50% of OFL, and is the most precautionary definition of those considered. This definition would provide the largest buffer between catch targets and limits and, consequently, the greatest assurance that management measures designed to achieve OY/ACL would be effective in sustaining snapper species over the long term.

The NS1 guidelines suggest that greater precaution is needed for species, like snapper, with life history characteristics (e.g., slow-growing, moderately long-lived) that make them more vulnerable to overfishing (see Section 3.0). Insufficient precaution could lead to overfishing. Overfishing reduces stock biomass and can reduce the size/age distribution of a population, depress the mean size/age at maturity, and decrease genetic diversity, ultimately resulting in growth overfishing and/or in recruitment failure. Overfishing also may alter the community structure and ecological functions of the supporting reef ecosystem. Snapper are part of a complex reef ecosystem, in which co-occurring species compete for resources, such as habitat and food. Consequently, any effects realized by one species or the complex as a whole are likely to impact in some way the ecological community.

Conversely, excessive precaution could lead fishery managers to constrain catches more than needed to prevent overfishing. This would result in higher biomass levels, reducing the potential for overexploitation and maintaining the age and size structure, sex ratio, and genetic integrity of snapper stocks at levels that better approximate natural conditions. Recruitment is generally highly variable due to natural variability in environmental factors that affect the survival of eggs and larvae. A stock maintained at a high biomass level can generally withstand several years of poor recruitment that may occur due to natural factors, but a stock subjected to overfishing for multiple years would find it more difficult to recover from such a situation.

Grouper

The parameter estimates defined by the no action **Alternative 1** proxies for grouper species/species groups are generally the lowest of all those considered under scenarios that incorporate a moderate amount of precaution (Table 4.2.2). Consequently, this alternative would be expected to support relatively low grouper catch rates relative to the action alternatives.

The primary differences between the reference points (or proxies) defined by the no action **Alternative 1** and those evaluated under the action alternatives are: (1) the no action reference points require estimates of catch, stock biomass, and fishing mortality rates, whereas alternatives require only catch estimates; and (2) the no action alternative estimates reference points at a smaller scale/finer resolution (i.e., for four distinct units within the grouper complex), whereas alternatives estimate aggregate reference points or proxies for the grouper complex as a whole.

Theoretically, the biomass based and fishing-mortality-rate based reference points specified by the no action alternative would be more precise and more effective in preventing overfishing. However, because data are insufficient to estimate biomass and fishing mortality rates in the U.S. Caribbean, these reference points must be calculated based on informed judgment regarding stock status in relation to MSY. As a result, the actual values associated with current definitions are highly uncertain. In some cases (i.e., MFMT), such values have not even been estimated.

The present practice of defining management reference points at the finest resolution possible could also be considered the ideal approach to monitoring fishery performance. Aggregate reference points would make it more difficult for fishery scientists and managers to monitor the status of individual grouper species. Grouper Units 1 (Nassau grouper) and 4 (red, misty, tiger, yellowedge, and yellowfin grouper) are currently classified as subject to overfishing in NMFS' report to Congress on the status of U.S. Fisheries. And Grouper Units 1, 2 (goliath grouper) and 4 are classified as overfished and managed under rebuilding plans.

While regulations have been implemented to end overfishing and rebuild these stocks, the response of individual grouper species to these regulations would be less apparent if reference points were redefined at the aggregate level. However, over 33% of grouper landed by Puerto Rico fishers and all grouper landed by USVI fishers in recent years (2006-2007) were not identified to species, making it difficult to effectively monitor fishery performance at the species- or unit-level. And the Council would still have the option of implementing species-specific regulations, such as the current harvest prohibitions on Nassau and goliath grouper, regardless of whether reference points were defined at the individual or aggregate level.

Additionally, the proxies defined by no action **Alternative 1** average catches over the longest time period during which data were considered to be relatively reliable at the time the Council approved the Comprehensive SFA Amendment. The NS1 guidelines support

using data collected over a long time series to capture the fishery's response to changing conditions. Because fewer years of catch data were available at that time, those proxies incorporated Puerto Rico and USVI catch data prior to 1999. The proxies evaluated in **Preferred Alternative 2** and **Alternatives 3** and **4** do not propose using these data in average catch calculations because the Council no longer considers USVI data collected prior to 1999 to be reliable and favors using a relatively consistent baseline across all islands.

Finally, in contrast to the no action **Alternative 1**, **Preferred Alternative 2** and **Alternatives 3** and **4** do not attempt to incorporate information on recreational grouper catches in the USVI because the MRFSS does not provide this information and no alternative data are available to reliably estimate these landings. As a result, the MSYs specified by these alternative proxies are expected to be underestimated to some degree. According to MRFSS, recreational fisheries landed about 42% of the total grouper catch in Puerto Rico, on average, during 2006-2007, the two years for which data are available following implementation of current management controls to end overfishing.

The primary difference between alternative reference point (or proxy) definitions is the time series of catch data on which they are based. **Preferred Alternative 2** would average catches over the longest time period prior to the 2006 implementation of current management controls for which the Council considers data to be consistently reliable across all islands. **Alternative 3** would average catches over the longest time period during which landings data are consistently reliable across all islands, including recent years in which harvest was further constrained by management controls. **Alternative 4** would average catches over just the last five years for which data are available (2003-2007), two of which are characterized by the more restrictive management controls in place today.

Preferred Alternative 2 would specify the highest MSY for the grouper complex (396,483 lbs), followed by **Alternative 3** (354,853 lbs), then **Alternative 4** (337,178 lbs) (Table 4.2.2). The MSY values specified by these alternatives differ by no more than 15%, indicating the choice of MSY proxy is not likely to have a substantial impact on current management controls or long-term yield. Figure 6.2.2 illustrates annual grouper landings from 1999 through 2007, the last year for which data are available. The landings trend appears relatively stable between 1999 and 2005, averaging 396,483 pounds annually, before declining to a lower average level in 2006-2007 (214,118 lbs).

The overfishing threshold defined by no action **Alternative 1** is an MFMT equal to the fishing mortality rate at MSY. Because this fishing mortality rate is unknown for U.S. Caribbean species, the Comprehensive SFA Amendment adopted natural mortality rate as a proxy for this parameter. However, data are insufficient to evaluate the sustainability of current fishing mortality rates relative to this proxy and make a determination as to whether overfishing is or is not occurring.

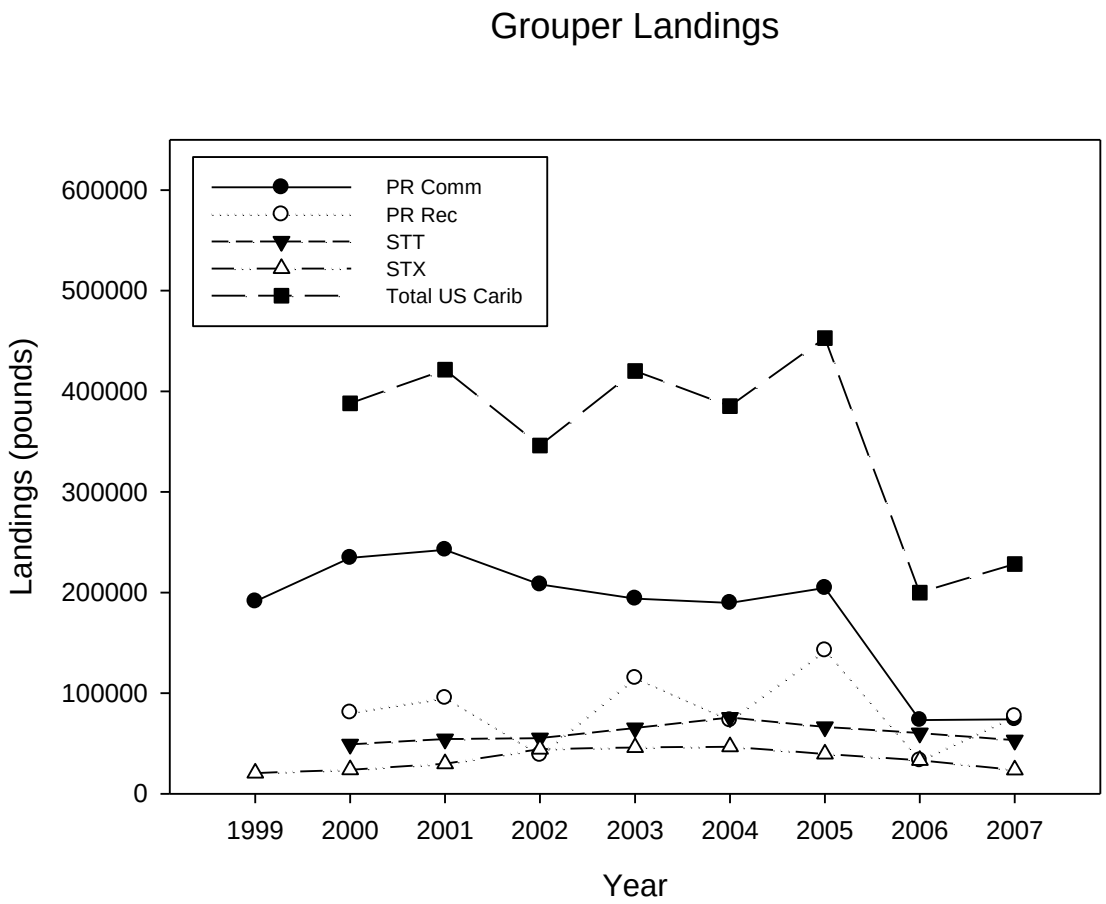


Figure 6.2.2. U.S. Caribbean grouper landings during 1999-2007.

Preferred Alternative 2 and **Alternatives 3** and **4** would specify a catch-based overfishing threshold, called the OFL, and annual catches would be evaluated relative to the OFL to determine whether overfishing is or is not occurring. This approach is consistent with the NS1 guidelines, which provide fishery managers the flexibility to determine if overfishing occurs based on either fishing mortality rates or actual annual catch.

Both the ranking and range of the OFL values specified by **Preferred Alternative 2** and **Alternatives 3** and **4** is equal to that described for MSY values as these alternatives would set OFL equal to MSY (Table 4.2.2). Based on recent landings data, the grouper complex would be classified as not subject to overfishing under any of these alternative OFL definitions. Recent landings also are below the current MSY and ABC for the grouper complex in aggregate, indicating actions implemented through the Comprehensive SFA Amendment to end overfishing may have successfully reduced grouper catches to sustainable levels. However, as previously noted, monitoring overfishing at the complex level could mask overfishing of individual species/species groups. Additionally, the recent decline in landings may be attributed to a decline in stock abundance.

While the no action **Alternative 1** does not explicitly define grouper ACLs, the ABC estimates specified by the Council's MSY control rule and detailed in Table 4.2.2 could be considered to represent ACLs if no additional action were taken through this amendment to revise management reference points. However, these ABC values are very uncertain as they were calculated using natural mortality rate as a proxy for the fishing mortality rate that would produce MSY and informed judgment regarding stock biomass. The aggregate value is relatively low compared to the ACL values specified by **Alternatives 2-4**, and would prevent the fishery from achieving OY as currently defined, even though recent data indicates management controls appear to have effectively reduced aggregate catches below the overfishing threshold.

The current OY provides a slight precautionary buffer between catch targets and limits. Restrepo et al. (1998) indicate fishing at that level under equilibrium conditions will reduce the risk of overfishing by 20-30% and will result in equilibrium yields at 94% of MSY or higher. **Preferred Alternative 2** and **Alternatives 3** and **4** would set the OY and ACL as equal values, requiring the Council to consider the socioeconomic and ecological components of OY when determining how far ACLs should be reduced below the overfishing threshold to account for scientific uncertainty in estimating the OFL and management uncertainty in effectively constraining harvest over time.

The relative ranking of the OY/ACL values specified by **Preferred Alternative 2** and **Alternatives 3** and **4** is equal to that described for the MSY alternatives as most of the OY/ACL values are derived in part from the MSY proxy (Table 4.2.2). Excluding consideration of sub-alternatives, **Preferred Alternative 2** would specify the highest OY/ACL values for the grouper complex, followed by **Alternative 3**, then **Alternative 4**.

Preferred Alternative 2 and **Alternatives 3** and **4** propose essentially the same suite of OY/ACL sub-alternatives for grouper. These sub-alternatives are distinguished from one another by the level of risk (and associated tradeoffs) each would assume. **Sub-alternative (c)** is the most risk prone, proposing to set the OY/ACL equal to the OFL (Table 4.2.2). **Preferred Sub-alternative (e)** and **Sub-alternatives (d)** and **(f)** are progressively more precautionary, incorporating increasingly larger buffers between the OY/ACL and OFL, which are recommended in fisheries characterized by scientific and management uncertainty. **Preferred Sub-alternative (h)** would set ACL equal to zero for Grouper Units 1and 2 (Nassau and goliath grouper), which are currently managed under a total harvest prohibition. This is the most precautionary definition of those considered and would provide the greatest assurance that these species are rebuilt to more sustainable levels.

The NS1 guidelines suggest that greater precaution is needed for species like grouper, which are considered to be particularly vulnerable to overfishing because of their life history (e.g., hermaphroditism) and behavioral (e.g., aggregation) characteristics. Some species, including the graysby, coney, red hind, and red grouper, are protogynous, functioning first as females, then as males. This reproductive strategy may make them particularly vulnerable to fishing because fisheries that target older, larger individuals may reduce the number of males that enter the population. Reducing the density of a

population (Bohnsack 1999) and the proportion of males in a population (Coleman et al. 1999) also reduces the genetic diversity of a population, making it less resilient to environmental change (Bohnsack 1999). Additionally, some species, such as the goliath and Nassau grouper, aggregate in the same locations to spawn, making it easy for fishermen to target and to remove them in large numbers (Coleman et al. 2000).

Insufficient precaution could lead to overfishing. Overfishing reduces stock biomass and can reduce the size/age distribution of a population, depress the mean size/age at maturity, and decrease genetic diversity, ultimately resulting in growth overfishing and/or in recruitment failure. Overfishing also may alter the community structure and ecological functions of the supporting reef ecosystem. Grouper are part of a complex reef ecosystem, in which co-occurring species compete for resources, such as habitat and food. Many large *Epinephelus* species appear to be the resident apex predators of the reef systems they inhabit. Consequently, any effects realized by one species or the complex as a whole are likely to impact in some way the ecological community.

Conversely, excessive precaution could lead fishery managers to constrain catches more than needed to prevent overfishing. This would result in higher biomass levels, reducing the potential for overexploitation and maintaining the age and size structure, sex ratio, and genetic integrity of grouper stocks at levels that better approximate natural conditions. Recruitment is generally highly variable due to natural variability in environmental factors that affect the survival of eggs and larvae. A stock maintained at a high biomass level can generally withstand several years of poor recruitment that may occur due to natural factors, but a stock subjected to overfishing for multiple years would find it more difficult to recover from such a situation.

Parrotfish

The parameter estimates defined by the no action **Alternative 1** proxies for the parrotfish complex are generally the lowest of all those considered under scenarios that incorporate a moderate amount of precaution (Table 4.2.2). Consequently, this alternative would be expected to support relatively low parrotfish catch rates relative to the action alternatives.

The primary difference between the reference points (or proxies) defined by the no action **Alternative 1** and those evaluated under the action alternatives is that the no action reference points require estimates of catch, stock biomass, and fishing mortality rates, whereas alternatives require only catch estimates. Theoretically, the biomass based and fishing-mortality-rate based reference points specified by the no action alternative would be more precise and more effective in preventing overfishing. However, because data are insufficient to estimate biomass and fishing mortality rates in the U.S. Caribbean, these reference points must be calculated based on informed judgment regarding stock status in relation to MSY. As a result, the actual values associated with current definitions are highly uncertain. In some cases (i.e., MFMT), such values have not even been estimated.

Additionally, the proxies defined by no action **Alternative 1** average catches over the longest time period during which data were considered to be relatively reliable at the time

the Council approved the Comprehensive SFA Amendment. The NS1 guidelines support using data collected over a long time series to capture the fishery's response to changing conditions. Because fewer years of catch data were available at that time, those proxies incorporated Puerto Rico and USVI catch data prior to 1999. The proxies evaluated in **Preferred Alternative 2** and **Alternatives 3** and **4** do not propose using these data in average catch calculations because the Council no longer considers USVI data collected prior to 1999 to be reliable and favors using a relatively consistent baseline across all islands.

Finally, in contrast to the no action **Alternative 1**, **Preferred Alternative 2** and **Alternatives 3** and **4** do not attempt to incorporate information on recreational parrotfish catches in the USVI because the MRFSS does not provide this information and no alternative data are available to reliably estimate these landings. As a result, the MSYs specified by these alternative proxies are expected to be underestimated to some degree. According to MRFSS, recreational fisheries landed about 11% of the total parrotfish catch in Puerto Rico, on average, during 2006-2007, the two years for which data are available following implementation of current management controls to end overfishing.

The primary difference between alternative reference point (or proxy) definitions is the time series of catch data on which they are based. **Preferred Alternative 2** would average catches over the longest time period prior to the 2006 implementation of current management controls for which the Council considers data to be consistently reliable across all islands. **Alternative 3** would average catches over the longest time period during which landings data are consistently reliable across all islands, including recent years in which harvest was further constrained by management controls. **Alternative 4** would average catches over just the last five years for which data are available (2003-2007), two of which are characterized by the more restrictive management controls in place today.

Alternative 4 would specify the highest MSY for the parrotfish complex (512,201 lbs), followed by **Preferred Alternative 2** (507,059 lbs), then **Alternative 3** (496,656 lbs) (Table 4.2.2). The MSY values specified by these alternatives differ by no more than 3%, indicating the choice of MSY proxy is not likely to have a substantial impact on current management controls or long-term yield. Figure 6.2.3 illustrates annual parrotfish landings, which were relatively stable from 1999 through 2007, the last year for which data are available. The landings trend appears relatively stable between 1999 and 2005, averaging 507,059 pounds annually, before declining to a lower average level in 2006-2007 (464,819 lbs).

The overfishing threshold defined by no action **Alternative 1** is an MFMT equal to the fishing mortality rate at MSY. Because this fishing mortality rate is unknown for U.S. Caribbean species, the Comprehensive SFA Amendment adopted natural mortality rate as a proxy for this parameter. However, data are insufficient to evaluate the sustainability of current fishing mortality rates relative to this proxy and make a determination as to whether overfishing is or is not occurring.

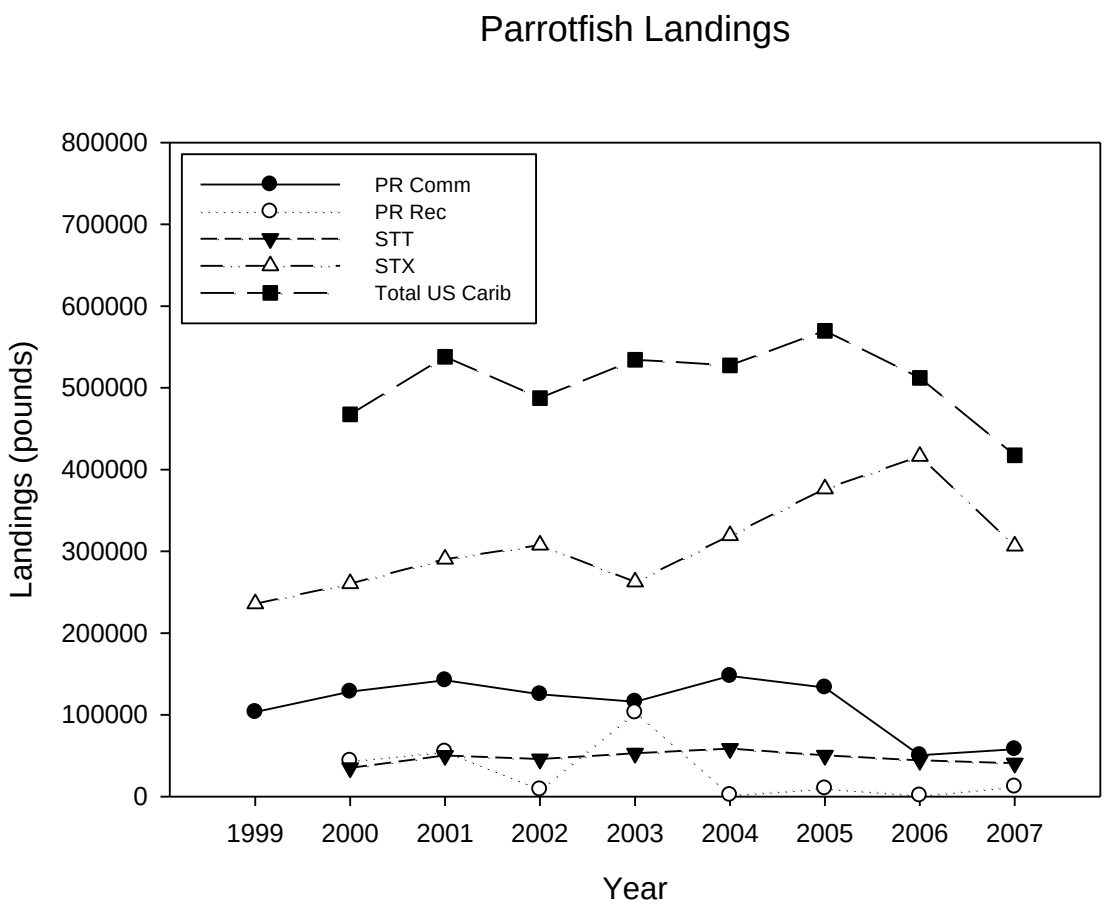


Figure 6.2.3. U.S. Caribbean parrotfish landings during 1999-2007.

Preferred Alternative 2 and **Alternatives 3** and **4** would specify a catch-based overfishing threshold, called the OFL, and annual catches would be evaluated relative to the OFL to determine whether overfishing is or is not occurring. This approach is consistent with the NS1 guidelines, which provide fishery managers the flexibility to determine if overfishing occurs based on either fishing mortality rates or actual annual catch.

Both the ranking and range of the OFL values specified by **Preferred Alternative 2** and **Alternatives 3** and **4** is equal to that described for MSY values as these alternatives would set OFL equal to MSY (Table 4.2.2). Based on recent landings data, the parrotfish complex would be classified as not subject to overfishing under any of these alternative OFL definitions. Recent landings are higher than expected relative to the current MSY and ABC estimates and considering restrictions implemented to end overfishing through the Comprehensive SFA Amendment. The cause of these higher than expected landings is not clear but may be attributed to the delayed implementation of the gillnet prohibition in state waters, increased reporting, or other factors.

While the no action **Alternative 1** does not explicitly define a parrotfish ACL, the ABC estimate specified by the Council's MSY control rule and detailed in Table 4.2.2 could be considered to represent the ACL of this complex if no additional action were taken through this amendment to revise management reference points. However, this ABC value is very uncertain as it was calculated using natural mortality rate as a proxy for the fishing mortality rate that would produce MSY and informed judgment regarding stock biomass. The value is lower than any of the ACL values specified by **Preferred Alternative 2** and **Alternatives 3** and **4**, and would prevent the fishery from achieving OY as currently defined.

The current OY provides a slight precautionary buffer between catch targets and limits. Restrepo et al. (1998) indicate fishing at that level under equilibrium conditions will reduce the risk of overfishing by 20-30% and will result in equilibrium yields at 94% of MSY or higher. **Preferred Alternative 2** and **Alternatives 3** and **4** would set the OY and ACL as equal values, requiring the Council to consider the socioeconomic and ecological components of OY when determining how far ACLs should be reduced below the overfishing threshold to account for scientific uncertainty in estimating the OFL and management uncertainty in effectively constraining harvest over time.

The relative ranking of the OY/ACL values specified by **Preferred Alternative 2** and **Alternatives 3** and **4** is equal to that described for the MSY alternatives as most of the OY/ACL values are derived in part from the MSY proxy (Table 4.2.2). Excluding consideration of sub-alternatives, **Alternative 4** would specify the highest OY/ACL values for the parrotfish complex, followed by **Preferred Alternative 2**, then **Alternative 3**.

Preferred Alternative 2 and **Alternatives 3** and **4** propose essentially the same suite of OY/ACL sub-alternatives for parrotfish. These sub-alternatives are distinguished from one another by the level of risk (and associated tradeoffs) each would assume. **Sub-alternative (c)** is the most risk prone, proposing to set the OY/ACL equal to the OFL (Table 4.2.2). **Sub-alternative (d)**, **Preferred Sub-alternative (e)**, and **Sub-alternative (f)** are progressively more precautionary, incorporating increasingly larger buffers between the OY/ACL and OFL, which are recommended in fisheries characterized by scientific and management uncertainty. **Preferred Sub-alternative (h)** would be expected to best benefit parrotfish, as well as their surrounding ecological environment, because it would set ACL to zero. The ecological benefits of prohibiting directed parrotfish harvest include protecting the critical functions parrotfish perform in coral reef ecosystems. **Sub-alternative (g)** would set ACL equal to the ABC recommended by the Council's SSC for parrotfish. The environmental impacts of **Sub-alternative (g)** are generally intermediate to those associated with **Sub-alternatives (c) and (d)**.

The NS1 guidelines suggest that greater precaution is needed for species like parrotfish, which exhibit life history (e.g., sex reversal) or behavioral (e.g., spawning aggregations) characteristics that make them particularly vulnerable to overfishing or are particularly susceptible to the fishery (e.g., easily captured) (see Section 3.0).

Insufficient precaution could lead to overfishing. Overfishing reduces stock biomass and can reduce the size/age distribution of a population, depress the mean size/age at maturity, and decrease genetic diversity, ultimately resulting in growth overfishing and/or in recruitment failure. Overfishing also may alter the community structure and ecological functions of the supporting reef ecosystem. Parrotfish are part of a complex reef ecosystem, in which co-occurring species compete for resources, and they perform a critical function as grazers (see Section 3.0). Consequently, any effects realized by one species or the complex as a whole are likely to impact in some way the ecological community.

Conversely, excessive precaution could lead fishery managers to constrain catches more than needed to prevent overfishing. This would result in higher biomass levels, reducing the potential for overexploitation and maintaining the age and size structure, sex ratio, and genetic integrity of parrotfish stocks at levels that better approximate natural conditions. Recruitment is generally highly variable due to natural variability in environmental factors that affect the survival of eggs and larvae. A stock maintained at a high biomass level can generally withstand several years of poor recruitment that may occur due to natural factors, but a stock subjected to overfishing for multiple years would find it more difficult to recover from such a situation.

Action 2(b) Queen conch complex

The parameter estimates defined by the no action **Alternative 1** proxies for the queen conch complex would support very high catch rates relative to the action alternatives (Table 4.2.2). The primary difference between the reference points (or proxies) defined by the no action **Alternative 1** and those evaluated under the action alternatives is that the no action reference points require estimates of catch, stock biomass, and fishing mortality rates, whereas alternatives require only catch estimates.

Theoretically, the biomass based and fishing-mortality-rate based reference points specified by the no action alternative would be more precise and more effective in preventing overfishing. However, because data are insufficient to estimate biomass and fishing mortality rates in the U.S. Caribbean, these reference points must be calculated based on informed judgment regarding stock status in relation to MSY. As a result, the actual values associated with current definitions are highly uncertain. In some cases (i.e., MFMT, ABC), such values have not even been estimated.

Additionally, the proxies defined by no action **Alternative 1** average catches over the longest time period during which data were considered to be relatively reliable at the time the Council approved the Comprehensive SFA Amendment. The NS1 guidelines support using data collected over a long time series to capture the fishery's response to changing conditions. Because fewer years of catch data were available at that time, those proxies incorporated Puerto Rico and USVI catch data prior to 1999. The proxies evaluated in **Preferred Alternative 2** and **Alternatives 3** and **4** do not propose using these data in average catch calculations because the Council no longer considers USVI data collected

prior to 1999 to be reliable and favors using a relatively consistent baseline across all islands.

Finally, in contrast to the no action **Alternative 1**, **Preferred Alternative 2** and **Alternatives 3** and **4** do not attempt to incorporate information on recreational queen conch catches in Puerto Rico and the USVI because the MRFSS does not provide this information and no alternative data are available to reliably estimate these landings. As a result, the MSYs specified by these alternative proxies are expected to be underestimated to some degree.

The primary difference between alternative reference point (or proxy) definitions is the time series of catch data on which they are based. **Preferred Alternative 2** would average catches over the longest time period prior to the 2006 implementation of current management controls for which the Council considers data to be consistently reliable across all islands. **Alternative 3** would average catches over the longest time period during which landings data are consistently reliable across all islands, including recent years in which harvest was further constrained by management controls. **Alternative 4** would average catches over just the last five years for which data are available (2003-2007), two of which are characterized by the more restrictive management controls in place today.

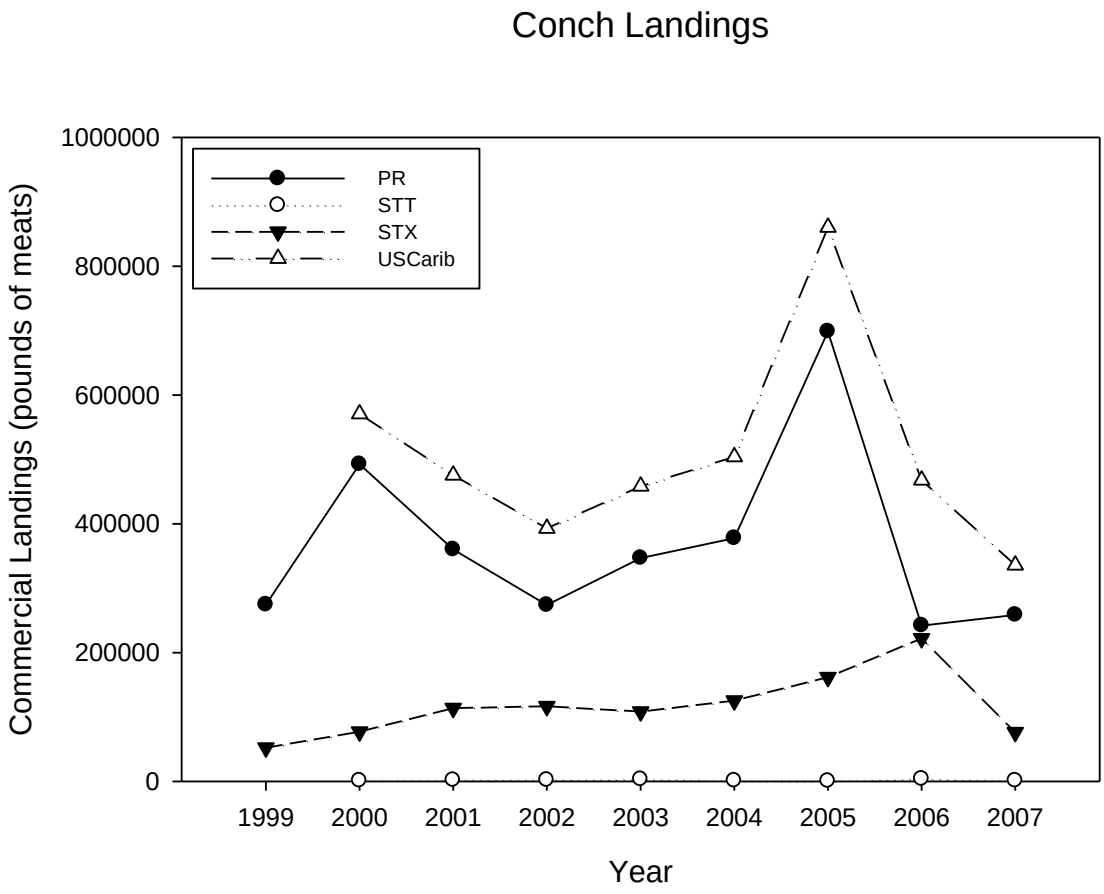


Figure 6.2.4. U.S. Caribbean conch landings during 1999-2007.

Alternative 4 would specify the highest MSY for the queen conch complex (525,152 lbs), followed by **Preferred Alternative 2** (512,718 lbs), then **Alternative 3** (488,073 lbs) (Table 4.2.2). The MSY values specified by these alternatives differ by no more than 7%, indicating the choice of MSY proxy is not likely to have a substantial impact on current management controls or long-term yield. Figure 6.2.4 illustrates annual conch landings from 1999 through 2007, the last year for which data are available. The landings trend appears relatively stable between 1999 and 2004, averaging about 455,000 lbs annually, before sharply peaking at 860,215 in 2005, then declining to a lower average level in 2006-2007 (401,705 lbs).

The overfishing threshold defined by no action **Alternative 1** is an MFMT equal to the fishing mortality rate at MSY. Because this fishing mortality rate is unknown for U.S. Caribbean species, the Comprehensive SFA Amendment adopted natural mortality rate as a proxy for this parameter. However, data are insufficient to evaluate the sustainability of current fishing mortality rates relative to this proxy and make a determination as to whether overfishing is or is not occurring.

Preferred Alternative 2 and **Alternatives 3** and **4** would specify a catch-based overfishing threshold, called the OFL, and annual catches would be evaluated relative to the OFL to determine whether overfishing is or is not occurring. This approach is consistent with the NS1 guidelines, which provide fishery managers the flexibility to determine if overfishing occurs based on either fishing mortality rates or actual annual catch.

Both the ranking and range of the OFL values specified by **Preferred Alternative 2** and **Alternatives 3** and **4** is equal to that described for MSY values as these alternatives would set OFL equal to MSY (Table 4.2.2). Based on recent landings data, the queen conch complex would be classified as not subject to overfishing under any of these alternative OFL definitions. Recent landings also are below the current MSY for the queen conch complex, indicating management action taken to end overfishing successfully reduced queen conch catches to sustainable levels.

The no action **Alternative 1** does not define an ACL for queen conch, or estimate the ABC of the stock due to data limitations (Table 4.2.2). However, the current OY provides a slight precautionary buffer between catch targets and limits. Restrepo et al. (1998) indicate fishing at that level under equilibrium conditions will reduce the risk of overfishing by 20-30% and will result in equilibrium yields at 94% of MSY or higher.

Preferred Alternative 2 and **Alternatives 3** and **4** would set the OY and ACL as equal values, requiring the Council to consider the socioeconomic and ecological components of OY when determining how far ACLs should be reduced below the overfishing threshold to account for scientific uncertainty in estimating the OFL and management uncertainty in effectively constraining harvest over time. Those values are lower than the OY estimated for queen conch in the Comprehensive SFA Amendment, regardless of the OY/ACL alternative selected.

The relative ranking of the OY/ACL values specified by **Preferred Alternative 2** and **Alternatives 3** and **4** is equal to that described for the MSY alternatives as most of the OY/ACL values are derived in part from the MSY proxy (Table 4.2.2). Excluding consideration of sub-alternatives, **Alternative 4** would specify the highest OY/ACL values for the queen conch complex, followed by **Preferred Alternative 2**, then **Alternative 3**.

Preferred Alternative 2 and **Alternatives 3** and **4** propose essentially the same suite of OY/ACL sub-alternatives for queen conch, which are based on average catches landed in St. Croix over various time periods. These sub-alternatives are distinguished from one another by the level of risk (and associated tradeoffs) each would assume. **Sub-alternative (c)** is the most risk prone, proposing to set the OY/ACL equal to the OFL. **Sub-alternatives (d)** through **(f)** are progressively more precautionary, incorporating increasingly larger buffers between the OY/ACL and OFL, which are recommended in fisheries characterized by scientific and management uncertainty. **Preferred Sub-alternative (g)** would set ACL equal to the ABC recommended by the Council's SSC for queen conch, and **Sub-alternative (h)** would set ACL equal to zero.

OY/ACL **Sub-alternative (h)** would be expected to best benefit queen conch and its surrounding ecological environment because it would require fishery managers prohibit all harvest of that species in federal waters. **Preferred Sub-alternative (g)** would be the next most conservative option for queen conch because it would support the lowest catch level and largest precautionary buffer relative to the remaining sub-alternatives. **Sub-alternatives (f)** through **(c)** would progressively reduce this safety margin and associated environmental benefits, with **Sub-alternative (c)** being the least conservative of those considered.

The NS1 guidelines suggest that greater precaution is needed for species like queen conch, which is particularly vulnerable to overfishing because it is easily harvested by hand (see Section 3.0). Insufficient precaution could lead to overfishing. Overfishing reduces stock biomass and can reduce the size/age distribution of a population, depress the mean size/age at maturity, and decrease genetic diversity, ultimately resulting in growth overfishing and/or in recruitment failure. Overfishing also may alter the community structure and ecological functions of the supporting reef ecosystem. Queen conch are part of a complex reef ecosystem, in which co-occurring species compete for resources, such as food and habitat. Consequently, any effects realized by one species or the complex as a whole are likely to impact in some way the ecological community.

Conversely, excessive precaution could lead fishery managers to constrain catches more than needed to prevent overfishing. This would result in higher biomass levels, reducing the potential for overexploitation and maintaining the age and size structure, sex ratio, and genetic integrity of grouper stocks at levels that better approximate natural conditions. Recruitment is generally highly variable due to natural variability in environmental factors that affect the survival of eggs and larvae. A stock maintained at a high biomass level can generally withstand several years of poor recruitment that may occur due to natural

factors, but a stock subjected to overfishing for multiple years would find it more difficult to recover from such a situation.

6.2.2 Direct and Indirect Effects on the Economic and Social Environments

Action 2(a) Snapper, grouper, and parrotfish complexes

Alternative 1 is the no action alternative and would have no added economic or social impacts; however, it would be incompatible with **Preferred Alternative 2** of Action 1(a) and **Preferred Alternative 2** of Action 1(b). **Preferred Alternative 2** and **Alternatives 3** and **4** are administrative actions and would not directly affect the economic and social environment. Their indirect effects are dependent upon the AMs, regulations that implement the AMs, other regulations, and other environmental factors.

The higher the OY and ACL, the larger the potential indirect economic and social benefits that could derive from exploitation of the resource. For example, **Alternative 1** would set an ACL for each FMU less than would be specified by either **Alternative 2c, 2d** or **Preferred Alternative 2e**; and, hence, the indirect economic and social benefits derived from the exploitation of the Snapper, Grouper and Parrotfish FMUs could be less under **Alternative 1** than **Alternative 2c, 2d** or **Preferred Alternative 2e** (Table 6.2.1). **Alternative 2c** would specify the highest ACL for each of the Snapper and Grouper FMUs, and **Alternative 4c** would specify the highest ACL for the Parrotfish FMU. Conversely, **Alternative 4f** would specify the lowest ACL for each of the Snapper and Grouper FMUs and **Alternative 3f** would specify the lowest ACL for the Parrotfish FMU.

Preferred Alternative 2 and **Alternatives 3** and **4** would directly affect the foundation upon which these reef fish fisheries are managed, and would likely require regulatory changes, such as proposed by Action 5(b). The regulatory changes, in turn, could have direct economic and social impacts on fishers, their families and fishing communities. In the short run, an alternative with a lower ACL, such as **Alternative 4f** for example, could require regulatory change that reduces landings below present levels and reduces economic and social benefits that derive from those landings. In the long run, it is expected that regulatory changes as a consequence of **Preferred Alternative 2** or **Alternatives 3 or 4** would generate greater net economic and social benefits than possible under **Alternative 1** by improving management of the resources. Actual indirect short- and long-term economic and social impacts, however, are dependent upon the AMs, regulations that implement the AMs, other regulations, and other environmental factors.

A neoliberal argument is that overfishing has continued because past governmental regulations have created an incentive to race for the fish, which is said to occur as a result of every fisherman racing to catch as many fish as possible before the government closes the fishery to further fishing (Johnson 2008). Hence, neoliberals would contend that if an ACL was established in Puerto Rico's regulated open-access fishery, it would result in adverse incentives that create a race for the fish and overcapacity with fishers being able to catch and land more fish than economically and biologically sustainable. Fishermen with larger vessels and gears capable of catching more of the fish in the same or a shorter period of time would be favored over Puerto Rico's historic artisanal fishermen. Also, the

more industrialized gears could negatively impact the economic and social benefits that derive from the use and non-use of the ecosystem of which the fishery is a part. The long-term economic and social benefits of any of the alternative ACLs for the Snapper, Grouper or Parrotfish FMUs would be dependent upon other regulations that rationalize the fishery for fishing businesses to maintain long-term profits.

Table 6.2.1. Alternatives 1-4 of Action 2(a): Proposed OYs and ACLs for Snapper, Grouper and Parrotfish FMUs.

Alternative	OY = ACL (Pounds)		
	Snapper	**Grouper**	**Parrotfish**
1	1,455,000	237,000	285,000
2c	2,004,003	396,483	507,059
2d	1,703,403	337,011	431,000
2e	1,503,002	297,362	380,294
2f	1,002,002	198,242	253,530
2h			430,000
3c	1,861,538	354,853	496,656
3d	1,582,307	301,625	422,158
3e	1,396,154	266,140	372,492
3f	930,769	177,427	248,328
3g			430,000
4c	1,725,798	337,178	512,201
4d	1,466,928	286,601	435,371
4e	1,294,349	252,884	384,151
4f	862,899	168,589	256,101
4g			430,000
Average 2006 - 07	1,360,996	214,118	464,819

Preferred Alternative 2's time series are based on annual landings prior to the 2005 Comprehensive SFA Amendment and other relevant regulatory changes. If the present regulatory environment is significantly different than it was prior to 2006 and/or annual landings have changed significantly since 2006, **Alternative 2c's** high degree of certainty, for example, could promote catch levels that are less viable than those levels specified by **Preferred Alternative 2e** or **Alternatives 2d** or **2f**. The larger annual catches of the Snapper and Grouper FMUs that would be supported by **Alternative 2c** may not be possible under current federal and/or territorial regulations. Also, **Alternative 2c's** higher ACLs could have a greater risk of diminishing the quantity and quality of the Snapper and Grouper FMUs and the economic and social values that derive from their exploitation in the long run.

Alternatives 2g, 3g, and **4g** would set the ACLs for the Snapper and Grouper FMUs at the ABCs that would be specified by the SSC. **Alternative 3g** and **4g** would set the ACL for the Parrotfish FMU at 430,000 pounds, which is smaller than the ACLs that would be

specified by **Alternatives 4c** and **4d, 2c** and **2d**, **and 3c** to **3e**, but larger than the OYs that would be established by **Preferred Alternative 2e** or by **Alternative, 2f, 3f, 4e,** and **4f**.

Preferred Alternative 2h and **Alternatives 3h and 4h** would set the ACL and OY for GU1, GU2, and/or the Parrotfish Complex at zero. **Alternative 1** would keep the OY for GU1 at 1,880 to 23,440 pounds and for GU2 at 1,880 to 10,301 pounds. Therefore, **Alternative 1** would allow for larger annual catches of Grouper Units 1 and 2 and could indirectly generate larger economic and social benefits from these sub-units than **Preferred Alternative 2h** or **Alternatives 3h** or **4h**; however, **Alternative 1** or any ACL greater than zero for Grouper Units 1 and 2 is in contradiction with the present regulatory environment. Grouper Unit 1 is composed of Nassau grouper and GU2 is composed of goliath grouper. Fishing for or possession of either of these two species is prohibited in the U.S. Caribbean EEZ and in Puerto Rico and USVI waters. **Alternative 1** is based on years of landings before the federal and territorial prohibitions, while Preferred **Alternative 2h** and **Alternatives 3h** and **4h** would be consistent with the closures of these fisheries.

In summary, **Alternatives 1** through **4** would have no direct economic or social impact. However, **Preferred Alternative 2** and **Alternatives 3** and **4** would indirectly affect the economic and social environments by fostering regulatory changes that could have short-term adverse economic and social impacts on fishers, their families, and fishing communities, but long- term net benefits. The actual impacts, however, are dependent upon the AMs, regulations that implement the AMs, and other regulations that combine to rationalize the fishery, and other environmental factors.

Action 2(b) Queen conch complex

Alternative 1 is the no action alternative, which would continue the use of proxies for the targets and thresholds that are used to prevent overfishing and optimize the exploitation of queen conch. These proxies are less reliable in preventing overfishing and optimizing the exploitation of the resource than targets and thresholds based on improved time-series landings data that include more recent years and more accurately reflect the current regulatory environment and other environmental factors. **Alternative 1** would likely result in less economic and social benefits from the Queen Conch FMU than could be realized by using alternative targets and thresholds based on improved time-series data.

Preferred Alternative 2 and **Alternatives 3** and **4** of Action 2(b) would redefine the MSY, OY, overfishing threshold, and ACL for the Queen Conch FMU, which would provide fishery managers with new targets and thresholds against which to evaluate the status and performance of this fishery. The new targets and thresholds would be based on more recent time-series landings data that are considered to be more reliable than the data used to develop the Comprehensive SFA Amendment reference points. The targets and thresholds specified by **Preferred Alternative 2** and **Alternatives 3** and **4** would not directly affect the resources, fishers, fishing families or fishing communities. However, **Preferred Alternative 2** and **Alternatives 3** and **4** would directly affect the regulatory foundation upon which the queen conch fishery is managed and could indirectly have

economic and social impacts on queen conch fishers, their families, and fishing communities as a result of regulatory change warranted by these targets and thresholds.

Table 6.2.2. Alternatives 1-4 of Action 2(b): Proposed MSY, OFL, OY and ACL for Queen Conch FMU.

Alternative	Pounds		
	MSY	**OFL**	**OY = ACL**
1	452,000		424,000
2c	512,717	512,717	107,720
2d			91,562
2e			80,790
2f			53,860
2g			50,000
2h			0
3c	488,073	488,073	116,899
3d			99,364
3e			87,674
3f			58,450
3g			50,000
3h			0
4c	525,152	525,152	138,587
4d			117,799
4e			103,940
4f			69,294
4g			50,000
4h			0
Average 2006 - 07	401,705	401,705	149,026*

* The MSY and OFL for the 2006-07 annual average are based on all U.S. Caribbean landings; the OY and ACL for the 2-year annual average are based on St. Croix landings only.

The higher the OY and ACL, the larger the potential indirect economic and social benefits that could derive from exploitation of the resource. **Preferred Alternative 2** and **Alternatives 3** and **4** would reduce the ACL from the present level of 424,000 pounds and could result in lower indirect economic and social benefits that derive from queen conch fishing (Table 6.2.2). **Alternative 2h, 3h** or **4h** would set the ACL at zero, which would necessitate a regulation that would prohibit fishing for queen conch in the U.S. Caribbean EEZ and could have the largest indirect adverse economic and social impacts on queen conch fishers, their families, and fishing families. **Preferred Alternative 2g** or **Alternative 3g** or **4g** would allow for the next smallest catch of queen conch, which could indirectly result in the second largest adverse economic and social impacts. However, actual outcomes are dependent upon the AMs, regulations that implement those AMs, other regulations that rationalize the fishery, and other environmental factors. For

example, the times series used to specify the targets and thresholds of **Alternatives 1, 2c** to **2f, 3c** to **3f,** and **4c** to **4f** are all-to-largely based on annual landings before seasonal and area restrictions were established by Amendment 1 of the Queen Conch FMP in 2005. The ACLs of those alternatives would not be consistent with the USVI's 50,000-pound annual catch limit for St. Croix. Preferred **Alternative 2g** or **Alternative 3g** or **4g** would be consistent with the 50,000-pound limit and Amendment 1 restrictions, and would have no economic and social impacts beyond the baseline, although the ACL of 50,000 pounds is substantially lower than the no action ACL of **Alternative 1**.

In summary, **Alternatives 1** through **4** would have no direct economic or social impact. However, **Preferred Alternative 2** and **Alternatives 3** and **4** could indirectly affect the economic and social environments by fostering regulatory changes that could have short-term adverse economic and social impacts on fishers, their families, and fishing communities, but long-term net benefits. The actual impacts, however, are dependent upon the AMs, regulations that implement the AMs, other regulations that combine to rationalize the fishery, and other environmental factors.

6.2.3 Direct and Indirect Effects on the Administrative Environment

Management reference points impact the administrative environment by triggering management review and action. While all the reference points considered here have some influence on fishery management decision-making, the primary parameter guiding management action is the ACL. ACLs effectively limit the total catch of a species, species group or complex that may be taken in any given year without requiring fishery managers impose additional management controls. As a result, more conservative ACL values would generally be expected to be more administratively burdensome than less conservative values because they would trigger management review and action more frequently.

Excluding consideration of sub-alternatives, the range of ACL values specified by **Preferred Alternative 2** and **Alternatives 3** and **4** for the snapper, grouper, parrotfish, and queen conch complexes do not differ enough to notably effect the administrative environment to varying degrees (Table 4.3.1). **Sub-alternative (f)** is expected to be the most administratively burdensome option because it would support the lowest catch levels relative to the other sub-alternatives and, therefore, trigger management review and action most frequently. **Sub-alternatives (e)** through **(c)** would progressively reduce the frequency with which management action was triggered. **Sub-alternative (c)** would trigger management action less frequently, but could have adverse administrative effects if it led to stocks becoming overfished, requiring the development of resource-intensive MSA rebuilding provisions.

An ACL of zero for Nassau and goliath grouper would benefit the administrative environment by supporting the current catch prohibitions. And an ACL of zero for queen conch would reduce the administrative burden of implementing compatible in-season closures each year.

6.3 ACTION 3: Annual Catch Limit Allocation/Management

6.3.1 Direct and Indirect Effects on the Physical, Biological, and Ecological Environment

Action 3(a) Snapper and grouper unit allocation/management

No action **Alternative 1** would require that reference points for management of commercial and recreational snapper and grouper species be established according to the Fishery Management Units described in Action 1, the exact construct of those units being determined by the decision whether to maintain the current composition of the FMUs or to modify them as described in Action 1. With respect to Action 3, the details of FMU composition are not essential. Rather, Action 3(a) affects whether reference points are established by unit or are aggregated according to the options described in **Alternatives 2** and **3**. Those alternatives determine how aggregate reporting is distributed both within each of the snapper and grouper complexes and within island groups (Puerto Rico and the combined USVI). **Alternative 2** would require aggregation within each of the snapper and grouper complexes. **Sub-alternative A** would allow establishment of aggregate reference points only for Puerto Rico. **Sub-alternative B** would allow establishment of aggregate reference points only for the USVI. **Sub-alternative C** would allow establishment of aggregate reference points for the entire U.S. Caribbean. **Alternative 3** basically reiterates **Alternative 2**, except that **Alternative 3** would allow establishment of aggregate reference points only for grouper. Again, the sub-alternatives allocate according to islands groups, as with **Alternative 2**.

By definition, **Alternative 1** of Action 3(a) would cause no change in the way that fisheries are executed in the U.S. Caribbean. Although **Alternatives 2** and **3** would alter the manner by which fishing activities are pursued in the U.S. Caribbean, those fisheries would remain fully functional. However, some changes in the direct and indirect impacts to the physical environment may occur in response to changes in emphasis on particular fishery management units. Aggregating catch quotas, by whatever option may be chosen via **Alternative 2** or **3**, would allow for shifting of effort within each of the snapper and grouper complexes. This is because, instead of a set quota for each unit within each of the snapper and grouper complexes, the quota would be an aggregate within complex depending upon which alternative is selected. Aggregating within either of the snapper or grouper complexes would allow the entire quota for that complex to be fulfilled by harvest of a subset of the members of the complex. For example, the entire snapper quota could be met by harvesting vermilion snapper. As the vermilion snapper population is depleted to the point of collapse, effort could be shifted to one or more other species of snapper. As a result, the overall landings would remain essentially the same and there would be no apparent indication that the vermilion stock is in distress despite the reality of its potential collapse. Changes in fishing effort and methods, in response to quota changes deriving from aggregation of harvest quotas, are difficult to predict. As a result, it is similarly difficult to predict changes in direct and indirect physical effects that may be realized in response to those changes in fishing patterns.

Direct and indirect effects on the biological and ecological environment resulting from Action 3(a) could be substantial. As noted in the paragraph above, allowing aggregation of catch may emphasize harvest of certain species and de-emphasize harvest of other species, thereby allowing the entire quota to be achieved by the harvest of one or a few species. Such an outcome potentially would greatly increase the harvest pressure on those species that are targeted. Because landings would not be managed at the level of individual species, or even at the level of the individual unit, scientists and managers would have no tool with which to restrict catch levels of individual species, so any stress that may be reflected by the catch data would not be easily identified or relieved. Instead, because overall harvest is maintained within the bounds of the quota, the overall harvest numbers would indicate that the management unit is not overfished or undergoing overfishing. In reality, those species that are being harvested may be experiencing substantial overfishing. Resultant direct and indirect effects, both biological and ecological, could be severe. From a biological perspective, overfishing could directly reduce the available spawing stock below a critical threshold, thereby reducing mating opportunities, cohort production, and genetic integrity of the stock. Indirect effects, for example the supply of propagules to other subpopulations of the affected species, also may be substantial. Direct and indirect ecological effects also would be expected, particularly in the delivery of ecosystem services provided by the affected species that include but are not limited to contributions as a predator or prey item within the ecosystem, by increases in other species that benefit by increased access to habitats or prey, and by loss of a food source previously provisioned by the affected species. The latter may be particularly problematic if the affected species is replaced in the ecosystem by a species that is less desirable or suitable for human consumption. In each of these cases, **Alternative 1** appears to provide the least likelihood of negative outcomes because it ensures that all harvest from all island groups is reported to the species level and that those species are managed as a coherent unit. Each of **Alternatives 2** and **3** fall short of this goal, **Alternative 2** to the greatest degree because it allows aggregation of the largest number of management units.

However, from a practical perspective it is not presently possible to effectively manage at the unit level within all of the islands. In the USVI, landings data are presently reported only to the level of the family complex, all landings being grouped within each of the parrotfish, snapper, and grouper complexes. Managing at a level of resolution more refined than the family complex is therefore not possible, at least until a more detailed harvest monitoring program is implemented. Aggregate reference points for the USVI are a necessary outcome of this situation and any sub-alternatives that preclude aggregating catch in the USVI (e.g., **Sub-alternative A** within both **Alternatives 2** and **3**) would not be practicable. However, both **Sub-alternative B** and **Sub-alternative C**, within each of **Alternatives 2** and **3**, are feasible. Those sub-alternatives will result in aggregate reference points for the USVI, thereby circumventing the mismatch between management desires and the reality of historic U.S. Caribbean data reporting. Because landings data from Puerto Rico are reported to species, albeit with varying levels of success as noted in Section 3.3, aggregate reference points for Puerto Rico are not a necessity.

Alternative 4 was added at the request of the Council and adopted as the preferred alternative in Action 3(a). In the USVI, the data are only reported in aggregate for both snapper and grouper, thereby essentially requiring that aggregate reference points be defined for snapper and grouper units in the USVI. This alternative also requires defining aggregate reference points for grouper in Puerto Rico. This reflects a concern by the Council for the large proportion of unclassified landings inherent in the Puerto Rico grouper data. However, based on the availability of species-specific data for snapper in Puerto Rico and on the relatively small proportion of unclassified landings within the snapper category, the Council's preferred option is to define unit-specific reference points for snapper in Puerto Rico. Fewer than 10% of the commercial landings of snapper in Puerto Rico are not reported to species. This alternative therefore provides the most highly resolved level of management for Puerto Rico snapper of any of the alternatives, while still addressing the data limitations inherent in the data for grouper in Puerto Rico and for snapper and grouper in the USVI.

Action 3(b) Sector allocation/management (Puerto Rico only)

Decisions regarding sector allocation and management potentially could impact the physical environment particularly of U.S. Caribbean coral reefs. Traps are commonly used in the commercial pursuit of U.S. Caribbean reef fish including parrotfish, snapper, and grouper. In contrast, recreational fishing is oriented more towards hook-and-line or spear fishing. Traps have the potential to be more damaging to the physical environment, through direct contact with reef structure, than are hook-and-line or spear fishing activities. **Alternative 1** would maintain the present situation where commercial harvest is not differentiated from recreational harvest on the island of Puerto Rico (recreational harvest is not monitored in the USVI so Action 3(b) is specific to Puerto Rico). A possible outcome of this situation is an increase in commercial harvesting activity as commercial fishermen maximize harvest until the aggregate (commercial and recreational) quota is achieved. This outcome could result in more traps in the water and therefore more direct impacts to the reef relative to **Preferred Alternative 2**, which would segregate commercial from recreational harvest quotas and monitoring.

Specifying separate commercial and recreational ACLs for Puerto Rico would not be expected to have substantial direct or indirect effects on the biology or ecology of U.S. Caribbean coral reef communities. Although **Preferred Alternative 2** would separate the tracking and management of commercial and recreational harvest, the overall harvest quota for each species complex would remain the same. It is possible that indirect effects would occur, as fewer commercial traps result in fewer direct interactions between gear and substrate and thereby fewer impacts on essential habitat for coral reef community members.

Action 3(c) Geographic allocation/management

No substantial change in the direct or indirect effects to the physical environment would be expected as an outcome of changes to geographic allocation and management, beyond those already discussed for Actions 3(a) and 3(b). As noted above, differential harvest of

species within each complex, depending upon whether the catch is aggregated or not, may result in changes in usage patterns of fishing gear. But, any other direct or indirect impacts to the physical environment are not anticipated. Establishing sub-regions within the U.S. Caribbean EEZ will require that fishermen land and report catch within more restrictive boundaries than was the previous case assuming that **Preferred Alternative 2** is chosen, but there is no reason to expect that fishing effort will be increased, reduced, or spatially reallocated as a result of that requirement.

Direct and indirect effects to the biological and ecological environment that result from Action 3(c) could be substantial. Arguments here are similar to those presented for Action 3(a) regarding direct and indirect biological and ecological effects. **Alternative 1** will maintain the current situation with the result that no changes to the biological or ecological environment would be detected. **Preferred Alternative 2**, by structuring harvest within each of three U.S. Caribbean island groups, would be expected to better distribute harvest among the island groups according to historic catch patterns. That outcome would result in a substantially reduction in the likelihood that U.S. Caribbean-wide quota opportunities could be focused within one of the subregions (i.e., island groups) causing overharvest in some areas and underharvest in others. Spreading harvest effort would be expected to facilitate sustainable harvest throughout the U.S. Caribbean, thereby minimizing direct and indirect effects due to that harvest.

6.3.2 Direct and Indirect Effects on the Economic and Social Environments

Action 3(a) Snapper and grouper unit allocation/management

Alternative 1 of Action 3(a) would maintain the targets and thresholds for the sub-units within the Snapper and Grouper FMUs; however, this would not be consistent with USVI reporting requirements which do not differentiate spcies of grouper or snapper.

Because there are no landings by sub-unit in the USVI, the average annual commercial landings of all snapper or all grouper in the USVI would be used as a proxy for each sub-unit's average annual landings for the territory, which, in turn, would be included in the specification of the targets and thresholds for each snapper or grouper sub-unit for the U.S. Caribbean as a whole. The assumption that each and every snapper or grouper sub-unit's average annual commercial landings are equal to the average annual commercial landings of all snapper or grouper would substantially overestimate commercial landings of each sub-unit in the USVI. However, that overestimation would likely offset, although by an unquantified amount, the underestimation of recreational landings of each member of the sub-units in the USVI. **Alternative 1** of Action 3(a) in combination with **Preferred Alternative 2e** of Action 2(a) would allow for overfishing of the sub-units of the Snapper and Grouper FMUs in the USVI and would indirectly result in diminished economic and social benefits that derive from exploitation of these resources over time. However, the actual impacts would be dependent upon the AMs, regulations that implement those AMs, other regulations created to rationalize the fishery, and other environmental factors.

Because **Alternative 2A** of Action 3(a) would define aggregate reference points for the snapper and grouper units for Puerto Rico only, it follows that this alternative would, by

default, define the targets and thresholds for the snapper and grouper sub-units for the USVI only. That is problematic, however, because the USVI has not required commercial fishers to report landings of snapper or grouper by species. Without the ability to differentiate which snapper or grouper landings are of a particular sub-unit, landings of each sub-unit would be a guess. Hence, when combined with **Preferred Alternative 2** of Action 2(a), **Alternative 2A** of Action 3(a) would specify the same targets and thresholds for each snapper sub-unit and the same targets and thresholds for each grouper sub-unit for the USVI. This combination would allow for overfishing of the sub-units of the Snapper and Grouper FMUs in the USVI and would indirectly result in diminished economic and social benefits that derive from exploitation of these resources over time. However, the actual impacts would be dependent upon the AMs, regulations that implement those AMs, other regulations created to rationalize the fishery, and other environmental factors.

Table 6.3.1. Alternative 2B of Action 3(a) coupled with Preferred Alternative 2(e) of Action 2(a).

FMU	Puerto Rico OY and ACL			USVI OY and ACL		
	Commercial	Recreational	Total	Commercial	Recreational	Total
Snapper						
Unit 1	251,192	84,288	335,480			
Unit 2	128,750	30,715	159,464			
Unit 3	305,096	73,375	378,470			
Unit 4	329,378	25,155	354,533			
Unclass.	60,086	6,098	66,183			
Total	*1,074,501*	*219,630*	*1,294,131*	*208,871*	*Zero*	*208,871*
Grouper						
Unit 1	13,102	4,629	17,731			
Unit 2	551	4,876	5,427			
Unit 3	84,656	54,047	138,704			
Unit 4	4,290	3,436	7,726			
Unit 5	7,108	1,142	8,249			
Unclass.	46,922	0	46,922			
Total	*156,629*	*68,129*	*224,759*	*72,604*	*Zero*	*72,604*

Alternative 2B of Action 3(a) would define aggregate reference points for the Snapper and Grouper FMUs for the USVI only, which is consistent with reporting practices in the USVI. According to **Preferred Alternative 2** of Action 2(a), the MSY for the Snapper FMU would be 278,495 pounds and the MSY for the Grouper FMU would be 96,805 pounds. Furthermore, in accordance with **Preferred Alternative 2(e)** of Action 2(a), the ACL for Snapper and Grouper FMUs would be 208,871 pounds and 72,604 pounds respectively (Table 6.3.1). By default, **Alternative 2B** would also define reference points for the snapper and grouper sub-units for Puerto Rico only as shown in Table 6.3.1.

Alternative 2C of Action 3(a) would define aggregate reference points for the Snapper and Grouper FMUs in both Puerto Rico and the USVI, although Puerto Rico reporting requirements differentiate landings of snapper and grouper species. Because it does not differentiate snapper or grouper sub-units, there would be the possibility that Puerto Rico fishermen could intensify fishing effort for any one of the snapper or grouper sub-units and increase landings of that sub-unit despite it experiencing overfishing because an aggregate ACL would be specified for all snapper or grouper. Although **Alternative 2C** could generate short-run benefits for snapper and/or grouper fishermen in Puerto Rico who would be able to increase landings of a sub-unit species, there would be smaller long-term net benefits and potentially long-term net costs associated with such exploitation of a particularly sub-unit fishery. The actual outcomes, however, would be dependent upon the AMs, regulations that implement the measures, other regulations that combine to rationalize the fishery, and other environmental factors.

Alternative 3A of Action 3(a) would define aggregate reference points for grouper only, for Puerto Rico only. Because **Alternative 3A** of Action 3(a) would define aggregate reference points for the Grouper FMU only for Puerto Rico, it would require reference points for snapper and grouper sub-units in the USVI, which is inconsistent with USVI reporting requirements.

Alternative 3B of Action 3(a) would define aggregate reference points for grouper in the USVI only and **Alternative 3C** would define aggregate reference points for grouper in Puerto Rico and the USVI. This would be consistent with reporting practices for grouper in the USVI, but not consistent with reporting practices for snapper in the USVI.

Preferred Alternative 4 is a combination of aspects of **Alternative 2B** and **3A**, which are consistent with USVI reported landing requirements**.** The ACLs for each territory are shown in Table 6.3.2. Unlike **Alternative 2B**, it does not define an ACL for the grouper sub-units for Puerto Rico, which could allow Puerto Rico grouper fishermen to increase landings of a particular grouper sub-unit while decreasing landings of another. However, that ability is restricted by present regulations, such as the closure of the goliath and Nassau grouper fisheries (Grouper Units 1 and 2).

In summary, neither **Preferred Alternative 4** nor **Alternative 1**, **2** or **3** would have a direct economic or social impact on fishermen, their families, or communities. However, they could indirectly affect the economic and social environments by fostering regulatory changes that could have short-term and long-term effects. **Alternatives 1**, **2A**, and **3** are not consistent with USVI reporting requirements and would allow for overfishing of the sub-units of the Snapper and/or Grouper FMUs in the USVI and would indirectly result in diminished economic and social benefits that derive from exploitation of these resources over time. However, the actual impacts would be dependent upon the AMs, regulations that implement those AMs, other regulations created to rationalize the fishery, and other environmental factors.

Table 6.3.2. Preferred Alternative 4 in Combination with Preferred Alternative 2(e) of Action 2(a).

FMU	Puerto Rico OY and ACL			USVI OY and ACL		
	Commercial	Recreational	Total	Commercial	Recreational	Total
Snapper						
Unit 1	251,192	84,288	335,480			
Unit 2	128,750	30,715	159,464			
Unit 3	305,096	73,375	378,470			
Unit 4	329,378	25,155	354,533			
Unclass.	60,086	6,098	66,183			
Total	*1,074,501*	*219,630*	*1,294,131*	*208,871*	*Zero*	*208,871*
Grouper						
Unit 1						
Unit 2						
Unit 3						
Unit 4						
Unit 5						
Unclass.						
Total	*156,929*	*68,129*	*225,058*	*54,453*	*Zero*	*54,453*

Preferred Alternative 4 and **Alternatives 2B** and **2C** are consistent with USVI reporting requirements and would base an ACL on known annual landings and average annual landings of snapper and/or grouper. Because of this consistency, any one of these four alternatives could support better management of the fishery(ies) and indirectly yield larger long-term net economic and social benefits than **Alternative 1, 2A** or **3**; however, actual benefits are dependent on the chosen alternatives of the previous proposed actions (Actions 1 and 2), AMs, regulations that implement the AMs,other regulations (including Action 6) that combine to rationalize the fishery, and other environmental factors.

Action 3(b) Sector allocation/management (Puerto Rico only)

Alternative 1, the no action alternative, would not specify sector-specific reference points, which could cause commercial and recreational fishers to compete for the ACL. Commercial fishermen with larger vessels and gears capable of catching more of the fish in the same or a shorter period of time would be favored over Puerto Rico's recreational and subsistence fishermen if there was a race for the catch. **Preferred Alternative 2**, however, would specify separate commercial and recreational annual catch limits in Puerto Rico that are based on the specifications of the MSY, OFL, and OY that are chosen. See Table 6.3.3 for the recreational and commercial ACLs for the Snapper sub-units and Grouper FMU proposed by **Preferred Alternative 2** of Action 3(b) in combination with **Preferred Alternative 4** of Action 3(a), **Preferred Alternative 2(e)** of Action 2(a) and **Preferred Alternative 2(g)** of Action 2(b). A commercial ACL could encourage some fishers to acquire larger vessels and gears that are capable of catching and landing more fish in the same or a shorter period of time than other fishers, which could adversely affect the historical distribution of economic and social benefits that derive from the fishery and the long-term benefits of the fishery and the ecosystem of which it is part.

Table 6.3.3. Preferred Alternative 2 of Action 3(b) coupled with Preferred Alternative 4 of Action 3(a) and Preferred Alternative 2(e) of Action 2(a) and Preferred Alternative 2(g) of Action 2(b).

FMU	Puerto Rico ACL (Pounds)	
	Commercial	Recreational
Snapper Unit 1	251,192	84,288
Snapper Unit 2	128,750	30,715
Snapper Unit 3	305,096	73,375
Snapper Unit 4	329,378	25,155
Grouper	156,929	68,129
Parrotfish	95,985	27,782
Conch	50,000	N/A

In summary, **Alternative 1** would not specify sector-specific reference points, which would cause commercial and recreational fishers to compete for a single ACL. Commercial fishers with larger vessels and gears capable of catching more of the fish in the same or a shorter period of time would be favored over Puerto Rico's recreational and subsistence fishers if there was a race for a single ACL and overcapacity was allowed. **Preferred Alternative 2**, however, would specify separate commercial and recreational annual catch limits in Puerto Rico. However, commercial fishers with larger vessels and gears capable of catching more of the fish in the same or a shorter period of time would be favored over Puerto Rico's historic artisanal fishers if there was a race for a commercial ACL and overcapacity was allowed. Such an environment could result in lower long-term benefits that derive from the resource and the ecosystem of which it is part and a transfer of economic and social benefits from artisanal to industrial fishers. The actual economic and social impacts, however, would be dependent on if the regulatory and economic environments support such competition for an ACL.

Action 3(c) Geographic allocation/management

Alternative 1, the no action alternative, would maintain Caribbean-wide reference points, and, as such, the U.S. Caribbean EEZ would continue to be an indivisible area. This could allow queen conch, parrotfish, snapper, and grouper that are harvested anywhere within the U.S. Caribbean EEZ to be continued to be harvested in areas of the EEZ off any of the islands of Puerto Rico, St. Croix or St. Thomas/St. John after the ACL has been reached for that island. This could result in overfishing in areas of the EEZ, which could have long-term negative economic and social impacts for fishermen and their families and communities.

Preferred Alternative 2 of Action 3(c) would divide and manage ACLs by island group and divide the associated EEZ into three parts (Table 6.3.4). There would be the Puerto Rico EEZ, the St. Croix EEZ, and the St. Thomas/St. John EEZ. Fish and/or shellfish that are harvested within an island EEZ would not have to be landed on that island. Once an

island's landings reach its ACL for a particular unit or sub-unit, the fishery for that unit or sub-unit in the island's EEZ would be subject to appropriate AMs. For example, if the STT/STJ ACL for the Snapper FMU were reached, **Preferred Alternative 2** could result in closure of the snapper fishery in the STT/STJ EEZ depending on the preferred alternatives of Actions 5(a) and 5(b). If the EEZ were not divided (as would be the case under **Alternative 1**), a closure of federal waters to snapper fishing, because the STT/STJ landings reached or surpassed the STT/STJ ACL, would extend to federal waters off Puerto Rico and St. Croix, although PR and/or STX landings may not have reached their respective snapper ACLs. Such a scenario would have adverse economic and social impacts on Puerto Rico and St. Croix snapper fishers, their families, and fishing communities if their access to the resource was reduced.

Table 6.3.4. Preferred Alternative 2 of Action 4(b) in combination with Preferred Alternative 4 of Action 3(a), Preferred Alternative 2 of Action 3(b), Preferred Alternative 2e of Action 2(a) and Preferred Alternative 2g of Action 2(b).

FMU	Puerto Rico ACL (Pounds)		St. Croix ACL (Pounds)	St. Thomas/St. John ACL (Pounds)
	Commercial	Recreational		
Snapper Unit 1	251,192	84,288		
Snapper Unit 2	128,750	30,715		
Snapper Unit 3	305,096	73,375		
Snapper Unit 4	329,378	25,155		
Snapper			90,835	118,037
Grouper	156,929	68,129	26,855	45,749
Parrotfish	95,985	27,782	219,914	36,614
Conch	0	N/A	50,000	0

Preferred Alternative 2 is similar to the current federal regulation that prohibits fishing for queen conch outside an area of the EEZ off St. Croix.

The Puerto Rican shelf, or fishable habitat 100 fathoms or less, encompasses an approximate 1,837 nm² area. Of that area, only 6.3 percent (116 nm²) occurs in the EEZ, and the vast majority of that area is found off the west coast of Puerto Rico. Conversely, the USVI shelf only encompasses an approximate 630 nm² area. Of that area, 38 percent (240 nm²) occurs in the EEZ. The bulk of the shelf occurs off St. Thomas and St. John, with a 291 nm² total area in territorial waters and a 218 nm² total area in federal waters. St. Croix has 98 nm² of fishable habitat in territorial waters, and only a 21 nm² area off its east coast that resides in the EEZ. This difference in the amount of fishable habitat that occurs in federal waters off each territory is a result of the difference in their jurisdictions. Puerto Rico waters extend offshore nine nm and cover an area of approximately 5,081 square miles, while USVI waters only extend out three nm and cover an area of about 579 square miles. Therefore, the USVI fisheries depend on the EEZ to a much greater extent than those managed off Puerto Rico. Further, St. Thomas and St. John have a greater reliance on the EEZ, with approximately 43 percent of the total shelf occurring in the EEZ, as compared to that of St. Croix, which only has approximately 18 percent of its

waters in the EEZ (CFMC 2005: 372). This suggests that the economic and social benefits of **Preferred Alternative 2** could be greater for St. Thomas/St. John fishers, their families, and communities than for fishers, fishing families, and communities in St. Croix and substantially greater for these social entities in St. Thomas/St. John than for their counterparts in Puerto Rico. **Preferred Alternative 2's** adverse economic and social impacts would be experienced by any fishers who presently harvest resources in one or more of the proposed EEZ areas. Adverse impacts could also result if a relocation of fishers increased competition in the EEZ off an island group or in territorial waters. There is insufficient information to assess how many fishers, if any, would be so affected and what would be the adverse economic and social impacts on fishers, their families, and fishing communities. Any fisher who may be adversely affected by **Preferred Alternative 2** is encouraged to comment on this proposed action.

6.3.3 Direct and Indirect Effects on the Administrative Environment

Action 3(a) Snapper and grouper unit allocation/management

The no action **Alternative 1** will create the greatest administrative burden of any of the proposed Action 3(a) alternatives. This situation results from the disparity between desired harvest reporting goals and the reality of reporting particularly in the USVI but also in Puerto Rico.

In the USVI, as discussed in Section 3.3, harvest of reef fish is reported only to the level of the species complex, so for example the individual grouper species are lumped for reporting purposes into a single category of grouper. The same situation holds for snapper and parrotfish, although for the latter the consequences are minimal with regard to management because there is only a single parrotfish unit. **Alternative 1** as proposed herein would require that reference points for setting harvest levels be established for each individual FMU within each of the snapper and grouper complexes. To achieve that goal would be a substantial undertaking and would require substantial modifications to the entire harvest monitoring program in the USVI. New forms would have to be developed, port samplers funded and trained, educational programs implemented to ensure that all landed fish are properly identified to the species level by the samplers and by law enforcement representatives, effective intercept strategies devised, and the fishermen convinced to cooperate with this program. Furthermore, a similar scheme would have to be developed from scratch for the recreational fishery as there is presently no monitoring program for recreational harvest in the USVI.

Defining reference points for grouper and snapper sub-units is considerably more tractable in Puerto Rico, with the result that application of **Alternative 1** also would be more tractable from an administrative perspective. In Puerto Rico, landings generally are reported to species although the thoroughness of that reporting varies among species complexes. For parrotfish, only a very small percentage of the total harvest is accurately reported to species; greater than 99% of harvested parrotfish are reported to the unclassified (i.e., not reported to species) 'parrotfishes' category. Again, this is not a significant problem because parrotfish are managed as a single unit, although it remains a worthwhile goal to record parrotfish harvest to species to facilitate future modifications to

the parrotfish FMU. At the opposite end of the spectrum, most snapper that are harvested by commercial fishermen from Puerto Rico waters are reported to species, with only about 1 out of 20 fish being reported to the generic 'snappers' category. A worthwhile goal is to obtain 100% reporting to species for all harvested resources. Unfortunately, grouper are even more distant from this goal than are snapper, with between 35-53% by weight of the classified landings being reported to the unclassified 'sea basses' category. To fully achieve the mandate of **Alternative 1** would therefore require a considerable administrative investment, less extensive than that described for the USVI but still substantial.

An initiative is underway to improve commercial fisheries data collection in both Puerto Rico and the USVI, but the proposed program is controversial particularly with the fishermen and is not presently associated with a source of funding. Moreover, the program is specific to the commercial sector so complimentary data for the recreational fisheries would remain unavailable. Although final program design and associated costs presently remain under consideration, an effective program is certain to require considerable investment in personnel, equipment, and the administrative environment. This is not to say that the program is not necessary and needed, only that a substantial increase in the administrative burden is an inherent component of the revised data collection program.

The administrative burden associated with **Alternative 2** of Action 3(a) would be considerably less than that described above for **Alternative 1**, but the full administrative burden is predicated upon the choice of sub-alternatives. In general, **Alternative 2** eliminates the obligation to report, monitor, and manage either the grouper or the snapper complexes according to individual FMU. Instead, all harvest within each of the snapper and grouper complexes will be combined within each complex for reporting and for management. The sub-alternatives will modify the administrative burden considerably. If **Alternative 2, Sub-alternative A** is chosen, aggregate reference points will only be applied to Puerto Rico harvest. This alternative does little to reduce the administrative burden because it does nothing to reduce the requirement to report and manage at the FMU level in the USVI. As explained above, the USVI is the area most lacking in species-level reporting and therefore most distant from an administrative environment supportive of species-level reporting. Some administrative relief would be obtained by aggregating catch in Puerto Rico, but this relief ultimately would be counter-productive because it would require disregarding the administrative effort invested in obtaining species-specific landings information in the first place. Because there is some error associated with species-specific landings in Puerto Rico, some advantage could be gained by pooling within species complexes and thereby eliminating effort applied to managing and modeling the unclassified component of catch. But, relief from this administrative burden would be far outweighed by the additional administrative obligations incumbent upon fisheries and data managers in the USVI. In contrast, **Alternative 2, Sub-alternative B** would provide substantial administrative relief for all of the reasons, but opposite logic, associated with **Sub-alternative A**. Catch would be aggregated within both the snapper and grouper complexes in the USVI, where data are only amenable to analysis at this level anyway. Catch would not be aggregated in Puerto Rico, where catch

is now reported to species albeit with varying levels of accuracy. The administrative burden would therefore change little in the USVI from the present reality, although administrative obligations as outlined for Puerto Rico in response to **Alternative 1** would still be realized. From an administrative perspective, the least burdensome sub-alternative within **Alternative 2** would be **Sub-alternative C**. That sub-alternative alleviates the requirement to report and manage landings at any level below the species complex within either Puerto Rico or the USVI. The result would be no additional administrative requirements in the USVI, where reef fish harvest already is reported and managed at the level of the species complex. Fishermen already comply with this program to a greater or lesser degree, there would be no need for additional employment and training of port agents, and the forms and functionalities presently in place would continue to suffice. Administrative obligations would be expected to decrease in Puerto Rico as there would no longer be a need for fisheries managers to provide detailed landings forms and no obligation for the fishermen to complete those detailed forms. **Alternative 2, Sub-alternative C** therefore results in the most benign administrative burden within **Alternative 2**.

By defining aggregate reference points only for grouper, while still requiring management of snapper at the level of the individual FMU, **Alternative 3** of Action 3A falls in-between **Alternatives 1** and **2** with respect to changes in the administrative burden. This alternative would demand less administrative attention than **Alternative 1** but more than any option within **Alternative 2**. Reasons for this are discussed in the paragraphs above. In summary, this alternative requires much less information to accomplish than does **Alternative 1** but, because detailed collection and management of species-specific landings data for snapper still would be required, **Alternative 3** with any sub-alternative would be more administratively burdensome than would be the case for any sub-alternative within **Alternative 2**. Within **Alternative 3, Sub-alternative B** is the most realistic and administratively benign because it is most consistent with extant data collection efforts in the U.S. Caribbean. That sub-alternative would require species-specific reporting of grouper in Puerto Rico but not in the USVI. Since harvested grouper already are reported to species in Puerto Rico, albeit with a substantial component of unclassified landings, the increase in the administrative burden would be minimized. However, because species-specific reporting of snapper still would be required in both Puerto Rico and the USVI, the administrative burden associated with snapper reporting and management would be substantially increased relative to any of the sub-alternatives within **Alternative 2** as discussed above. **Sub-alternative A** provides little administrative relief because the obligation remains to report snapper and grouper landings at the species level in the USVI where those data are not presently available. **Sub-alternative C** reduces the administrative burden relative to **Sub-alternative A** but does not achieve the relief implicit within **Sub-alternative B** because it still requires that species-specific landings data for snapper be available from the USVI. Those data are not presently available and will not be for the foreseeable future.

The least burdensome alternative from an administrative standpoint would be **Preferred Alternative 4**. This alternative is consistent with data collection and management efforts as the presently stand in both Puerto Rico and the USVI. For the USVI, each of the

snapper and grouper complexes would be managed in aggregate, and that is how the data are presently collected in the USVI. As commercial and recreational data collection efforts are improved in the USVI, management strategies for both grouper and snapper can be modified to accommodate those more highly resolved data, and those modifications will create an additional administrative burden reflecting modifications to port sampling, data streaming, and analytical procedures. Until then, **Preferred Alternative 4** provides the most administratively benign approach to management of grouper and snapper complexes in the USVI. For Puerto Rico, data are available with which to manage both grouper and snapper at the level of the individual unit. However, as discussed above, the data regarding grouper landings in Puerto Rico include a substantial proportion of unclassified landings. In contrast, the landings data regarding snapper are predominately reported to the species level with consistently less than 10% of the landings reported to the unclassified category (Figure 4.3.1). **Preferred Alternative 4** appropriately addresses the data situation for both complexes and therefore would create the least administrative burden with respect to port sampling, data streaming, and analytical procedures.

Action 3(b) Sector allocation/management (Puerto Rico only)

Alternative 1of Action 3(b) would maintain the present situation with regard to managing the commercial and recreational harvest sectors in Puerto Rico. An initial administrative burden would be expected because, at present, there are no harvest quotas or guidelines for the recreational fishery in Puerto Rico. Quotas would have to be established, and that effort will require modeling and/or analysis of the presently available data. However, because the establishment of catch quotas for the recreational fishery in Puerto Rico is inherent within Action 2(a), and that action calls for a combined commercial and recreational quota, **Alternative 1** adds no additional administrative burden beyond that resulting from implementation of Action 2(a).

Preferred Alternative 2 requires separation of the commercial and recreational catches, establishment of separate quotas for each sector, and implementation of separate monitoring and accountability measures for each sector. Additional administrative burdens would be realized as a result. Because catch data are presently obtained, for the commercial sector via the commercial trip ticket effort and for the recreational sector via the MRFSS program, acquiring and separating the data would require no additional administrative effort. Initial effort would be required to establish catch quotas, but those quotas would be derived anyway as an outcome of Action 2(a). The largest additional burden would be realized from separately monitoring and enforcing the quotas, separately identifying that harvest is approaching the sector-specific quotas, and applying sector-specific AMs as necessary. These administrative burdens would be offset to some degree, and potentially to a considerable degree, by more effective and appropriate management of the individual sectors. In particular, separating management of the two sectors will directly reduce competition for a limited resource between the two sectors and will eliminate the dependence of one sector on the harvest activities of the other. Those outcomes will reduce conflict between sectors and may, as a result, reduce the likelihood of litigation and associated administrative obligations.

Action 3(c) Geographic allocation/management

The no action **Alternative 1** would cause little change to the administrative environment. Although reef fish and conch landings in the U.S. Caribbean are reported by island group, quotas and regulations are applied on a pan-U.S. Caribbean basis rather than by island group. Choosing **Alternative 1** would maintain this situation. Because no geographic division lines would be developed to demarcate subregions within the U.S. Caribbean EEZ, no additional effort would be required to establish those boundaries or to monitor them.

An increase in the administrative burden would be expected in response to implementation of **Preferred Alternative 2**. With regard to actual harvest, quotas would be established for the EEZ of each island group. To ensure that annual harvest is maintained within those quotas, additional effort will be required to track landings independently for each island group, to identify potential overages in a timely manner, and to efficiently and effectively reduce harvest so as to achieve but not exceed the quota. This additional administrative burden may be offset to some degree by the smaller universe of stakeholders to whom the message must be delivered. For example, if the St. Croix snapper quota is met, only the fishermen on St. Croix will have to be notified. An increase in administrative effort also will be required to establish the formal dividing lines, to distribute that information and to ensure that it is understood by all members of the affected user groups, and to enforce access to those subregions on the high seas or at the dock. A fully effective monitoring and enforcement program could be a substantial undertaking. However, it is not likely that there would be any noticeable difference among sub-alternatives with regard to the added administrative burden. Those sub-alternatives simply provide slightly different approaches to drawing the lines. Geographic differences among sub-alternatives are not large, so choosing one over the other would be unlikely to increase enforcement efforts and would have no impact on other administrative requirements.

6.4 ACTION 4: Management Measures

6.4.1 Direct and Indirect Effects on the Physical, Biological, and Ecological Environment

Action 4(a) Species-specific parrotfish prohibitions

The **Preferred Alternative 2** prohibition on harvest of midnight, rainbow, and blue parrotfish may have substantial benefits for the reef ecosystems of the U.S. Caribbean. These three species, along with all species of parrotfish, are herbivorous grazers of the reefscape, providing an essential ecological service by controlling the proliferation of algal species that otherwise overgrow the reef surface and interfere with settlement of coral propagules (Brock 1979, Mumby et al. 2006). Midnight, rainbow, and blue parrotfish exhibit the largest maximum size of the parrotfish species that inhabit U.S. Caribbean coral reefs, but they are also of greatest conservation concern because of their relatively long population doubling time, low resilience, and low abundance on Caribbean

reefs (Table 4.4.1). Although analyses of the abundance of parrotfish, on coral reefs subject to commercial and recreational harvest relative to pristine reefs, are rare within the U.S. Caribbean, there is concern among scientists and managers that these three large species are depauperate on harvested reefs relative to pristine reefs. While the evidence is not definitive, caution is advised due to the essential ecological services provided by these species. Both direct and indirect effects would be expected from limiting harvest of blue, rainbow, and midnight parrotfish. Direct effects include those resulting from grazing by parrotfish on the reefscape, an activity that ameliorates competition between algae and coral propagules. Indirect effects relate to the provision of habitat by the coral whose abundance may be enhanced by increased recruitment due to that reduced competition with algae. Less substantial indirect effects would include materials transfer between reefs and seagrass beds that also are populated by parrotfish during their life cycle.

Action 4(b) Recreational bag limits

To the extent that bag limits reduce recreational fishing activity, direct and indirect effects on the physical environment may be realized. Those direct and indirect effects would emanate from reduced interaction between fishing gear and the benthic substrate, especially living coral. The primary effects of recreational fishing on the physical environment of the coral reef generally result from fishing gear interactions with the sea floor. Fishing gear can damage or disturb bottom structure, and living coral is particularly sensitive to such damage and disturbance. No action **Alternative 1** would maintain the status quo and therefore would not be expected to elicit change. **Alternatives 2-4** would be expected to progressively enhance the direct and indirect effects of this action by reducing harvest by increasing percentages depending upon the bag limit and the complex to which the aggregate bag limit is applied. By establishing a vessel limit that essentially caps the recreational harvest from any one of the complexes for each individual vessel, **Alternative 6** provides an upper limit to recreational harvest and maximizes the positive effects, both direct and indirect, to the physical, biological, and ecological environment. **Alternative 5** reiterates the prohibition on take of three species of parrotfish in the U.S. Caribbean EEZ that is proposed in **Alternative 2** of Action 4(a) and therefore reiterates the direct and indirect benefits discussed above. **Alternative 7** was proposed by the Council at their April 2010 meeting and is the preferred alternative. That alternative would provide the greatest flexibility to the individual fisherman but would allow for the continued harvest of ecologically important parrotfish. However, in combination with **Alternative 2** of Action 4(a), harvest of the three largest parrotfish species (midnight, rainbow, blue) would not be allowed. Based upon data from 2006-2007, an allowance of two parrotfish per fisher would be expected to reduce the parrotfish catch by a minimum of 20 percent (Figure 4.4.1) and probably more since parrotfish are rarely reported in the recreational harvest from the U.S. Caribbean EEZ. Moreover, if **Alternative 2** of Action 4(a) is implemented, the three largest (and therefore most appealing to recreational fishers) of those parrotfish species will no longer be available for harvest, in which case the reduction in parrotfish take may be even greater. The physical, biological, and ecological benefits provided by parrotfish would be expected to be enhanced accordingly.

6.4.2 Direct and Indirect Effects on the Economic and Social Environments

Action 4(a) Species-specific parrotfish prohibitions

Alternative 1 is the no action alternative. As such, **Alternative 1** would not affect fishing for or possession of parrotfish in the EEZ or landings of parrotfish from the EEZ. Hence, **Alternative 1** would have no economic or social impact beyond the baseline.

Preferred Alternatives 2A, 2B, and **2C** of Action 4(a) follow logically from **Preferred Alternative 2(h)** of Action 2(a). **Preferred Alternative 2A** would prohibit fishing for or possession of midnight parrotfish in the EEZ. **Preferred Alternative 2B** would apply that prohibition to blue parrotfish, and **Preferred Alternative 2C** would apply the prohibition to rainbow parrotfish. Parrotfish are a shallow-water reef fish. None of Puerto Rico's recreational fishers interviewed for MRFSS in 2006 or 2007 reported catching parrotfish in the EEZ. This suggests **Preferred Alternatives 2A, 2B** and **2C** would have little to no economic or social impact on recreational fishers of Puerto Rico. Recreational fishers, who catch parrotfish in the EEZ, are encouraged to comment on the economic and social impacts of **Preferred Alternatives 2A, 2B,** and **2C**.

Landings of midnight, blue, and rainbow parrotfish represent a very small portion of all commercial parrotfish landings in Puerto Rico from 1983 to 2007, and in most years during this 25-year period, there were no reported landings of these three species. From 1999 to 2007, annual adjusted landings of blue parrotfish averaged 15 pounds, with no landings after 2003. The highest adjusted landings of blue parrotfish (469 pounds) occurred in 1994 (see Table 5.3.17 in Section 5.3.1). Reported landings of midnight parrotfish have been infrequent. From 1983 to 2007, commercial landings of midnight parrotfish were reported in only 4 years, peaking in the first year at 333 pounds (adjusted weight). From 1999 to 2007, an average of 4 pounds (adjusted weight) of midnight parrotfish was landed annually, although landings were reported in only two of those years. Rainbow parrotfish were first reported to be landed in 1995, and an average of 553 pounds (adjusted weight) were landed annually from 1999 to 2007, although none were reported to be landed in 2007. If the adjusted landings account for all commercial landings of these three species in Puerto Rico, combined landings for these species account for approximately half a percent of annual landings of all parrotfish in both pounds and dollars. However, at least 98.6 percent of each year's adjusted commercial landings of parrotfish are in the generic category of "Parrotfish" during the years from 1983 to 2007, and from 1999 to 2007, generic landings represent an average of 99.5 percent of annual landings of all parrotfish. It is reasonable to expect that commercial landings of midnight, blue, and rainbow parrotfish are included among these generic landings. Therefore, the actual percent of all parrotfish landings represented by blue, rainbow, and midnight parrotfish is unknown due to lack of species-specific reporting of parrotfish landings. Moreover, the percent of the adjusted commercial parrotfish landings that originated in the EEZ, if any, is similarly unknown due to inadequate landings information.

According to a comment made at the April 27, 2009, scoping meeting for this amendment in San Juan, commercial and recreational fishers in Puerto Rico catch the same kind of

parrotfish and in the same areas. That comment suggests little to none of the commercial landings of parrotfish result from fishing in the EEZ, and if correct, **Preferred Alternatives 2A, 2B** and/or **2C** would have little to no economic or social impact on commercial fishers, their families, and fishing communities of Puerto Rico. Puerto Rico's commercial fishers, who catch parrotfish in the EEZ, are encouraged to comment on the economic and social impacts of **Preferred Alternatives 2A, 2B,** and/or **2C**.

MRFSS is not conducted in the USVI, so there are no data regarding annual recreational landings of parrotfish or any other species. Hence, the economic and social impacts of **Preferred Alternatives 2A, 2B** and/or **2C** on recreational fishers of the USVI would be unknown. However, it is expected that the vast majority of parrotfish that are caught by recreational fishers of the USVI are taken in territorial waters. USVI recreational fishers, who catch parrotfish in the EEZ, are encouraged to comment on the economic and social impacts of **Preferred Alternatives 2A, 2B** and/or **2C**.

Parrotfish landings represent a substantial portion of St. Croix's annual commercial landings of all species. During the 10-year period from 1998 to 2007, an average of approximately 31 percent of St. Croix's annual commercial landings by weight derived from parrotfish landings. Parrotfish landings are not so substantial in St. Thomas/St. John; from 2000 to 2007, they made up an average of approximately 6 percent of the district's annual commercial landings of all species by weight. The annual average of parrotfish landings in 2006 and 2007 was 361,229 pounds in St. Croix and 42,528 pounds in St. Thomas/St. John.

There was a general increase in commercial landings of parrotfish in both St. Croix and St. Thomas/St. John from 2000 to 2006, followed by a significant decline in both island groups in 2007 (Figure 6.4.2.1). During these eight years, St. Croix's landings of parrotfish accounted for approximately 87 percent of the USVI's annual commercial landings of parrotfish by weight and 86 percent by dollars, on average. Landings of blue, midnight, and rainbow parrotfish are unknown because any species of parrotfish that are commercially landed in the USVI are reported within the broad category of parrotfish.

DRAFT

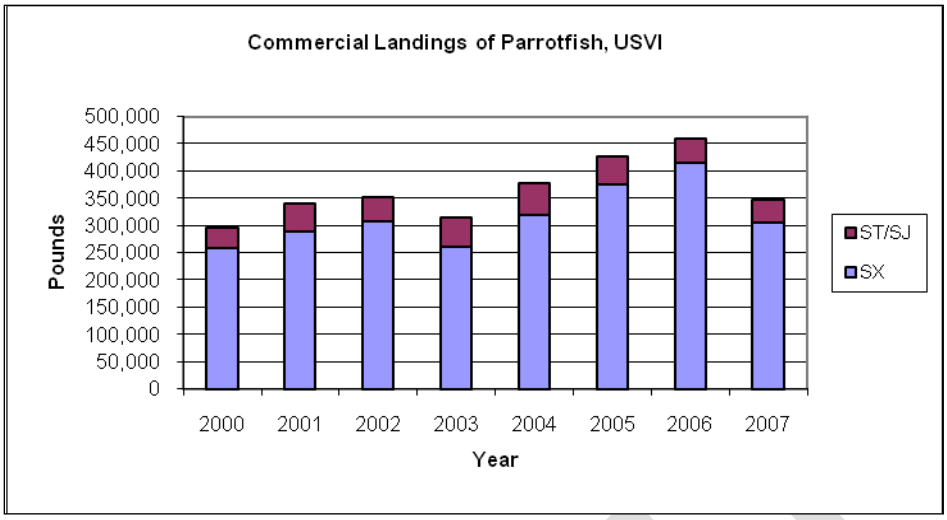


Figure 6.4.2.1. Commercial landings of parrotfish in St. Croix and St. Thomas/St. John, 2000-2007.

Major commercial fishing areas include both territorial and federal waters off St. Croix's east coast, where the East End and Lang Bank fishing grounds are popular among netfishers looking to catch parrotfish and other reef species (Valdés-Pizzini et al. 2010). Lang Bank is also popular with divers and trap fishers. Parrotfish are harvested in federal waters off St. Croix; however, it is unknown what percent of commercial parrotfish landings in St. Croix are composed of blue, midnight, and rainbow parrotfish that derive from the EEZ. The economic and social impacts of **Preferred Alternatives 2A, 2B,** and **2C** are unknown; however, it is likely that St. Croix fishers, their families, and fishing communities could experience larger adverse impacts than their counterparts in St. Thomas/St. John and possibly significantly larger adverse impacts than their counterparts in Puerto Rico. Commercial fishers of the USVI, who catch parrotfish in the EEZ, are encouraged to comment on the economic and social impacts of **Preferred Alternatives 2A, 2B,** and/or **2C**.

In summary, **Alternative 1** of Action 4(a) is the no action alternative and would not have any added short-term economic or social impacts. **Preferred Alternative 2** of Action 4(a) follows logically from **Preferred Alternative 2h** of Action 2(a) for rainbow, blue and midnight parrotfish and would have direct adverse short-term economic and social impacts on the U.S. Caribbean fishers who take midnight, rainbow, and/or blue parrotfish in the EEZ. It is expected that they could mitigate for loss of harvest of these species from the EEZ, if there is any, by either increasing effort in territorial waters or by targeting other parrotfish or nonparrotfish species in federal waters, subject to any ACL limitations on those species.

Action 4(b) Recreational bag and vessel limits

Alternative 1 is the no action alternative, which would not establish a recreational bag limit on reef fish harvest in the EEZ. It would not have an economic or social impact beyond the baseline.

Alternative 2 of Action 4(b) would allow larger recreational catches per person than **Alternative 3**, and **Alternative 3** would allow larger recreational catches per person than **Alternative 4**. Hence, among these three alternatives, **Alternative 4** would likely have the largest adverse economic and social impacts and **Alternative 2** would likely have the lowest if recreational fishing of snapper, grouper, and parrotfish species occurs in federal waters. However, **Alternative 5** would essentially prohibit recreational fishing of parrotfish in federal waters, and would have the largest adverse economic impact among **Alternatives 2** through **5** for parrotfish. **Alternative 5** could be especially harmful to subsistence fishers of the USVI, especially St. Croix, because ethnographic evidence suggests they are more dependent upon parrotfish than the Puerto Rican counterparts.

The largest adverse economic and social impacts of **Preferred Alternative 7** and **Alternatives 2** through **6** of Action 4(b) could be on recreational fishers of St. Thomas/St. John and St. Croix because more fishable habitat is in the EEZ off St. Thomas/St. John and St. Croix than in the EEZ off Puerto Rico. **Alternative 6** and **Preferred Alternative 7's** boat limits could adversely affect charter vessel operations because their catch of parrotfish and combined catch of snapper, grouper, and parrotfish would be limited, which could discourage anglers from buying their services.

Preferred Alternative 7 of Action 4(b) is a combination of a daily personal limit and daily vessel limit. Specifically, it combines personal daily limits of two parrotfish per person (**Alternative 4C** of two parrotfish per person) and 10 snapper, grouper and parrotfish combined per person with vessel limits of six parrotfish per boat and 30 snapper, grouper, and parrotfish combined per boat. The vessel limits are three times the personal limits, which is equivalent to **Alternative 6B**, which is smaller than **Alternative 6C**. Consequently, the adverse economic and social impact on charter vessel operations could be larger with **Preferred Alternative 7** than **Alternative 6C**.

None of the recreational bag limits would apply to a person with a commercial fishing license in Puerto Rico or the USVI. Currently, there is a moratorium on commercial fishing licenses in the USVI; however, Puerto Rico does not limit the number of commercial fishing licenses. The cost of a commercial fishing license in Puerto Rico is either $10 for a beginner or $40 for an experienced commercial resident fisher and $250 for a nonresident. The beginner license is typically valid for one year and cannot be renewed (Juan Agar, pers. comm.), and one for an experienced fisher is valid for 4 years, which can be renewed. A resident fisher is required to show from tax returns over a year or more that at least 20 percent of his/her income derives from fishing to obtain an experienced commercial fishing license (Juan Agar, pers. comm.). That income requirement suggests that Puerto Rico's recreational fishers would be able to obtain a one-year beginner commercial license to avoid the recreational bag limit, but would have to show at least 20 percent of his/her annual income derived from fishing to continue to have a commercial license. The same income requirement does not appear to hold for nonresident fishers. Note that the 20 percent minimum income requirement suggests that a Puerto Rican fisher who derives less than 20 percent of his/her annual income from fishing cannot be a commercial fisher although s/he sells all or part of the catch. That

may explain the prevalence of recreational fishers in Puerto Rico who sell some of their catch.

The other economic cost of a Puerto Rico commercial license is the time and money spent to report landings caught under that license, if any. If a recreational fisher, who presently catches more individuals in the EEZ than would be allowed by the proposed bag limits, purchases a resident or nonresident commercial fishing license and reports his or her landings caught under that license, such landings could compromise reported commercial landings of snapper, grouper, and/or parrotfish species in Puerto Rico. These landings could be counted against the commercial ACL(s) of grouper, snapper, and/or parrotfish in Puerto Rico. Thus, there would be unintended competition among commercial and recreational fishers for the allowed commercial catch and possibly increased overage and higher overage of commercial catch during a fishing season. That overage could result in a shortened fishing season and diminished commercial landings the next year (see Action 5(b)), which would have negative economic and social impacts on commercial fishers in the snapper, grouper, and/or parrotfish fisheries of Puerto Rico. If the fisher self-identifies as a recreational fisher, who just happens to have a commercial fishing license, s/he may wrongfully not report her or his landings of these species caught under the license because there is no existing requirement to report recreational landings. Recreational and commercial fishers, who fish in the EEZ, are encouraged to comment on the economic and social impacts of Action 4(b).

If the economic and social cost of either **Preferred Alternative 7** or **Alternatives 2, 3 4, 5,** or **6** is greater than the economic and social cost of obtaining a commercial fishing license for a USVI recreational fisher, the lower cost option would be to purchase a nonresident commercial license for $250 that is good for 4 years and can be renewed. The personal and social cost of obtaining a commercial fishing license may be understood as the loss of being officially identified as both a recreational fisher and member of a recreational fishing community, although the person may continue to self-identify and be identified in the Virgin Islands as a recreational fisher. Similarly, if the economic and social cost of either **Preferred Alternative 7** or **Alternatives 2, 3 4, 5,** or **6** is greater than the economic and social cost of obtaining a beginner commercial license for a Puerto Rico recreational fisher, the lower cost option would be to purchase a beginner commercial license, although the savings may be good for only one year. After the expiration of the resident's beginner commercial license, the Puerto Rican recreational fisher would experience any adverse economic and social impacts that result from the bag or vessel limits. However, the least cost option may be to substitute fishing in territorial waters for fishing in federal waters to mitigate for any lost landings and associated economic and social benefits because of the bag limits. Fishers are encouraged to comment on potential economic and social impacts of these various bag and vessel limits.

6.4.3 Direct and Indirect Effects on the Administrative Environment

Action 4(a) Species-specific parrotfish prohibitions

No additional direct or indirect effects on the administrative environment are anticipated in response to the **Alternative 1** no action option. It is likely that both direct and indirect

effects would be realized in response to the **Preferred Alternative 2** option to prohibit harvest of blue, midnight, and rainbow parrotfish. Direct obligations would befall law enforcement agents to be able to properly identify the three species of prohibited parrotfish within the context of a milieu of parrotfish species in the landed catch. Indirect obligations would incur to track and prosecute these violations.

Action 4(b) Recreational bag limits

Administrative obligations would be increased by the implementation of bag limits, but those obligations would increase only marginally with increasingly restrictive bag limits or with a vessel limit. The initial increase would result from the increased effort required of law enforcement agents to monitor catch and to properly assign that catch to the appropriate species. However, little additional effort would be required to determine if the catch met a 10-fish, 5-fish, or 2-fish limit. Some effort would be required to ensure that the number of fishers on the vessel is adequate to account of the harvest of multiple individual limits. Finally, because the bag limits are restrictive relative to the **Alternative 1** case, it is likely that violations of this regulation would occur. Those violations would be without precedent so would constitute a new source of administrative effort, in the form of ticketing and prosecution, relative to the no action alternative.

6.5 ACTION 5: Accountability Measures

6.5.1 Direct and Indirect Effects on the Physical, Biological, and Ecological Environment

Action 5(a) Triggering accountability measures

The alternatives under this action will not have a direct effect on the physical, biological, and ecological environments. These alternatives simply supply the Council with a mechanism to address overruns of the annual catch limit proxies established and described in this amendment under Action 2. Indirect effects to the biological and ecological environment, however, would vary depending on the alternative selected as preferred, although no effects to the physical environment are expected with any of these alternatives. **Alternative 1**, the no action alternative, would maintain the status quo and no AMs would be triggered. While this alternative would have no direct biological or ecological effect, it also would not satisfy compliance with MSA mandates.

Alternative 2A would trigger AMs to be considered based on landings from a single-year. Such a process is the least precise among **Alternatives 2A-C**, and probably the least accurate, and may result in triggering AMs when, if more data were available, AMs might not need to be triggered at all. On the other hand, because such a one-year process is not very accurate, it may show that AMs should have been triggered earlier. Consequently, using a single-year trigger for AMs will result in a generally higher frequency of triggering AMs and adjusting the ACLs than a multi-year approach (i.e., **Alternatives 2B** and **2C**). **Alternative 2A** would result in a more conservative biological and ecological effect on resources than the no action **Alternative 1**.

Alternative 2B of Action 5(a) is more precise and accurate than **Alternatives 1** and **2A** in that it is based on a 2-year average. The resulting biological and ecological effects from the 2-year trigger approach would be expected to be more precise than a single-year trigger but still marginally acceptable due to the still relatively short 2-year sample period upon which the trigger is based. Potential biological and ecological effects would be similar to that for a single-year trigger in that AMs may be triggered more frequently than needed. The degree of difference between alternatives cannot be determined at this time. However, **Alternative 2B** represents a more statistically reliable method for triggering AMs than **Alternatives 1** and **2A**.

Alternative 2C of Action 5(a) is most precise and accurate when compared to **Alternatives 1, 2A,** and **2B** because it is based on a 3-year time period average. The resulting estimates of biological and ecological effects would be expected to be statistically more precise than a single- or 2-year trigger because it is based on more information (i.e., 3 years rather than 1 or 2 years) with results being more reliable. Indirect effects of **Alternative 2C** are anticipated to be more precise and accurate than other alternatives such that AMs would be triggered more reliably than when using a smaller data base (i.e., shorter time period) for the trigger. The indirect effect of all alternatives is that, when AMs are triggered based on the three-year average, the resource would be managed more conservatively than when AMs are not triggered. The degree of difference between alternatives cannot be determined at this time. However, **Alternative 2C** represents the most statistically reliable method for triggering AMs.

Alternatives 3A-C will have similar direct and indirect biological and ecological effects as **Alternatives 2A-C**, but prior to triggering an AM based on a single-, 2-, or 3-year average of landings, scientific advice (from the SEFSC and the Council SSC) would be needed to determine whether the ACL was exceeded due to increased catch, due to an improved data collection/monitoring effort, or due to a combination of the two. Such a consultation would assist the Council in its determination that catches actually exceeded the ACL. A Commercial Data Collection Improvement Program is under development by the SEFSC and is focused to provide more precise and accurate commercial fishery landings information for the U.S. Caribbean, and there is a real possibility that a greater amount of landings data will be collected for each island mass. For **Alternatives 3A-C**, a determination will have to be made to examine whether an overrun of the ACL was due to increased catches by fishers or through improved data collection/monitoring efforts. The SEFSC and the SSC will provide an analysis of the information and consult with the Council before any determination is made. A single year of landings beginning in 2010 will be the basis for the initial consultation and subsequent determination whether an ACL was exceeded or not. The addition of such a scientific review would result in a more reliable and defensible decision by the Council to take further management action by triggering an AM to redress ACL overages.

Action 5(b) Applying accountability measures

The alternatives under this action will not have a direct effect on the physical, biological, and ecological environments. These alternatives simply describe alternative measures to

address overruns of the annual catch limit proxies established and described in this amendment under Action 2. Indirect effects to the biological and ecological environment, however, would vary depending on the alternative selected as preferred, although no effects to the physical environment are expected with any of these alternatives. **Alternative 1**, the no action alternative, would maintain the status quo and no AMs would be triggered. While this alternative would have no direct biological or ecological effect, it also would not satisfy compliance with MSA mandates.

The indirect biological and ecological effects of **Preferred Alternative 2**, which would shorten the season length to prevent a future overage, would result in reduction of fishing effort for the species undergoing overfishing. When fishing effort on a population is reduced, the general effect is an increase in individual size and abundance of individuals in the population, but the rate and extent of these changes cannot be determined at this time. **Preferred Alternative 2** could result in fishers being restricted to a shorter harvesting season, with the intent of restricting their harvest to levels less than the currently established ACL. Theoretically, the fish population would immediately begin to rebound towards non-fished levels via recruitment and growth. Another short-term effect may be that fishers harvesting non-regulated species or those species with quota remaing may incidentally catch species for which the ACL has been met. In such a case, regulatory discards (i.e., fish discarded due to harvest restrictions) may result in discard mortality. The level of such mortality cannot be determined at this time.

Fish and coral reef habitats would be indirectly affected **Preferred Alternative 2** and **Alternative 3** by a shortened season by not being subjected to the same degree of pre-AM interaction with fishers or gear. Trophic predator-prey interaction should begin to return to a "more natural state", which generally leads to a more species diverse reef community.

The biological and ecological indirect effects of **Alternative 3**, which would shorten the length of the fishing season by the amount needed to pay back the overage in addition to shortening the season length to prevent a future overage, would likely have a greater biological benefit than only reducing the length of fishing season as specified in **Preferred Alternative 2**. However, like **Preferred Alternative 2**, AMs that shorten the fishing season can increase the magnitude of regulatory discards and may not be as effective as AMs that lower the target level but still allow some catch.

A shortened season length as a result of **Alternative 3** (i.e., AM implementation to prevent a future overage) would result in reduction of fishing effort for the species undergoing overfishing. As explained for **Preferred Alternative 2**, reduction of fishing effort generally results in a more natural size distribution of individuals and a larger number of individuals in the population, but the rate and extent of these changes cannot be determined at this time. Also, similar to indirect effects of **Preferred Alternative 2**, fishers would not be allowed to harvest as much fish as before the ACL overrun, so the fish population theoretically would immediately begin to rebound toward a non-fished level via recruitment and growth.

6.5.2 Direct and Indirect Effects on the Economic and Social Environments

Action 5(a) Triggering accountability measures

Alternative 1 of Action 5(a) would not have an economic or social impact beyond the baseline. Without regulations that implement the AMs, **Alternative 2** and **Preferred Alternative 3** would have no added economic or social impacts. However, **Preferred Alternative 3** could have a smaller indirect adverse economic and social impact than **Alternative 2** because it would include considerations for improvements in reported landings that suggest larger landings that are not actually larger. Among the sub-alternatives of **Preferred Alternative 3**, **Preferred Sub-alternative C** could have the smallest indirect adverse economic and social impact because it would require inclusion of a 3-year average of landings as opposed to a two-year average (**Sub-alternative B**) or single year of landings (**Sub-alternative A**).

Preferred Alternative 3 of Action 5(a) would not have an economic or social impact on queen conch fishers in Puerto Rico or St. Thomas/St. John because there is no fishing for queen conch in the EEZ off Puerto Rico or St. Thomas/St. John, nor can fishers take conch from the EEZ off St. Croix and transport it through the EEZ for landing in either Puerto Rico or St. Thomas/St. John. **Preferred Alternative 3C** of Action 5(a)) would also not have an economic or social impact on St. Croix queen conch fishers because **Preferred Alternative 2g** of Action 2(b) would set the ACL for queen conch at 50,000 pounds, which is consistent with the current St. Croix limit set by the USVI.

Action 5(b) Applying accountability measures

Alternative 1 of Action 5(b) would not apply AMs and would have no economic or social impact. Preferred **Alternative 2** or **Alternative 3** of Action 5(b) would have the greatest adverse economic and social impacts if all landings derived from fishing in the EEZ; however, they do not. The vast majority of U.S. Caribbean catches of reef fish are believed to derive from territorial waters, as only about 14 percent of the fishable habitat in the U.S. Caribbean occurs in the EEZ (CFMC 2005: 236). If few of the landings for the species or species groups result from fishing in the EEZ, a shortened federal fishing season would have little economic or social impact.

Alternative 3 would likely have a larger adverse economic and social impact on fishers, their families, and fishing communities than **Preferred Alternative 2** because it would reduce the fishing season by a longer length of time. However, the actual economic and social impacts of either **Preferred Alternative 2** or **Alternative 3** are greatly dependent upon the percent of landings that derive from fishing in the EEZ and the chosen ACLs relative to current landings. With more fishable habitat in their territorial waters, Puerto Rican fishers would be most able to mitigate for any losses of landings due to a shortened federal fishing season by shifting into territorial waters, if the territorial season were to remain open. With the least amount of fishable habitat in territorial waters off St. Thomas/St. John, it is expected that St. Thomas/St. John fishers would be least able to mitigate for lost landings due to a shortened federal fishing season.

Given the limited amount of fishing for reef fish in the EEZ, it is reasonable to expect that fishers could mitigate most of the adverse economic and social impacts of a shortened federal fishing season, if any, by shifting any fishing from the EEZ to territorial waters, if the territorial fishery is open. However, the amount of fishable habitat in territorial waters and the EEZ vary substantially. Only 6.3 percent of Puerto Rico's fishable habitat occurs in the EEZ, and the vast majority of that area is found off the west coast of Puerto Rico. Conversely, 38 percent of the USVI' fishable habitat occurs in the EEZ. St. Thomas and St. John have a greater reliance on the EEZ, with approximately 43 percent of the total shelf occurring in the EEZ, as compared to that of St. Croix, which only has approximately 18 percent of its waters in the EEZ (CFMC 2005).

From 2000 to 2007, Puerto Rico's annual commercial snapper landings accounted for, on average, approximately 88 percent of U.S. Caribbean annual commercial snapper landings (pounds), followed by St. Thomas/St. John's landings that accounted for approximately 11 percent and St. Croix's landings that accounted for the remaining nine percent of those U.S. Caribbean commercial landings. Because the majority of commercial snapper are landed in Puerto Rico and because Puerto Rico has significantly less fishable habitat in the EEZ than the USVI, it is reasonable to expect that a shortened snapper fishing season in the EEZ would not substantially reduce U.S. Caribbean landings of snapper. Puerto Rico's fishers could likely mitigate for any losses of snapper landings by increasing effort in territorial waters.

USVI snapper fishers may have significantly less ability to mitigate for lost catch due to a shortened fishing season in the EEZ. For example, approximately 55 percent of the commercial snapper catch landed in St. Croix from 2000 to 2001 occurred in the EEZ according to trip ticket data (CFMC 2005). The amount and percentage of the catch from the EEZ may have been reduced since then by regulations, such as seasonal/area closures, that have been implemented after 2001.

From 2000 to 2007, Puerto Rico's annual grouper landings represented, on average, approximately 54 percent of U.S. Caribbean grouper landings (pounds) and St. Thomas/St. John's annual grouper landings represented approximately 29 percent and St. Croix's annual grouper landings represented approximately 17 percent of those U.S. Caribbean landings. Trip ticket data from 2000 to 2001 suggests approximately 44 percent of the reported commercial grouper catch landed in St. Croix occurred in the EEZ (CFMC 2005). The amount and percentage of the catch from the EEZ may have been reduced since then by regulations, such as the seasonal closure of Grammanik Bank, that have been implemented after 2001.

From 2000 to 2007, St. Croix's annual commercial landings of parrotfish accounted for, on average, approximately 66 percent of the U.S. Caribbean's commercial landings of parrotfish, followed by Puerto Rico with approximately 24 percent and St. Thomas/St. John with approximately 10 percent of those annual U.S. Caribbean landings of parrotfish. As stated in Section 6.4.2, there is expected to be no landings of parrotfish in Puerto Rico that are caught in the EEZ.

Current federal regulation prohibits fishing for or possession of queen conch in or from the Caribbean EEZ from July 1 through September 30 each year. Taking queen conch from the EEZ, except for an area off St. Croix, and transporting it outside that area to either St. Thomas/St. John or Puerto Rico is prohibited at all times. Neither **Preferred Alternative 2** or **Alternative 3** would have an economic or social impact on queen conch fishers in Puerto Rico or St. Thomas/St. John because there is no fishing for queen conch in the EEZ off Puerto Rico or St. Thomas/St. John nor can fishers take conch from the EEZ off St. Croix and transport it through the EEZ for landing in either Puerto Rico or St. Thomas/St. John. Neither **Preferred Alternative 2** or **Alternative 3** would have an adverse economic or social impact on St. Croix conch fishers because **Preferred Alternative 2(g)** of Action 2(b) equals the ACL to the St. Croix District's 50,000-pound limit.

In summary, **Alternative 1** would not apply the AMs and would have no economic or social impact. **Alternative 3** would likely have a larger adverse economic and social impact on fishers, their families, and fishing communities than **Preferred Alternative 2** because it would reduce the fishing season by a longer length of time. However, the actual economic and social impacts of either **Preferred Alternative 2** or **Alternative 3** are greatly dependent upon the percent of landings that derive from fishing in the EEZ and the chosen ACLs relative to current landings. With more fishable habitat in their territorial waters, Puerto Rican fishers are most able to mitigate for any losses of landings due to a shortened federal fishing season by shifting into territorial waters, assuming the territorial season remains open. With the least amount of fishable habitat in territorial waters off St. Thomas/St. John, it is expected that St. Thomas/St. John fishers would be least able to mitigate for lost landings due to a shortened federal fishing season.

Preferred Alternative 2 of Action 5(b) would not have an economic or social impact on queen conch fishers in Puerto Rico or St. Thomas/St. John because there is no fishing for queen conch in the EEZ off Puerto Rico or St. Thomas/St. John, nor can fishers take conch from the EEZ off St. Croix and transport it through the EEZ for landing in either Puerto Rico or St. Thomas/St. John. **Preferred Alternative 2** of Action 5(b) would also not have an economic or social impact on St. Croix queen conch fishers because **Preferred Alternative 2g** of Action 2(b) would set the ACL for queen conch at 50,000 pounds, which is consistent with the current St. Croix limit set by the USVI.

6.5.3 Direct and Indirect Effects on the Administrative Environment

Action 5(a) Triggering accountability measures

Alternative 1 is the no action alternative, and would not have an administrative effect. **Alternatives 2A-C** and **Alternatives 3A, 3B**, and **Preferred Alternative 3C** would define the trigger to AMs if the ACL is exceeded; however, they do not apply those measures. Without regulation that implements the AMs, **Alternatives 2** and **3** would not change existing fishing practices and would have no impact to enforcement. **Alternatives 3A, 3B**, and **Preferred Alternative 3C** would require the SEFSC to tally yearly landings and provide those numbers to the Council SSC, resulting in some administrative effect, albeit minor.

Action 5(b) Applying accountability measures

Alternative 1, the no action alternative, would not apply AMs. It would not have an administrative impact. **Preferred Alternative 2** and **Alternative 3** would establish the regulation that would reduce the length of the fishing season in the EEZ for a species or species group if the annual or average annual catch exceeded the ACL for the species or species group.

Preferred Alternative 2 would reduce the length of the fishing season in the EEZ for the species or species group by the amount of time needed to prevent overage. For example, if it were found that a single year's commercial landings or an annual average of those landings exceeded the commercial ACL by 10,000 pounds, and commercial fishers landed an average of 10,000 pounds a month, then the next federal fishing year would be shortened by one month under **Preferred Alternative 2**. **Alternative 3** would require a shorter fishing season than **Preferred Alternative 2** in the next fishing year in order to pay-back any overages. Using the previous example for **Alternative 3**, the next federal fishing year would be shortened by two months because the allowed commercial catch would be equal to the commercial ACL less the overage of 10,000 pounds. Both **Preferred Alternative 2** and **Alternative 3** would have similar administrative impacts to management because regulatory actions would have to be developed to implement AMs. Also, **Preferred Alternative 2** and **Alternative 3** would have minimal if any impact on enforcement.

6.6 ACTION 6: Framework Measures

6.6.1 Direct and Indirect Effects on the Physical, Biological, and Ecological Environment

The Council currently has at its disposal, three different regulatory vehicles for addressing fishery management issues for a fishery. First, a full amendment may be developed to implement or modify management measures as necessary. The amendment process can take anywhere from one to three years dependent upon the type of National Environmental Policy Act (NEPA) document needed to support the amendment actions. Second, the Council may vote for an interim or emergency rule that could remain effective for 180 days with the option to extend it for an additional 186 days. Interim, and/or emergency rules can be implemented only under limited circumstances and act as short-term management tools while permanent regulations are being developed through the amendment process. Third, the Council may prepare a regulatory amendment based on framework procedures. Typically, framework actions can take about nine months to implement, and are effective until modified.

The no action **Alternative 1** would not establish framework procedures to allow for adjustments to various management measures. This would maintain the current procedure for modifying management regulations, potentially causing delays in important changes. Often, when a modification to management measures is needed, corrective action is required quickly. Not allowing regulations to be adjusted through framework would most likely lead to extended delays in implementation of necessary changes. Such a scenario

could be biologically detrimental since overfishing or other threats would persist until the appropriate modifications could be put in place through amendment action. Alternately, if new data shows a stock is doing better than previous assessments indicate and more restrictive management measures are maintained, unnecessary harvest restrictions could prevent the fishery from harvesting its optimum yield.

Under **Alternatives 2** and **3**, adjustments to regulations could be made with relative ease as new fishery and stock abundance information become available. Unlike **Alternative 1**, **Alternatives 2** and **3** would likely be biologically beneficial for reef fish and queen conch. However, **Alternative 2** would provide better protection because the framework under **Alternative 2** is more comprehensive and will provide a larger framework for the Council to work under than **Alternative 3**. **Alternative 3** may inadvertently leave out some management measures which may be needed in the future. If changes to omitted measures are needed, a full plan amendment would be required. During the development of the full plan amendment, the measures that require change will still be in effect, potentially harming the reef fish and queen conch populations for a longer period of time.

Establishing framework procedures allows for periodic adjustments to management measures which could be implemented in a timely manner. Allowing management adjustments to be made through framework actions could eliminate the need to prepare and analyze individual amendments or amendment actions for each adjustment needed.

Framework actions are implemented by the RA and require less public and Council participation when compared to the lengthy amendment process. The majority of public participation and Council weigh-in on framework issues typically takes place when the framework procedures are initially drafted during the amendment process. This reduces the need for long public comment periods and periods of consideration by the Council, as would be the case under **Alternative 1**. Eliminating these time-consuming factors under **Alternatives 2** and **3** would enable harvest modifications to be expedited when they are most needed.

6.6.2 Direct and Indirect Effects on the Economic and Social Environments

Alternative 1 is the no action alternative and would have no direct economic and social impacts. It would not establish a framework to authorize setting, adjusting, and implementing of ACLs and AMs that could be deemed necessary to improve management of the resource, and hence, could indirectly result in lower long-term net economic and social benefits that derive from exploitation of the resources. Because **Alternatives 2** and **3** would establish such a framework, it is expected that the indirect long-term net economic and social benefits of **Alternatives 2** and **3** would be larger than those of **Alternative 1**.

6.6.3 Direct and Indirect Effects on the Administrative Environment

Alternative 1 would be the most administratively burdensome of the three alternatives being considered, because all modifications to the management measures outlined in Section 4.6 would need to be implemented through an FMP amendment, which is a more

laborious and time consuming process than a framework action. **Alternative 2** would incur less of an administrative burden than **Alternatives 1** or **3** since several steps in the lengthy amendment process would be eliminated if the RA were given the latitude to adjust certain management regulations through framework actions. **Alternative 3** could potentially leave out important management measure and if they need to be changed in the future, developing a full plan amendment would be burdensome to managers. **Alternative 2** provides for a more comprehensive framework and will prevent that type of burden on managers.

6.7 Cumulative Effects Analysis

NEPA requires federal agencies to assess not only the indirect and direct impacts associated with regulatory actions, but also the cumulative impacts associated with those actions. 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, and can either be additive or synergistic. A synergistic impact is when the combined impacts are greater than the sum of the individual impacts.

The following cumulative effects analysis (CEA) is based upon guidance offered in CEQ (1997). The report outlines 11 items for consideration in drafting a CEA for a proposed action. These items are:

1. Identify the significant cumulative effects issues associated with the proposed action and define the assessment goals.
2. Establish the geographic scope of the analysis.
3. Establish the timeframe for the analysis.
4. Identify the other actions affecting the resources, ecosystems, and human communities of concern.
5. Characterize the resources, ecosystems, and human communities identified in scoping in terms of their response to change and capacity to withstand stress.
6. Characterize the stresses affecting these resources, ecosystems, and human communities and their relation to regulatory thresholds.
7. Define a baseline condition for the resources, ecosystems, and human communities.
8. Identify the important cause-and-effect relationships between human activities and resources, ecosystems, and human communities.
9. Determine the magnitude and significance of cumulative effects.
10. Modify or add alternatives to avoid, minimize, or mitigate significant cumulative effects.
11. Monitor the cumulative effects of the selected alternative and adapt management.

The CEA for the biophysical environment will follow these 11 steps. Cumulative impacts on the socio-economic environment will be analyzed separately.

DRAFT

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

The CEQ cumulative impacts guidance states this step is accomplished through three activities. The three activities are as follows:

I. Identifying the direct and indirect impacts of the proposed actions.

Direct and indirect impacts of the proposed actions are summarized in Sections 6.1 through 6.6. Establishing ACLs, AMs, and redefining management reference points for snapper, grouper, parrotfish, and queen conch in the U.S. Caribbean will serve to restore and stabilize natural trophic and competitive relationships, rebuild species abundances, re-establish natural sex ratios, and contribute to the long-term health of the ecosystem while reinvigorating sustainable fisheries.

II. Identifying which resources, ecosystems, and human communities are affected.

The resources, ecosystems, and human communities affected by this action are described in Sections 5.0 and 6.0. These include:

1. Managed resources (snapper, grouper, parrotfish, and queen conch);
2. Non-target fisheries (wenchman and creole-fish);
3. Habitat, including essential fish habitat;
4. Protected resources including marine mammals and corals;
5. And, Puerto Rico and USVI fishing communities

III. Identifying impacts that are important from a cumulative impacts perspective.

The effects most important from a cumulative impacts perspective are described in this CEA.

2. Establish the geographic scope of the analysis.

The immediate areas affecting managed resources, non-target fisheries, habitat, and protected resources are federal waters of the U.S. Caribbean. The immediate areas affecting humans would include fishing communities of Puerto Rico and the USVI.

The following is a summary description of the distribution of queen conch and the reef fish species affected by this proposed amendment. More detailed descriptions of these species can be found in section 5.2.

Queen conch

The queen conch occurs in semi-tropical and tropical waters of the Atlantic Ocean, ranging from south Florida and Bermuda to northern South America, including the Caribbean Sea.

The queen conch generally occurs on expanses of shelf to about 250 ft (76 m) depth. It is commonly found on sandy bottoms that support the growth of seagrasses, primarily turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), shoal grass (*Halodule wrightii*), and epiphytic algae upon which it feeds (Randall 1964, Stoner and Waite 1990). This species also occurs on gravel, coral rubble, smooth hard coral or beach rock bottoms, and sandy algal beds (CFMC 1996). Sandt and Stoner (1993) have shown that queen conch actively select among their habitats, with juveniles being more selective than adults, and are dependent on certain habitat requirements. The most productive nurseries occur in shallow (5-6 m deep) seagrass meadows (Stoner 1997). Juveniles exhibit a strong preference for intermediate densities of seagrasses, whereas adults show less habitat specificity (Stoner and Waite 1990).

Both commercial and recreational fishers of Puerto Rico and the USVI harvest queen conch. There is no evidence that there is a subsistence queen conch fishery in Puerto Rico, and there is expected to be no subsistence queen conch fishery in the USVI. See Sections 5.3.2.9.5 and 5.3.2.10.6 and 5.3.2.11 for more detailed information about these fisheries in Puerto Rico, and see Section 5.3.3.6.5 for detailed information about the commercial fishery in the USVI.

Fishing for and possession of queen conch in federal waters is restricted to an area off St. Croix, and this amendment would not end that restriction. Hence, only queen conch fishers of St. Croix could be affected by this amendment.

Relevant Reef fish Species

Reef fish species addressed in this amendment include Snapper Units 1 and 2, Grouper Units 1 to 4, and the Parrotfish Unit. In general, these species are found in tropical and subtropical waters of the western Atlantic stretching from the southeastern United States and Bermuda south through the Gulf of Mexico and Caribbean Sea to Brazil. Specific information on the distribution of these species is found in Section 5.2.2.

In general, reef fish are widely distributed in the Caribbean, occupying both pelagic and benthic habitats during their life cycle. Habitat types and life history stages are summarized in the Generic EFH Amendment (CMFC 2002) and in Section 5.2.2, and are incorporated by reference.

Commercial, recreational, and subsistence fishers of Puerto Rico and the USVI harvest species within Snapper Units 1 and 2, Grouper Units 3 and 4, and the Parrotfish Unit. Creole-fish, which is presently included in Grouper Unit 3, would be moved to a data-collection only category because it is not targeted in any fishery. Creole-fish is not a targeted species. For more detailed descriptions of Puerto Rico's commercial fisheries for these sub-units and units, see Sections 5.3.2.9.1 (Snapper Unit 1), 5.3.2.9.2 (Grouper Unit 4), 5.3.2.9.3 (Grouper Unit 1), 5.3.2.9.4 (Parrotfish), 5.3.2.9.6 (Snapper Unit 2), and 5.3.2.9.7 (cardinal snapper). For more detailed descriptions of the USVI' commercial fisheries, see Sections 5.3.3.6.1 (Snapper), 5.3.3.6.2 and 5.3.3.6.3 (Grouper), and 5.3.3.6.4 (Parrotfish). Fishing for Nassau grouper (Grouper Unit 1) and goliath grouper (Grouper

Unit 2) are prohibited in federal, Puerto Rico, and USVI waters; however, illegal catch of both species have been reported in Puerto Rico.

For more detailed descriptions of Puerto Rico's recreational fisheries for these sub-units and units, see Sections 5.3.2.10.2 (Snapper Unit 1), 5.3.2.10.3 (Grouper Unit 4), 5.3.2.10.4 (Grouper Unit 1), 5.3.2.10.5 (Parrotfish Unit), and 5.3.2.10.7 (Snapper Unit 2). See Section 5.3.2.10.8 for a description of the subsistence fishery. See Sections 5.3.3.7 and 5.3.3.8 for more information about the recreational and subsistence fisheries of the USVI.

3. Establish the timeframe for the analysis.

Section 3.2 describes the history of management of reef fish and queen conch in the U.S. Caribbean.

The timeframe for the CEA should take into account both historical efforts to manage reef fish and queen conch, as well as future considerations if this Amendment and its subsequent regulations are approved and implemented by NOAA Fisheries. The timeframe for the CEA begins with the implementation of the Reef Fish FMP in September 1985 and extends through 2019, which is ten years after this Amendment would first be approved and implemented.

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

The Council is currently developing another regulatory amendment to the Queen Conch FMP to establish compatible closures with USVI. The purpose of the regulatory amendment is to implement federal regulations compatible with the USVI regulations to close the queen conch fishery in federal waters once the territorial government has determined the quota in St. Croix has been reached. When harvest is allowed in territorial and not in federal waters or vice versa, there is an added cost to law enforcement to prove that a catch was taken illegally. Compatible closures benefit both federal and territorial law enforcement and fishers because agents could simply inspect the catch at the docks, versus conducting operations in territorial and/or federal waters, and fishers do not incur any added cost of providing proof that conch were legally caught. In combination with this proposed Amendment, there should be little to no added impact to queen conch fishers of St. Croix or their families and communities because less conch fishing occurs in federal waters and the 50,000-pound limit is reached by landing conch harvested from territorial waters.

The Council is currently developing another regulatory amendment to the Reef Fish FMP to extend the seasonal closure of Bajo de Sico, which is off the west coast of Puerto Rico. Bajo de Sico has been identified as an important spawning site, especially for red hind and possibly other resident grouper including Nassau and yellowfin, as well as an important foraging site for these and other Caribbean reef fish. The Bajo de Sico closed area has

been described as a well developed and diverse coral and sponge habitat that provides essential fish habitat (EFH) for Caribbean reef fish. The purpose of the regulatory

Table 6.9.1. Federal regulations affecting queen conch and reef fish.

Multiple Caribbean Stock Complexes (including the five stocks/stock complexes considered herein)
Permanent Area Closures:
Fishing for any species is prohibited year-round in the Hind Bank Marine Conservation District off St. Thomas
Seasonal Area Closures:
From March 1 through June 30 each year, all fishing is prohibited in the Mutton Snapper Spawning Aggregation Area off St. Croix
From December 1 through February 28 each year, fishing is prohibited in the four Red Hind Spawning Aggregation Areas (Lang Bank east of St. Croix and Bajo de Sico, Tourmaline Bank, and Abrir La Sierra Bank off western Puerto Rico)
From February 1 through April 30 each year, no person may fish for or possess any species of fish, except for highly migratory species, in or from the Grammanik Bank closed area off St. Thomas
Gear Prohibitions and/or Restrictions:
Fishing with pots, traps, bottom longlines, gillnest, or trammel nets is prohibited year-round in the Red Hind Spawning Aggregation Areas, Grammanik Bank closed area, and Mutton Snapper Spawning Aggregation Area
An explosive may not be used in the U.S. Caribbean EEZ
A powerhead may not be used in the U.S. Caribbean EEZ to harvest Caribbean reef fish
A poison, drug, or other chemical may not be used to fish for Caribbean reef fish in the U.S. Caribbean EEZ
A gillnet or trammel net may not be used in the U.S. Caribbean EEZ
A fish trap used or possessed in the U.S. Caribbean EEZ must have an escape mechanism as defined and comply with minimum mesh size regulations
Proposed Seasonal Area Closures:
Alternatives extend the seasonal closure of Bajo de Sico from three to nine months for reef-fish fishing
Snapper Unit 1 (silk, black, vermilion, blackfin)
Seasonal EEZ Closure:
From October 1 through December 31 each year, no person may fish for or possess vermilion, black, silk, or blackfin snapper in or from the U.S. Caribbean EEZ
Grouper Unit 1 and 2 (Nassau and goliath grouper)
Permanent EEZ Closure:
No person may fish for or possess Nassau or goliath grouper in or from the U.S. Caribbean EEZ. Such fish caught must be released immediately with a minimum of harm
Grouper Unit 4 (red, misty, tiger, yellowedge, and yellowfin)
Seasonal EEZ Closure:
From February 1 through April 30 each year, no person may fish for or possess red, tiger, tiger, yellowfin, or yellowedge grouper in or from the Caribbean EEZ
Queen Conch (queen conch)
Seasonal EEZ and/or Area Closures:
No person may fish for or possess a queen conch in or from the U.S. Caribbean EEZ from October 1 through June 30 outside the area east of $64^{0}34'$ longitude which includes Lang Bank east of St. Croix
No person may fish for, or possess onboard a fishing vessel, queen conch in or from the U.S. Caribbean EEZ from July 1 through September 30 each year
Hookah gear cannot be used while harvesting queen conch
Landing Restrictions:
Queen conch in or from the U.S. Caribbean EEZ must be maintained with meat and shell intact
Commercial Catch and Recreational Bag Limits:
A fisherman who had a valid commercial license issued by Puerto Rico or the USVI may not possess in or from the U.S. Caribbean EEZ more than 150 conch per day when permitted fishing is allowed
A fisherman without a valid commercial license issued by Puerto Rico or the USVI is subject to a bag limit of three conch per day; if more than four persons are aboard the fishing vessel, the limit is 12 conch per vessel per day, regardless of the number of trips per day, when fishing is allowed
Minimum Size Limit:
The minimum size limit for queen conch is 9” (22.9 cm) in length and 3/8” (9.5 mm) in lip thickness at its widest point. A queen conch with a length of at least 9” or lip width of at least 3/8” is not undersized

amendment is to protect red hind spawning aggregations and large snapper and grouper from directed fishing mortality. An extended seasonal closure of the Bajo de Sico area in combination with previous actions and this proposed amendment could have significant cumulative adverse economic and social impacts on fishers and fishing communities on Puerto Rico's west coast if there is a geographic allocation (**Alternative 2** of Action 3(c)). Thirty-six percent of the Puerto Rican commercial fishers interviewed by Griffith et al. (2007) in 2005 reported that the Bajo de Sico Marine Protected Area had directly caused adverse socioeconomic impacts on them and their families; and approximately 54 percent reported that the closure indirectly adversely affected their local communities. Some of the adverse socioeconomic effects were increases in transiting time and associated fuel costs associated with avoiding Bajo de Sico while it is closed. However, approximately 21 percent of the interviewed fishers stated that the 3-month seasonal closure created employment and investment opportunities in their communities. Other previous federal actions that have affected these fisheries are summarized in Table 6.9.1. Griffith et al. (2007) estimate that between 250 and 300 fishing families were adversely affected by the combination of the Bajo de Sico and Tourmaline Bank seasonal closures.

Griffith et al. (2007) emphasize that there have been cumulative social and economic effects resulting from the various area closures on the west coast (i.e., Tourmaline Bank, Bajo de Sico, Abrir la Sierra, Desecheo, and La Mona/Monito), as well as the other seasonal closures for numerous commercially important species (e.g., several deepwater snapper species between October and December and several grouper species between February and April). Similar to the Bajo de Sico closure, these latter closures are meant to protect these species during their spawning season.

The seasonal closure of Bajo de Sico avoided the imposition of more restrictive size limits, which the fishermen dislike more than any other regulation because they believe such rules result in the wasteful discarding of fish (Griffith et al. 2007). Some fishermen have avoided the adverse impacts of the closures by not complying with the various area closures (e.g., Bajo de Sico) and other regulations (e.g., licensing and reporting requirements), which reduces the ability to accurately assess the fishery. With insufficient enforcement on the water, non-compliance was reported to have increased, causing resentment on the part of compliant fishermen. This may in turn further reduce compliance. Compliance with the actions and alternatives proposed in this amendment would allow for improved management of reef fish and queen conch fisheries and larger net long-term economic and social benefits. Griffith et al. (2007) note that, as long as imports of undersized fish continues to be allowed, it is easier for illegally harvested undersized fish to be mixed with fish of the same size that have been legally imported.

Puerto Rico and the USVI have implemented regulations to manage reef fish and queen conch in their state and territorial waters. For example, fishing for goliath (Grouper Unit 2) or Nassau (Grouper Unit 1) grouper is prohibited in Puerto Rico and USVI waters. See Tables 6.9.2 and 6.9.3 for state and territorial regulations that affect these fisheries. If Puerto Rico and/or the USVI established landings quotas consistent with the ACLs that would be established by this Amendment, there could be cumulative adverse impacts on fishers, their families, and fishing communities; however, that would be dependent on the

ACLs and the levels of annual landings at the time such quotas could be established. If the ACLs are greater than or equal to annual landings, there would be no additional adverse impact.

Table 6.9.2. Puerto Rico regulations that affect reef fish and queen conch fisheries.

All Fishing
Permanent Area Closures:
No fishing around Mona and Monito Islands
No fishing in Luiz Peña Channel Marine Reserve and Isla de Desecheo Marine Reserve
No fishing in no-take zone of Tres Palmas Marine Reserve
Seasonal Area Closures:
From December 1 through February 28 each year, fishing is prohibited in the three Red Hind Spawning Aggregation Areas west of Puerto Rico (Bajo de Sico, Tourmaline Bank, Abrir La Sierra Bank)
Gear Prohibitions and/or Restrictions:
Fishing with pots, traps, bottom longlines, gillnest, or trammel nets is prohibited year-round in the Red Hind Spawning Aggregation Areas
No fishing by means of explosives; traps and nets have specific minimum mesh size requirements; nets have length limits; no combined use of SCUBA and spearfishing by recreational fishers
Snapper Unit 1 (silk, black, vermilion, blackfin)
Seasonal Territorial Closure:
From October 1 through December 31, no person can commercially or recreationally fish for silk or blackfin snapper in Puerto Rico waters
Snapper Unit 4 (yellowtail)
Minimum Size Limit:
Minimum size limit of 10.5” (26.7 cm) fork length (FL)
Grouper Unit 1 (Nassau) and 2 (goliath)
Permanent Territorial Closures:
No person may commercially or recreationally fish for or possess Nassau or goliath grouper in or from waters of Puerto Rico
Grouper Unit 4 (red, misty, tiger, yellowedge, yellowfin)
No regulations specific to these species
Queen Conch (queen conch)
Seasonal and/or Areal Closures:
No person may fish for, or possess on board a fishing vessel, a queen conch in or from Puerto Rico waters from July 1 through September 30 each year
Minimum Size Limit:
In Puerto Rico, the minimum size limit for queen conch is 9” (22.9 cm) in length and 3/8” (9.5 mm) lip width at its widest point
Commercial and Recreational Catch Limits:
Daily commercial limit of 150 conch per person and 450 per boat, and daily recreational bag limit of 3 per person and 12 per boat if more than four people on the boat
Gear Prohibitions and/or Restrictions:
No use of surface supplied (i.e., hookah) gear
Parrotfish
No regulations specific to these species

Regulations that alter the allowable harvest of other managed species in the U.S. Caribbean or alter importation of seafood into the U.S. Caribbean territories may alter recreational and commercial queen conch, snapper, grouper, and/or parrotfish fishing. When reduction in harvest of other managed species or in imports of substitute species occurs, a positive economic effect on queen conch, snapper, grouper, and parrotfish fisheries could occur, while conversely, increases in levels of wild and/or imported substitute species would be expected to create a depressed economic value of queen conch

and reef fish. However, it is difficult to say with certainty if these trends would hold true for all, some, or even none of the species. Changes in economic value would largely depend on the health and status of the fisheries and the amount of substitute species caught and imported.

Increases in aquaculture, for example, could affect these fisheries and their economic and social value. The National Sustainable Offshore Aquaculture Act of 2009 (H.R. 4363) was introduced on December 16, 2009 by U.S Representative Lois Capps and the bill is in subcommittee as of the time of this writing. If it or a similar bill is passed into law, it could result in offshore aquaculture operations off Puerto Rico and/or the USVI, which could indirectly affect Council managed fisheries, including conch and reef fish, fish habitats, and human communities.

Natural and human induced disasters, as well as socioeconomic changes, can also affect resources, ecosystems, and communities. Such events include hurricanes, earthquakes, tropical storms, flooding, tsunamis, water pollution, coral bleaching, disease outbreaks, invasive species (e.g., lionfish), high fuel prices, economic recessions and depressions, and gentrification of island coasts. These events can negatively affect the revenues and profits of Puerto Rico and USVI fishers. They can also damage existing infrastructure and reduce resource availability.

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

This step should identify the trends, existing conditions, and the ability to withstand stresses of the environmental components. According to the CEQ guidance, two types of information are needed to describe stress factors. The first are the socioeconomic-driving variables that identify the types, distribution, and intensity of key social and economic activities within the region(s). The second are the indicators of stress on specific resources, ecosystems, and communities.

CEA factor 4 above describes the various stresses affecting the resources, ecosystems, and human communities of concern. Fishermen face numerous economic stresses, such as additional costs to fishing or lower ex-vessel prices for harvested fish. Added costs include higher prices for fuel, insurance, dock fees, ice, replacement gear, and food. Factors reducing ex-vessel prices for fishermen include market gluts, increases in imported fish, or fish health issues. Changes in revenue and increased operating costs are two indicators of socioeconomic stress. In recent years, the additional stresses of overfishing, hurricanes, and fuel prices have resulted in marginal profits and losses in revenue forcing many fishermen to leave fisheries and seek more stable sources of employment. Fishermen targeting healthier and a larger number of stocks and with lower expenses are more resilient to the stresses described above. In contrast those fishermen relying on stocks that are frequently subject to overfishing and stringent management regulations, or that have greater expenses relative to other fishermen, are less resilient to various stresses making them more likely to seek other jobs.

DRAFT

Table 6.9.3. USVI regulations that affect reef fish and queen conch fisheries.

All Species
Permanent Area Closure:
All fishing, except bait fishing and fishing for blue runner, is prohibited in the Virgin Island Coral Reef National Monument
No fishing in the Buck Island National Monument (U.S. Department of Interior)
No fishing in St. James Reserve or Cas Cay Mangrove Lagoon Reserve, except for bait fry in limited areas
Seasonal Area Closures:
From December 1 through February 28 each year, fishing is prohibited in the Red Hind Spawning Aggregation Area east of St. Croix (Lang Bank)
No harvest of any species from March 1 through June 30 within the Mutton Snapper Spawning Area
Areal prohibitions and limitations on fishing in the East End Marine Park off St. Croix
Gear Prohibitions and /or Restrictions:
Fish trap restrictions in St. Croix and St. Thomas/St. John districts
Prohibition on the use of gill and trammel nets in territorial waters
Fishing with pots, traps, bottom longlines, gillnest, or trammel nets is prohibited year-round in the Red Hind and Mutton Snapper Spawning Aggregation Areas
Snapper Unit 1 (silk, black, blackfin, vermilion)
The possession of silk, black, blackfin, and vermilion snapper is prohibited from October 1 through December 31 each year in the St. Thomas/St. John district
Grouper Unit 1 (Nassau)
Permanent Territorial Closure:
No person may commercially or recreationally fish for, or possess, Nassau grouper in or from waters of the USVI
Grouper Unit 2 (goliath)
Permanent Territorial Closure:
No person may commercially or recreationally fish for, or possess, goliath grouper in or from waters of the USVI
Grouper Unit 4 (red, misty, tiger, yellowedge, yellowfin)
The possession of red, misty, tiger, yellowedge, and yellowfin grouper is prohibited from February 1 through April 30 each year in territorial waters
Queen Conch (queen conch)
Seasonal and/or Area Closure:
No person may fish for, or possess onboard a fishing vessel, a queen conch in or from USVI waters from June 1 through October 31 each year
Minimum Size Limit:
Minimum of 9" (22.9 cm) total length or 3/8" (9.5 mm) lip thickness. No possession of conch meats smaller than 2 per pound (un-cleaned) or 3 per pound (cleaned)
Annual Total Catch Limit:
50,000 pounds in the St. Croix district and 50,000 pounds in the St. Thomas/St. John district. Thereafter, the season will be closed until November 1 of that year. All conch must be landed and reported in the district from which they were harvested
Commercial and Recreational Catch Limits:
Daily commercial limit of 200 conch per boat (having a licensed commercial fisher on board), and daily recreational bag limit of six conch per person and total of 24 conch per boat
Catch Restrictions:
All conch must be landed alive and in shell
Parrotfish
No fishing with gill and trammel nets in territorial waters

Indicators of stress to the biological environment include reductions in population abundance and habitat degradation. The Council and NOAA Fisheries evaluate the status of wild stocks relative to various pre-defined benchmarks and implement necessary management measures to maintain sustainable resources. This proposed amendment would improve those benchmarks and the management measures that result from them. The susceptibility to stress depends on a species' productivity and life history. In general, longer lived and slower-growing species, such as many reef fishes, are more susceptible to

stresses (overfishing, becoming overfished), than shorter-lived and more fecund species. As a result, the time to rebuild these populations is often much longer and reductions in harvest are much greater.

Puerto Rico and USVI commercial fisheries have been characterized as "artisanal" because their commercial fishing vessels tend to be less than 45 feet long, have small crews, participate in multiple fisheries, and yield smaller revenues and/or their seafood processors are small-scale producers. Fishing areas shift with regulatory change, land use and development, land-based pollution, and other factors, such as climate change. For example, water temperature increased in both Guyanilla and Tallaboa Bays of Puerto Rico as a result of hot water discharged by the Central Costa Sur Power Plant, and cloro was discharged by PPG Industries that had a significant adverse impact on marine and coastal resources on the south coast (Pérez 2005: 235). Fishers that operated in the bays had difficulty selling their catches because buyers and consumers feared the fish were tainted with cloro or another contaminant. In response, some fishers went into deeper waters, which was difficult for those with small vessels and modest fishing gear to do. Access to fisheries also has been challenged in both Puerto Rico and the USVI, and privatization of beach front areas continues to reduce public access to fisheries.

Commercial fishing tends not to be a full-time job in Puerto Rico. Pérez's (2005: 225) survey found that "full-time fishing is not an option for any small-scale fishermen's household in southern Puerto Rico." During economic downturns, fishers are more likely to combine fishing with other occupations in the pursuit of maintaining household incomes. That may require fishers to move to urban areas on the island or to the U.S. mainland. However, that does not mean they abandon or do not return to fishing. Puerto Rican commercial fishers depend more upon fishing when industrial unemployment rises (Pérez 2000: 4). McCaffrey (1999: 112) describes fishing as an "occupational safety net," and according to Griffith et al. (2007), fishing "absorbs the unemployed and poor during difficult economic times and on the other subsidizes individuals working part-time or full-time in the formal economy." Griffith et al.'s (2007) ethnographic work found that between 40 percent and 45 percent of commercial fishers listed other occupations that were held to supplement fishing incomes. If fishers are more likely to combine fishing with other occupations in the pursuit of maintaining household incomes during an economic downturn, a graphical comparison of the number of active fishers and the unemployment rate do not suggest such a relationship. Nonetheless, during times of recession, depression or other economic downturns, such as experienced from 2007 to 2010 in Puerto Rico, commercial fishing increases in importance for fishing households. Given this economic downturn, former commercial fishers may be returning to fishing, whether they are licensed or not.

USVI commercial fishers tend not to derive all of their income from fishing. The average St. Thomas/St. John commercial fisher derives 74 percent of his/her income from fishing, while 60.2 percent of the average St. Croix fishers' annual income derives from fishing (Kojis 2004). Some of the commercial fishers stated that none of their income derives from fishing. This suggests these fishers may be participants in an unreported subsistence fishery. Seventy-five percent of St. Thomas/St. John's commercial fishers obtain more

than half of their income from fishing, while 54 percent of St. Croix commercial fishers are similarly reliant on fishing. The recent economic downturn may be increasing the importance of fishing to fishers, their families, and fishing communities.

The ability of these fishers and their communities to withstand any potential adverse impacts caused by the proposed amendment is greatly dependent on their reliance on fishing in federal waters. With more fishable habitat in their state waters, Puerto Rican fishers are most able to mitigate for any losses of landings due to a shortened federal fishing season by shifting into territorial waters, assuming the territorial season remains open. With the least amount of fishable habitat in territorial waters off St. Thomas/St. John, it is expected that St. Thomas/St. John fishers would be least able to mitigate for lost landings due to a shortened federal fishing season because of a Caribbean-wide ACL.

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

This section examines whether resources, ecosystems, and human communities are approaching conditions where additional stresses could have an important cumulative effect beyond any current plan, regulatory, or sustainability threshold (CEQ 1997). Sustainability thresholds can be identified for some resources, which are levels of impact beyond which the resources cannot be sustained in a stable state. Other thresholds are established through numerical standards, qualitative standards, or management goals. The CEA should address whether thresholds could be exceeded because of the contribution of the proposed action to other cumulative activities affecting resources.

The MSA requires federal fishery management plans to prevent overfishing and achieve optimum yield on a continuing basis. This proposed amendment is intended to improve federal managers' ability to prevent overfishing and achieve long-term optimal yield. Stresses affecting each of these resources include directed fishing mortality, habitat loss and degradation, increasing demand for food and feed, and environmental changes (e.g., hurricanes, changes in temperature, etc.). The status of many of these species is regularly assessed. When fisheries are determined to be undergoing overfishing or are overfished, NOAA Fisheries and/or the Councils are required by the MSA to implement conservation and management measures to prevent overfishing and rebuild overfished stocks. States and interstate compacts may also impose regulations to control fishing mortality and harvest. For endangered and threatened species, the ESA prohibits take, import or export, shipment, or sale of any endangered species and most threatened species.

Stresses affecting fishing communities include additional regulatory restrictions, competition from foreign seafood imports, coastal development, loss of infrastructure, and rising fuel prices. All of these stresses have placed a greater burden on fishermen and fishing communities that threaten their short- and long-term sustainability. In the past several years, the Council has implemented numerous regulations to end overfishing of reef fish and queen conch. The Council has also approved several rebuilding plans to increase stock biomass and abundance of reef fishes. These regulations have resulted in lower allowable catch levels, gear restrictions, and limited access. Although the net

benefit of these regulations is expected to result in more abundant and stable fisheries in the long-term, they have the unavoidable adverse effect of negatively affecting socioeconomic benefits in the short-term. As a result, the cumulative effect of more restrictive regulations, coastal development, higher fuel prices, economic downturns, and natural disasters has led many fishermen to increase non-fishing employment in recent years.

Although the intent of this proposed amendment is to improve the targets and thresholds of queen conch and reef fish units, it may cause additional stresses (e.g., lower landings). It is expected that the Council will choose the least-cost alternatives that accomplish the purpose of the amendment.

7. Define a baseline condition for the resources, ecosystems, and human communities.

The purpose of defining a baseline condition for the resource and ecosystems in the area of the proposed action is to establish a point of reference for evaluating the extent and significance of expected cumulative effects.

The status of Council managed resources are summarized in the annual status report to Congress on the Status of U.S. Fisheries (NMFS 2008). The baseline status of Council managed species is also described in Section 5.0. The remainder of Council managed species are either healthy or their status is unknown.

The status and health of EFH has been extensively described (CFMC 1998, 2004) and it is currently under review. The Council, NOAA Fisheries, and other federal agencies have designated numerous areas in the Caribbean to protect and conserve EFH. These areas protect EFH from a wide variety of direct impacts, including: loss of fishing gear, restricted use of certain fishing gears, and damage from anchors.

Section 5.3 describes baseline economic and social conditions for fishing communities in Puerto Rico and the USVI. The Generic Essential Fish Habitat Amendment (CFMC 1998), FEIS (CFMC 2004), Griffith et al. (2007), and Stoffle et al. (2009) provide more extensive characterization of fishing-dependent communities. St. Thomas, St. John, St. Croix, and Puerto Rican fishing communities would be affected as a result of the various actions and alternatives proposed herein; however, until the set of alternatives is chosen, it is impossible to quantify the combined impacts, such as expected net losses of annual landings, ex-vessel revenues, and income, at this time.

8. Identify the important cause-and-effect relationships between human activities and resources, ecosystems, and human communities.

Cause-and-effect relationships for various aspects of queen conch and reef fish fisheries and measures proposed in this Amendment to address these potential effects are described in Sections 5 and 6. Actions considered in this amendment should not have adverse effects on public health or safety since these measures should not alter actual fishing

practices, just where or when activities can occur. Depending on the preferred alternatives, fishing may still occur, just limited to the extent allowed by the annual catch limits. Unique characteristics of the geographic area are highlighted in Section 5. Adverse effects of fishing activities on the physical environment are described in detail in Section 6.1-6.6 of the actions.

9. Determine the magnitude and significance of cumulative effects.

Past actions affecting the queen conch and reef fish fisheries are summarized in Tables 6.9.1, 6.9.2, and 6.9.3 and described in Section 3.2. Annual catch limits and AMs are intended to prevent or greatly reduce the risk of overfishing and are expected to have positive biological benefits. However, they may also impose more restrictive catch levels on fisheries resulting in negative social and economic impacts over the short-term. To the extent that catch limits and AMs can prevent overfishing and assist in rebuilding overfished stocks, they should have positive long-term benefits to both the biological and socio-economic environments.

The process of protecting queen conch and reef fish species through the specification of management targets, thresholds, and AMs, and regulations that implement those AMs, is expected to have a short-term adverse impact on the social and economic environment, and will create a burden on the administrative environment. The no action alternatives being considered would avoid these negative effects, but they would not be in compliance with new amendments of the MSFMCA that require each FMP to specify ACLs and AMs for managed fisheries. The range of alternatives has varying degrees of economic and social costs and administrative burdens, starting at zero. For example, if the ACL for queen conch is set at 50,000 pounds or ACL for Grouper Unit 1 is set at zero, neither would have an adverse economic or social impact. See Sections 6.2.2b and 6.2.1a for more detailed information. However, and also for example, if there was a Caribbean-wide ACL for aggregate snapper, the largest adverse economic and social impact could be on St. Thomas/St. John fishers because less fishable habitat occurs in territorial waters off St. Thomas/St. John, followed second by St. Croix fishers who have more fishable habitat in territorial waters than St. Thomas/St. John, but substantially less than their counterparts in Puerto Rico. Recreational and commercial fishers of Puerto Rico, St. Croix, and St. Thomas/St. John would be in competition for the single ACL, which would favor fishers with larger vessels and gears capable of catching more of the fish in the same or a shorter period of time over recreational and historic artisanal fishermen (Section 6.3.2c).

To ensure stocks are not overharvested, periodic monitoring of the fisheries is needed to estimate the condition of the stocks. This monitoring should be designed to incorporate new information and to address unanticipated developments in the respective fisheries and would be used to make appropriate adjustments in the reef fish regulations should fishery practices not achieve needed take reductions. Additionally, NMFS and other government agencies support research on these species by federal, state, academic, and private research entities.

DRAFT

Depending upon the outcome of these reviews, the Council may determine further management action should be taken, such as adjusting an ACL and promulgating regulations consistent with the revised ACL. What type of rulemaking vehicle NMFS or the Council determines is needed is difficult to predict. Actions would be dictated by the severity of overages and by the time frame needed to implement a regulatory change. The Council has three options for implementing these measures. The first is to amend the Queen Conch or Reef Fish FMPs to include new information and management actions. Recent plan amendments put forth by the Council have taken between two and three years from conception to implementation. NMFS may take other management actions through emergency or interim measures. Emergency actions and interim measures can be implemented only under limited circumstances. They only remain in effect for 180 days after the date of publication of the rule and may be extended by publication in the *Federal Register* for one additional period of not more than 186 days provided the public has had an opportunity to comment on the emergency actions and interim measures. The MSA further states that when a Council requests that an emergency action and interim measure be taken, the Council should also be actively preparing plan amendments or regulations that address the emergency on a permanent basis.

Queen conch and reef fish management measures include a number of area-specific and seasonal regulations where fishing is restricted or prohibited in order to protect habitat or spawning aggregations of fish, or to reduce fishing pressure in areas that are heavily fished. This requires on the water monitoring by law enforcement, which is time consuming and expensive. However, the USCG has been pro-active establishing fisheries officers trainings which include the local enforcement agencies.

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

The process of protecting queen conch and reef fish species through the specification of management targets, thresholds, and AMs, and regulations that implement those AMs is expected to have a short-term adverse impact on the social and economic environment, and will create a burden on the administrative environment. The no action alternatives being considered would avoid these negative effects, but they would not achieve the goal of curbing overfishing and would not be in compliance with new amendments of the MSFCMA that require each FMP to specify ACLs and AMs for managed fisheries. The range of alternatives has varying degrees of economic and social costs and administrative burdens, starting at zero.

To ensure queen conch and reef fish stocks are managed for optimum yield, periodic reviews of stock status are needed. These reviews are designed to incorporate new information and to address unanticipated developments in the respective fisheries and would be used to make appropriate adjustments in the reef fish regulations should harvest not achieve OY objectives. These assessments would be requested as needed by the SEDAR Steering Committee. Reviews of queen conch and reef fish populations should benefit from updated landings information through commonwealth, territorial, and federal fishery monitoring programs to be implemented in the future. Additionally, NMFS and

other government agencies support research on these species by federal, state, academic, and private research entities.

Actions that the Council could employ to restrict annual or average annual landings beyond reducing the fishing season, include, but would not be limited to, establishing a permit system to limit the number of fishers in federal waters, trip limits, restrictions on gear use, and/or area closures. The Council has several options for implementing these measures. The first is to amend the Queen Conch or Reef Fish FMP to include new information and management actions. The second method is a regulatory amendment.

The Council can also request NMFS to take other management actions through emergency or interim measures. Emergency actions and interim measures can be implemented only under limited circumstances. They only remain in effect for 180 days after the date of publication of the rule and may be extended by publication in the *Federal Register* for one additional period of not more than 186 days provided the public has had an opportunity to comment on the emergency actions and interim measures. The MSA further states that when a Council requests that an emergency action and interim measure be taken, the Council should also be actively preparing plan amendments or regulations that address the emergency on a permanent basis.

What type of rule making vehicle the NMFS or the Council determines is needed is difficult to predict and would be dictated by the severity of overages in the harvest as well as the time frame needed to implement a regulatory change.

Enforcing reef fish regulations is labor intensive. NMFS law enforcement officials work cooperatively with other federal (including the USCG) and state agencies to keep illegal activity to a minimum.

11. Monitor the cumulative effects of the selected alternatives and adapt management.

The effects of the proposed actions are, and will continue to be, monitored through collection of fisheries data by NMFS and the state and territorial governments, stock assessments and stock assessment updates, life history studies, economic and social analyses, and other scientific observations. Commercial landings data is collected by PRDNER in Puerto Rico and by VIDPNR in the USVI. Recreational data is collected through MRFSS, which has not been conducted in the USVI.

6.8 Unavoidable Adverse Effects

Constraing the harvest of queen conch and reef fish in the U.S. Caribbean, as mandated by the MSRA, is expected to have some negative short-term effects on the social and economic environment, and will create some burdens with respect to the administrative environment. These effects are discussed in detail throughout Section 6 of the document. No alternatives are being considered that would avoid these negative effects because they are a necessary cost associated with setting Annual Catch Limits for the affected fisheries. The range of alternatives has varying degrees of economic costs and administrative

burdens. Some alternatives have relatively small short-term economic costs and/or administrative burdens, but would also provide smaller and more delayed long-term benefits. Other alternatives have greater short-term costs, but provide larger long-term benefits. Therefore, it is difficult to mitigate these measures and managers must balance the costs and benefits when choosing management alternatives for the queen conch and reef fish fisheries.

The proposed actions would be applied to all participants in the fishery, regardless of their race, color, national origin, or income level, and as a result are not considered discriminatory. Additionally, none of the proposed actions are expected to affect any existing subsistence consumption patterns. Therefore, no environmental justice issues are anticipated and no modifications to any proposed actions have been made to address environmental justice issues.

6.9 Relationship Between Short-Term Uses and Long-Term Productivity

The process of protecting queen conch and reef fish species through the specification of management targets, thresholds, and AMs, and regulations that implement those AMs, is expected to adversely affect the economic and social environments related to the uses of the resources in the short-run. However, the process is also expected to provide larger benefits to those environments in the long-run than would be expected with the no action alternative. It is anticipated that more stable and sustainable catches of queen conch and reef fish will be realized as an outcome of the provisions of this amendment, assuming that alternatives other than the "no-action" alternatives are chosen.

6.10 Mitigation, Monitoring, and Enforcement Measures

As mentioned in Section 6.8, the process of establishing ACLs and AMs for the queen conch and reef fish fisheries of the U.S. Caribbean is expected to have some negative short-term effects on the social and economic environment, and will create additional burdens for the administrative environment. This is particularly true when establishing annual catch limits that may fall below the average annual catch of some species that has been previously realized. No alternatives are being considered that would completely avoid these negative effects because they are a necessary cost associated with establishing ACLs and AMs in the U.S. Caribbean. It is therefore difficult to mitigate these measures and managers must balance the costs and benefits when choosing management alternatives for these fisheries.

Harvest of reef fish and conch in the U.S. Caribbean has been monitored for many decades, but as discussed in Section 3.3 of this document the history of that monitoring has been replete with problems. Those problems cannot be singularly attributed but cannot be corrected a posteriori. Instead, initiatives are underway to substantially improve both commercial and recreational fisheries data collection programs. For commercial harvest data, the SEFSC is leading an effort to enhance the data collection program for both Puerto Rico and the USVI. When implemented, the U.S. Caribbean Commercial Data Improvement Program will provide for improved and more comprehensive data reporting forms, species-specific landings data, more timely reporting, data that are

referenced by location, depth and gear, better validation of catch and effort, detailed biological information, and enhanced enforcement. For recreational harvest data, the NMFS is advancing and evolving the MRFSS data collection program to the MRIP program, and this evolution should result in more targeted and detailed data on recreational catch. Additionally, it is anticipated that the MRIP will be expanded in the U.S. Caribbean to include the USVI. These advancements in fisheries data collection programs will provide the data required to populate advance fisheries assessment models, thereby allowing for more precise and responsive guidance for the management of these fisheries.

Enforcing queen conch and reef fish harvest regulations is time- and labor-intensive. Cooperation between NMFS Law Enforcement, the U.S. Coast Guard, local enforcement agencies, and other entities such as the Department of Defense is essential, and that cooperation continues to grow via Joint Enforcement Agreements and other instruments. These agreements are typically reconsidered and renewed on a frequent (e.g., annual) basis, which allows for adaptation to changing regulations and conditions.

6.11 Irreversible and Irretrievable Commitments of Resources

There are no irreversible or irretrievable commitments of agency resources proposed herein. The actions to impose minimum conservation standards are readily changeable by the Council or the National Marine Fisheries Service in the future.

6.12 Any Other Disclosures

There are no additional disclosures regarding the proposed actions.

DRAFT

7.0 REGULATORY IMPACT REVIEW

7.1 Introduction

The NMFS requires a Regulatory Impact Review (RIR) for all regulatory actions that are of public interest. The RIR does three things: (1) it provides a comprehensive review of the level and incidence of impacts associated with a 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).

7.2 Problems and Objectives

The purpose and need, issues, problems, and objectives of the proposed Amendment are presented in Section 1.2 and are incorporated herein by reference.

7.3 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 for an existing fishery should be stated in terms of producer and consumer surplus, changes in profits, and employment in the direct and support industries. However, there is substantial uncertainty regarding the economic impact of the proposed ACLs on existing U.S. Caribbean fisheries. However, where figures are available, they are incorporated into the analysis of the economic impacts of the different actions and alternatives.

7.4 Description of Relevant Fisheries

The relevant fisheries are described in Section 5.3, and are incorporated herein by reference.

7.5 Economic Impacts of Management Measures

7.5.1. Action 1. Amend Stock Complexes in Reef Fish FMU

DRAFT

Preferred Alternative 2 of Action 1(a) would remove yellowedge and misty grouper from Grouper Unit 4 and combine the two species to create Grouper Unit 5. **Preferred Alternative 2** of Action 1(a) would also add black grouper to Grouper Unit 4 and remove creole-fish from Grouper Unit 4 and place it in a data-collection only category. Creole-fish is not targeted in any fishery and is widespread throughout its range. **Preferred Alternative 2** of Action 1(b) would transfer wenchman from Snapper Unit 2 to Snapper Unit 1 and add cardinal snapper to Snapper Unit 2.

Preferred Alternative 2 of Action 1(a) and **Preferred Alternative 2** of Action 1(b) are administrative actions and would not affect existing fishing practices. Hence, they would have no economic impacts.

7.5.2. Action 2. Redefine management reference points or proxies

7.5.2.1 Action 2(a). Redefine management reference points or proxies for species/species groups within the snapper, grouper, and parrotfish complexes

Preferred Alternative 2 of Action 2(a) would define aggregate management reference points or proxies for snapper, grouper and parrotfish based on what the Council considers to be the longest time series of catch data prior to the implementation of the Comprehensive SFA Amendment that is consistently reliable across all islands. The MSY proxy specified by **Preferred Alternative 2** would equate to average annual catch, calculated using commercial landings data from 1999-2005 for Puerto Rico and St. Croix and from 2000-2005 for St. Thomas/St. John, and recreational landings data from 2000-2005 for Puerto Rico only (Table 7.1). **Preferred Alternative 2(b)** would equate the OFL to the MSY proxy. Overfishing would occur when average annual catches exceed the OFL, unless NMFS' Southeast Fisheries Science Center (in consultation with the Caribbean Fishery Management Council and its Scientific and Statistical Committee) determines the overage occurred because data collection/monitoring improved, rather than because catches actually increased.

Neither **Preferred Alternative 2** nor **Preferred Alternative 2(b)** of Action 2(a) would have a direct economic impact on fishermen, their families or communities because neither would affect existing fishing practices. The indirect impacts of **Preferred Alternative 2** or **Preferred Alternative 2(b)** on snapper, grouper and/or parrotfish fishermen, if any, are dependent upon the proposed ACLs in combination with additional action (Action 5).

Table 7.1. Proposed MSY Proxies and OFLs for Snapper, Grouper and Parrotfish in U.S. Caribbean.

	MSY Proxy = OFL = Average Pounds Landed Annually
Unit	**U.S. Caribbean**
Snapper	2,004,003
Grouper	396,483
Parrotfish	507,059

Preferred Alternative 2(e) would equate the ACL for the Parrotfish, Grouper and Snapper Units to OY, which would be equal to three-fourths of the OFL (Table 7.2.).

Table 7.2. Proposed ACLs for Snapper, Grouper and Parrotfish.

	ACL = OY = 0.75 x OFL
Unit	**U.S. Caribbean**
Snapper	1,503,002
Grouper	297,362
Parrotfish	380,294

Preferred Alternative 2(e) would not have a direct economic impact because it would not change existing fishing practices. However, **Preferred Alternative 2(e)** may have indirect adverse economic impacts if it motivates subsequent action (Action 5) that reduces average annual harvests by reducing the length of federal fishing seasons. The magnitude of the indirect impact is substantially affected by two factors: the extent that landings derive from federal, as compared to territorial, waters; and second, regulatory changes since 2005. If landings derive entirely or almost entirely from territorial waters, a regulation that reduces the length of federal fishing seasons would have no to minimal impact, especially if fishermen could easily substitute fishing in territorial waters for fishing in federal waters. Conversely, if all or almost all of the landings derive from harvest in federal waters, a regulation that reduces the length of federal fishing seasons could have a substantial adverse economic impact. About 4.7 percent of the fishable area off Puerto Rico is in the U.S. Caribbean EEZ, and the remaining 95.3 percent is in territorial waters (CFMC 2005). The USVI shelf encompasses an area of approximately 630 nm^2 (2,161 km^2). Of that area, 38 percent occurs in the U.S. Caribbean EEZ. The bulk of the shelf occurs off St. Thomas and St. John, with a 291 nm^2 (998 km^2) total area in territorial waters and a 218 nm^2 (748 km^2) total area in federal waters. St. Croix has 98 nm^2 (336 km^2) of fishable habitat in territorial waters and a 21-nm^2 (72-km^2) area off its east coast that resides in the EEZ. This comparison of fishable areas in territorial and federal waters is reflected in Puerto Rico landings, which largely derive from fishing in territorial waters, and Puerto Rico fishermen's ability to substitute fishing in territorial waters for fishing in federal waters. The comparison is also reflected in USVI landings' substantially larger share from fishing in federal waters. It is more difficult for USVI fishermen to substitute fishing in territorial waters for fishing in federal waters.

The years of landings used to specify the ACLs of **Preferred Alternative 2(e)** are prior to the implementation of the Comprehensive SFA Amendment to the reef fish and conch FMPs in 2005. The SFA Amendment substantially changed the management regime by implementing a suite of management measures designed to curb or end overfishing, including for example seasonal and area closures. Table 7.3 compares average annual landings from 2006 and 2007 to the proposed MSY Proxy (**Preferred Alternative 2**) and ACL (**Preferred Alternative 2(e))** for each unit. The proposed ACL for each unit is less than the average annual landings from 2006 to 2007 for that unit. Such a difference suggests **Preferred Alternatives 2, 2(b)** and **2(e)** could motivate regulatory changes to reduce current average annual harvests of snapper, grouper and parrotfish in the EEZ,

which could have adverse economic impacts on snapper, grouper and parrotfish fishermen of Puerto Rico and the USVI, their families and communities. However, actual indirect impacts of **Preferred Alternatives 2**, **2(b)** and **2(e)** are dependent on subsequent actions of this amendment and the extent that fishing for these species occurs in federal waters, as well as more recent territorial actions. These economic impacts are more fully described in the sections that address each subsequent action.

Table 7.3. Comparison of Proposed MSY Proxies and ACLs for Snapper, Grouper and Parrotfish to Average Annual Landings from 2006 to 2007 for Each Unit for U.S. Caribbean.

Unit	Pounds		
	MSY Proxy	2006- 07 Ave. Landings	ACL
Snapper	2,004,003	2,425,180	1,503,002
Grouper	396,483	342,949	297,362
Parrotfish	507,059	525,881	380,294

Preferred Alternative 2(h) would set the ACL for Grouper Units 1 and 2 and rainbow, blue and midnight parrotfish at zero. Since the early to mid 1990s, no person may fish for or possess Grouper Unit 1 (Nassau grouper) or Grouper Unit 2 (goliath grouper) in or from the Caribbean EEZ. **Preferred Alternative 2(h)** would set the ACL for Nassau grouper and ACL for goliath grouper at zero, which is consistent with the this prohibition. Consequently, **Preferred Alternative 2(h)** would not motivate regulatory change in the goliath or Nassau grouper fishery and would not have an indirect economic impact. The ACLs for goliath and Nassau grouper set by **Preferred Alternative 2(h)** would also be consistent with Puerto Rico's and the USVI's bans on fishing for and possession of goliath and Nassau grouper.

Preferred Alternative 2(h) would not have a direct impact on rainbow, midnight and blue parrotfish fishermen; however, it motivates **Preferred Alternative 2** of Action 4(a) that would prohibit harvesting of rainbow, midnight and blue parrotfish in federal waters (Action 4(a)). The direct economic impact of the proposed prohibition, which is the indirect impact of **Preferred Alternative 2(h),** is discussed in section 7.5.4.

7.5.2.2. Action 2(b). Redefine management reference points or proxies for queen conch

Preferred Alternative 2 of Action 2(b) would define aggregate management reference points or proxies for queen conch based on what the Council considers to be the longest time series of catch data prior to the implementation of the Comprehensive SFA Amendment that is consistently reliable across all islands. The MSY proxy specified by **Preferred Alternative 2** would equate to average annual catch, calculated using commercial landings data from 1999-2005 for Puerto Rico and St. Croix and from 2000-2005 for St. Thomas/St. John, and recreational landings data from 2000-2005 for Puerto

Rico only (Table 7.4). **Preferred Alternative 2(b)** would equate the OFL to the MSY proxy. Overfishing would occur when average annual catches exceed the OFL, unless NMFS' Southeast Fisheries Science Center (in consultation with the Caribbean Fishery Management Council and its Scientific and Statistical Committee) determines the overage occurred because data collection/monitoring improved, rather than because catches actually increased.

Preferred Alternative 2 would not have a direct economic impact on queen conch fishermen, their families or their communities because it would not affect existing fishing practices. Its indirect impact is dependent upon subsequent action (see Action 5).

Table 7.4. Proposed MSY Proxy and ACL for Queen Conch for U.S. Caribbean

Unit	Pounds	
	MSY Proxy = OFL	ACL
Queen Conch	917,716	50,000

Preferred Alternative 2(g) would equate the ACL and OY for queen conch to OY at the ABC specified by the SSC. The SSC has recommended a 50,000-pound ABC. Consequently, **Preferred Alternative 2(g)** would establish an ACL of 50,000 pounds. Present regulation prohibits fishing for or possession of queen conch in federal waters off Puerto Rico, St. Thomas or St. John. The only queen conch fishery in federal waters is off St. Croix, and any landings of queen conch taken from those waters must occur in St. Croix. Since 2008, the USVI government has specified a 50,000-pound annual quota in the St. Croix District of the queen conch fishery. The fishery in the District closes when the 50,000-pound landings limit is met and the season remains closed until November 1, where after the new season begins. **Preferred Alternative 2(g)** is consistent with the St. Croix District's 50,000-pound annual landings quota, and would not motivate regulatory changes that would directly affect existing queen conch fishing practices in federal waters. Therefore, **Preferred Alternative 2(g)** would not have a direct or indirect economic impact.

7.5.3. Action 3. Annual catch limit allocation/management

7.5.3.1 Action 3(a). Snapper and grouper unit allocation/management

Preferred Alternative 4 of Action 3(a) would define aggregate reference points for snapper and grouper in the USVI and define aggregate reference points for grouper but not snapper in Puerto Rico. The proposed ACLs for Snapper Units 3 and 4 and Grouper for Puerto Rico are greater than the average annual landings from 2006 to 2007 (Table 7.5). This comparison suggests **Preferred Alternative 4** would not motivate regulatory change that reduces the length of the federal fishing season for Snapper Units 3 and 4 or grouper in the EEZ off Puerto Rico or otherwise attempts to reduce annual landings of these units or sub-units. However, because the ACLs for Snapper Units 1 and 2 are less

than average annual landings of the units from 2006 to 2007, **Preferred Alternative 4** would motivate regulatory change that reduces the length of the federal fishing season for Snapper Units 1 and 2 in the EEZ off Puerto Rico or otherwise attempts to reduce annual landings of these sub-units. The comparison also suggests Puerto Rico's fishermen who may be adversely affected by a regulatory change that reduces the federal fishing season or otherwise attempts to reduce average annual harvest in the EEZ could mitigate for such losses by shifting effort from Snapper Units 1 and 2 to Snapper Units 3 and 4 and/or grouper. The proposed ACLs for Snapper and Grouper in the USVI are smaller than average annual landings of these units from 2006 to 2007 in the USVI, which suggests **Preferred Alternative 4** would motivate regulatory change that reduces the length of the federal fishing seasons for these units in federal waters off the USVI or otherwise attempts to reduce annual landings of these units.

Table 7.5. Proposed MSY Proxies and ACLs and Average 2006-07 Annual Landings of Snapper Units 1 – 4 and Grouper and for Puerto Rico and Snapper and Grouper for the USVI.

Unit/Sub-Unit		Pounds					
		MSY Proxy		Ave. 2006-07 Landings		ACL	
		Puerto Rico	USVI	Puerto Rico	USVI	Puerto Rico	USVI
Snapper	Unit 1	447,307		356,409		335,480	
	Unit 2	212,619		159,535		159,464	
	Unit 3	504,627		253,084		378,470	
	Unit 4	472,711		256,052		354,533	
	Total		278,495		296,812		208,871
Grouper	Total	299,678	96,805	128,830	85,287	224,759	72,604

Preferred Alternative 4 would not have a direct economic impact on USVI or Puerto Rico fishermen, their families and/or communities; however, it may motivate regulatory change that reduces the length of the federal fishing seasons or otherwise attempts to reduce average annual harvests of Snapper Units 1 and 2 in the EEZ off Puerto Rico and snapper and grouper in federal waters off the USVI. The magnitude of the adverse economic impacts of the regulatory changes is greatly dependent upon the significance of fishing in federal, not territorial, waters.

7.5.3.2 Action 3(b). Commercial and recreational sector allocation/management (Puerto Rico only)

Preferred Alternative 2 would separate commercial and recreational ACLs in Puerto Rico. This action applies only to Puerto Rico waters because recreational harvest data are not available for the USVI. No separate sector allocation for queen conch is specified because there is no queen conch fishery in federal waters off Puerto Rico. A comparison of the proposed Commercial ACLs for Snapper Units 1 through 4, Grouper, and Parrotfish to average annual commercial landings from 2006 to 2007 suggests the proposed Commercial ACLs for Snapper Units 3 and 4, Grouper, and Parrotfish would not motivate

regulatory change that reduces the length of the federal commercial fishing seasons for these sub-units and units or otherwise attempts to reduce annual commercial harvests of these units in federal waters (Table 7.6). The proposed Commercial ACLs for Snapper Unit 1 and 2 are less than the average annual commercial landings for these sub-units from 2006 to 2007. This suggests **Preferred Alternative 2** of Action 3(b) could motivate regulatory change that reduces the length of the federal commercial fishing seasons for Snapper Units 1 and 2 or otherwise attempts to reduce commercial harvest of these sub-units in federal waters off Puerto Rico.

Table 7.6. Comparison of Commercial and Recreational ACLs for Snapper Units, Grouper and Parrotfish in Puerto Rico to Average Annual Landings of Units from 2006 to 2007 in Puerto Rico.

Unit/Sub-Unit		ACL		Ave. 2006-07 Landings	
		Pounds	Individuals	Pounds	Individuals
		Commercial	Recreational	Commercial	Recreational
Snapper	Unit 1	251,192	73,409	151,300	157,769
	Unit 2	128,750	6,938	151,007	3,690
	Unit 3	305,096	68,845	183,987	93,711
	Unit 4	329,378	24,587	239,445	29,935
Grouper	Total	156,629	82,571	39,104	44,156
Parrotfish	Total	95,985	27,782	54,332	5,027

The proposed Recreational ACLs for Snapper Unit 1, Grouper and Parrotfish are less than the corresponding average annual recreational landings for these sub-unit/units from 2006 to 2007, which suggests **Preferred Alternative 2** could motivate regulatory change that reduces the length of the federal recreational fishing seasons for Snapper Unit 1, Grouper and Parrotfish or otherwise attempts to reduce recreational harvest of these sub-unit/units in federal waters off Puerto Rico. The magnitude of the adverse economic impact is largely dependent upon the significance of recreational fishing in federal, not territorial, waters. If Puerto Rico fishermen can substitute fishing in territorial waters for fishing in federal waters with little to no displacement costs, there may be little to no adverse economic impact from reducing the length of the federal fishing seasons for Snapper Unit 1, Grouper and Parrotfish or other attempts to reduce recreational harvest from federal waters off Puerto Rico. Note that the commercial ACLs are in pounds, while the recreational ACLs are in number of individuals.

Preferred Alternative 2 would benefit recreational and subsistence fishermen who fish in federal waters off Puerto Rico because they could not be in competition with commercial fishermen who also fish in the same federal waters should there be a race to catch as many fish as possible before the federal fishing season is closed. In such a race, industrial-scale commercial fishing operations with larger vessels and gears capable of catching more of the sub-unit/units in the same or a shorter period of time would be favored over Puerto Rico's historic small-scale commercial, recreational and subsistence fishermen. As of March 9, 2010, 582 of Puerto Rico's recreational fishermen were registered with the

DRAFT

National Angler Registry, and in 2008, there were 852 active commercial fishermen with 690 fishing vessels in Puerto Rico.

Regarding the commercial sector, commercial fishers with larger vessels and gears capable of catching more of the sub-unit/unit in the same or a shorter period of time would be favored over Puerto Rico's historic artisanal fishers if there was a race to catch as many fish as possible before the federal fishing season is closed and if overcapacity was allowed. Such an environment could result in lower long-term benefits that derive from the sub-unit/unit and the ecosystem of which it is part, and a transfer of economic benefits from artisanal fishermen to industrial-scale fishing operations. The actual indirect economic impacts of **Preferred Alternative 2** on commercial fishermen, however, would be dependent on if the regulatory and economic environments support such a race.

7.5.3.3 Action 3(c). Geographic allocation/management

Preferred Alternative 2 would not have a direct economic impact on fishermen, their families and communities because it would not change existing fishing practices. However, it could motivate regulatory changes that could have economic impacts on Puerto Rico and USVI fishermen, their families and communities.

Preferred Alternative 2 would divide the Caribbean EEZ into three parts and manage ACLs by island group (St. Croix, St. Thomas/St. John, and Puerto Rico,). For example, **Preferred Alternative 2** of Action 3(c) in combination with the preferred alternative of Action 3(b) would specify a St. Croix Grouper ACL of 26,855 pounds, a St. Thomas/St. John Grouper ACL of 45,749 pounds, Puerto Rico Commercial Grouper ACL of 156,629 pounds, and a Puerto Rico Recreational Grouper ACL of 82,571 (Tables 7.6. and 7.7). **Preferred Alternative 2(a)** would use a mid-point or equidistant method for dividing the EEZ among the three island groups.

Table 7.7. Proposed ACLs for Snapper, Grouper and Parrotfish for St. Croix and St. Thomas/St. John.

Unit/Sub-Unit		Pounds			
		ACL		Average Annual Landings 2006-07	
		St. Croix	St. Thomas/ St. John	St. Croix	St. Thomas/ St. John
Snapper	**Total**	90,835	118,037	130,581	166,231
Grouper	**Total**	26,855	45,749	28,475	56,812
Parrotfish	**Total**	219,914	36,614	361,229	42,528

Preferred Alternative 2 would not prevent fishers from an island group from fishing in the EEZ of another island group, but their catch would be counted against the ACL of the island group upon which their catch is landed. For example, a St. Thomas commercial fisherman could harvest grouper in the Puerto Rico EEZ and land the catch in St. Thomas,

where it would count against the St. Thomas/St. John Grouper ACL. If it is determined that landings have exceeded the ACL for a sub-unit/unit for an island group (Action 5(a)), the EEZ off that island group would be closed to fishing for that particular sub-unit/unit for a portion of the season as specified by the preferred alternative of Action 5(b). For example, if the grouper fishing season was closed early in the Puerto Rico EEZ, no fisherman, regardless of which island group s/he belonged to, could fish for grouper in the Puerto Rico EEZ after the season closed. **Preferred Alternative 2** would not prevent fishermen from fishing for that sub-unit/unit elsewhere in the EEZ where the fishery remains open and landing their catch where they are appropriately licensed to do so. However, it is expected that most fishermen who fish in federal waters do so in waters closest to their home island. For example, if St. Croix fishermen's annual landings of snapper in 2010 exceeded the proposed St. Croix Snapper ACL of 90,835 pounds and there was a subsequent reduction in the length of the federal fishing season for snapper in the St. Croix EEZ in 2011, it is likely that the average fisherman of St. Croix who fishes for snapper in federal waters would not move into the Puerto Rico or St. Thomas/St. John EEZ even if those waters were open to snapper fishing. S/he could act to mitigate for potential loss of snapper landings that originated from the St. Croix EEZ by relocating to territorial waters to harvest snapper, shifting effort to harvest other species in federal and/or territorial waters, and/or by increasing effort in the St. Croix EEZ to catch the same amount of snapper in less time in 2011.

A comparison of average annual landings of snapper, grouper and parrotfish from 2006 to 2007 to the proposed ACLs for each of the two USVI island groups suggests **Preferred Alternative 2** of Action 3(c) could motivate regulatory change that reduces the lengths of the federal fishing seasons for snapper, grouper and parrotfish in federal waters off St. Croix and St. Thomas/St. John, which could have a significant adverse impact on St. Croix and St. Thomas/St. John snapper, grouper and parrotfish fishermen, their families and communities (Table 7.7). However, average annual landings from 2006 to 2007 may not be representative of current average annual landings. For example, trammel and gill nets have been popular gears to take parrotfish in waters off St. Croix where most parrotfish are landed. According to a public comment by the St. Thomas Fishermen's Association (May 7, 2009), trammel and gill nets have represented 90 percent of the parrotfish landings in St. Croix. One of the SFA implementing regulations of 2005 was a prohibition on the use of gillnet or trammel net in federal waters. In July 2006, their use was banned in USVI waters. Parrotfish landings fell from 460,311 pounds in 2006 to 347,239 pounds in 2007. The net ban was initially met with resistance by parrotfish fishers who used one or both nets and continued to use the nets because the ban was not enforced. Enforcement of the ban did not begin until April 2008. Hence, landings of parrotfish prior to 2008 do not reflect that enforcement, although the 2007 landings represent those after the net ban was implemented in July 2006.

The 50,000-pound ACL for queen conch in combination with current regulation that limits queen conch fishing in the EEZ to waters off St. Croix essentially establishes a St. Croix ACL of 50,000 pounds, which is equal to the St. Croix District's annual quota set by the VIDPNR. Hence, **Preferred Alternative 2** would not motivate regulatory change that reduces the length of the queen conch fishing season in the EEZ or otherwise attempts to reduce queen conch landings beyond current levels. **Preferred Alternative 2** would not

have a direct or an indirect adverse economic impact on queen conch fishermen, their families and communities.

The potential indirect economic impacts of **Preferred Alternative 2** of Action 3(c) on Puerto Rico fishermen are the same as, not additive to, the indirect economic impacts of **Preferred Alternative 2** of Action 3(b) that are described in section 7.5.3.2.

It is possible that **Preferred Alternative 2** of Action 3(c) could have a greater beneficial long-term indirect economic impact on St. Thomas/St. John and St. Croix snapper, grouper and parrotfish fishermen than fishermen from Puerto Rico because a larger percent of fishable habitat is found in federal waters off St. Thomas/St. John and St. Croix than Puerto Rico. For example, if St. Croix's 2010 landings of snapper exceed the proposed St. Croix Snapper ACL, the length of the snapper fishing season in the St. Croix EEZ would be shortened in 2011 (Action 5) and no fisherman, regardless of which island group s/he belonged to, would be allowed to fish in the St. Croix EEZ after the snapper fishery in the St. Croix EEZ was closed. Such a closure of the St. Croix EEZ to snapper fishing could yield a larger population of snapper in the long run and higher associated economic benefits that derive from exploitation of the resource, especially for Cruzan fishermen.

7.5.4 Action 4. Management measures

7.5.4.1 Action 4(a). Species-specific parrotfish prohibition

Preferred Alternative 2 of Action 4(a) follows logically from **Preferred Alternative 2(h)** of Action 2(a) that specifies the commercial and recreational ACLs for midnight parrotfish, blue parrotfish and rainbow parrotfish would be zero. **Preferred Alternative 2** of Action 4(a) would prohibit fishing for and possession of midnight parrotfish, blue parrotfish and rainbow parrotfish in federal waters.

Table 7.8 Recreational Landings of Rainbow, Midnight and Blue Parrotfish in Puerto Rico, 2000 to 2007.

Year	Individuals		
	Rainbow	Midnight	Blue
2000	662	0	1,904
2001	0	0	128
2002	0	0	0
2003	550	0	3,326
2004	0	0	0
2005	0	0	0
2006	0	0	0
2007	0	0	0

Preferred Alternative 2 would have direct adverse economic impacts on Puerto Rico, St. Croix and St. Thomas/St. John fishermen who harvest midnight, rainbow, and/or blue parrotfish in the EEZ. From 2000 to 2007 there were no reported recreational landings of midnight parrotfish and only sporadic landings of rainbow and blue parrotfish in Puerto Rico (Table 7.8). From 2004 to 2007, there were no recreational landings of any of the three species. The data suggest **Preferred Alternative 2** would have no to very little adverse economic impact on recreational fishermen of Puerto Rico.

Commercial landings of blue, midnight and rainbow parrotfish have also been minimal in Puerto Rico. From 1999 to 2007, a total of 32 pounds of midnight parrotfish and 136 pounds of blue parrotfish harvested from territorial and federal waters were landed (Table 7.9). Commercial landings of rainbow parrotfish taken from territorial and federal waters were reported in 1999 and from 2002 to 2006, ranging from 13 to 2,128 pounds. These figures suggest that any adverse economic impact of **Preferred Alternative 2** on Puerto Rico's commercial fishermen would be experienced by those who occasionally harvest rainbow parrotfish. However, it is expected that commercial fishermen could mitigate for any loss of harvest of rainbow, midnight and/or blue species from the EEZ, if there is any, by increasing effort in territorial waters and/or by targeting other parrotfish or non-parrotfish species in federal waters, subject to any ACL limitations on those species, if any. Approximately 95 percent of fishable habitat off Puerto Rico is within territorial waters. None of Puerto Rico's recreational fishers interviewed for MRFSS in 2006 or 2007 reported catching parrotfish in the EEZ. According to a scoping-meeting comment, commercial and recreational fishers in Puerto Rico catch the same kind of parrotfish and in the same areas. That comment suggests **Preferred Alternative 2** of Action 4(a) would have no direct or indirect economic impact on commercial or recreational fishers, their families, and fishing communities of Puerto Rico.

Table 7.9. Commercial Landings (Adjusted) of Rainbow, Midnight and Blue Parrotfish in Puerto Rico, 1999 to 2007, in Dollars and Pounds.

	Ex-Vessel Revenue (Dollars)			Landings (Pounds)		
Year	**Rainbow**	**Midnight**	**Blue**	**Rainbow**	**Midnight**	**Blue**
1999	24	49	26	13	24	13
2000	0	0	0	0	0	0
2001		0	212	0	0	106
2002	279	0	0	140	0	0
2003	963	6	28	617	8	17
2004	3,275	0	0	2,128	0	0
2005	2,783	0	0	1,855	0	0
2006	331	0	0	220	0	0
2007	0	0	0	0	0	0

MRFSS is not conducted in the USVI, so there are no data regarding annual recreational landings of parrotfish or any other species. Hence, the economic impact of **Preferred Alternative 2** on recreational fishermen of St. Croix and St.Thomas/St. John is unknown. The economic impact of **Preferred Alternative 2** of Action 4(a) on St. Croix and St. Thomas/St. John commercial fishers is also unknown because landings of parrotfish are

not reported by species; however, it is likely that St. Croix fishers and their families could experience a larger adverse economic impact than their counterparts in St. Thomas/St. John, because of the much larger landings of parrotfish in St. Croix relative to St. Thomas/St. John (Table 7.7). It is expected that St. Croix and St. Thomas/St. John fishermen could mitigate for losses of harvest of midnight, blue, and/or rainbow parrotfish in federal waters, if any, by either increasing effort for other parrotfish or other species in the EEZ and/or relocating to territorial waters when or if they are targeting these species; however, the ability to mitigate is conditional upon the proposed ACLs and corresponding regulations that restrict harvest of other species.

7.5.4.2 Action 4(b). Recreational bag limits

Preferred Alternative 7 would establish an aggregate bag limit for the Snapper, Grouper and Parrotfish Units in federal waters of 10 individual fish per recreational fisher including not more than two parrotfish per fisher or six parrotfish per boat, and 30 aggregate snapper, grouper, and parrotfish per boat on a fishing day.

Preferred Alternative 7 could have an adverse economic impact on recreational fishermen and charter vessel operations of Puerto Rico and the USVI because their catch of parrotfish and combined catch of snapper, grouper and parrotfish in the EEZ would be limited. However, the magnitude of the adverse economic impact on recreational fishermen and charter vessel operations is dependent upon the significance that fishing for these species in federal waters has for these persons and operations and their ability to shift fishing to territorial waters to mitigate for losses of harvest, if any. It is rare for a recreational fisherman in Puerto Rico to harvest more than two parrotfish during a fishing trip, and there are no records of fishermen harvesting five or more parrotfish during a single boat trip during the period from 2000 to 2007, which suggests the parrotfish limitation would have little to no adverse impact on Puerto Rico's recreational fishermen or charter vessel operations. Approximately 4.7 percent of the fishable area off Puerto Rico is in the U.S. Caribbean EEZ, which suggests Puerto Rico recreational fishermen and charter vessel operations could substitute fishing in territorial waters for federal waters if they expect to exceed the aggregate bag limit.

There are no data on recreational fishing in the USVI; however, it is expected that St. Croix and St. Thomas/St. John recreational and subsistence fishermen and charter vessel operations would be less able to substitute fishing in territorial waters for federal waters than their counterparts in Puerto Rico. In 2009, there was one charter boat operation in St. Croix and nine in St. Thomas/St. John. As of March 9, 2010, there were 12 USVI recreational fishermen registered with the National Angler Registry. Therefore, up to 10 charter boat operations and up to 12 recreational fishermen in the USVI could be adversely affected by the recreational bag limit. **Preferred Alternative 7's** recreational bag limits could affect charter boat operations' abilities to maintain historic numbers of paying passengers per fishing trip into federal waters, which would decrease their revenues per trip. Similarly, recreational and subsistence fishermen could have less fish to bring back home and consume when they fish in the EEZ. In the long run, however, **Preferred Alternative 7** could yield increased populations of these species, which would have higher beneficial economic impacts on these recreational and subsistence fishermen.

If the economic cost of **Preferred Alternative 7** is greater than the economic cost of obtaining a commercial fishing license, the least cost option for a charter vessel operation or recreational (or subsistence) fisherman would be to purchase a Puerto Rico commercial license. USVI fishermen could buy a Puerto Rico commercial fishing license, but Puerto Rico's charter vessel operators and recreational and subsistence fishermen could not similarly buy a USVI commercial license to land their catches in the USVI because of a moratorium on commercial fishing licenses in the USVI. The cost of a Puerto Rico commercial license for a nonresident is $250, which is good for four years and can be renewed. The cost for a Puerto Rico resident is $10, which may be good for only one year because it is a beginner license, and the cost for a license for an experienced fisherman is $40, which is renewable every four years. A resident must show sales of catch to get a non-beginner license. The most likely least cost option for the average charter fishing operation or recreational fisherman would be to substitute fishing in territorial waters for federal waters when it is intended that landings of the species would exceed the recreational bag limit(s) or vessel limit.

7.5.5. Accountability measures

7.5.5.1 Action 5(a): Triggering accountability measures

Preferred Alternative 3 would trigger AMs if the ACL is exceeded by landings specified by **Preferred Alternative 3(c)** and NMFS' SEFSC (in consultation with the Caribbean Fishery Management Council and its Scientific and Statistical Committee) determines the overage occurred because catches increased versus data collection/monitoring improved. **Preferred Alternative 3(c)** is equal to a single year of landings effective beginning 2010, a 2-year running average of landings effective 2011, then a 3-year running average of landings effective 2012 and thereafter (i.e., 2010, 2010-2011, 2010-2012, 2011-2013, etc.).

Preferred Alternatives 3 and **3(c)** would not have a direct economic impact on fishermen, their families or communities because they would not directly affect current fishing practices. However, **Preferred Alternatives 3** and **3(c)** motivate Action 5(b) and Action 5(b) could directly affect existing fishing practices in the U.S. Caribbean by reducing the federal fishing season(s) in parts of the EEZ. The economic impacts of Action 5(b) are described in section 7.5.5.2.

7.5.5.2 Action 5(b): Applying accountability measures

Preferred Alternative 2 would reduce the length of the fishing season for the sub-unit or unit the year following the trigger determination by the amount needed to prevent such an overage from occurring again. Shortening the length of the closed season is expected to increase the population size (density) of the species being considered in federal waters. The increased population, in turn, is expected to result in increased profits to fishermen during that portion of the year when the fishery is open in federal waters in following years, resulting in a potential increase in effort in the EEZ, which, in the long run, would reduce the population and effort until an equilibrium is established.

Ways fishermen could mitigate for a loss of landings of a unit or sub-unit due to a shortened federal fishing season include:

- Relocating to territorial waters to fish for the unit or sub-unit;
- Increasing harvest of other species in territorial and/or federal waters; and/or
- Increasing effort in federal waters in order to catch more fish before the federal fishery for the unit or sub-unit closes.

These mitigating strategies would not be without costs. **Preferred Alternative 2** may have displacement costs, such as catch-and-landings changes, trip-level search and associated costs, crowding and congestion costs, and personal safety costs that are associated with relocating to territorial or other federal waters. Increasing harvest of other species could adversely affect their stocks and reduce the long-term economic benefits that derive from those stocks. Furthermore, increasing effort to catch the same amount of or more fish in a shortened federal fishing season could produce lower long-term economic benefits that derive from the resource and the ecosystem, and a transfer of economic benefits from small-scale commercial, recreational and subsistence fishermen to industrial fishing operations. In a race to catch the same amount of or more fish before the federal fishery closes, industrial-scale commercial fishing operations with larger vessels and gears capable of catching more of the fish in the same or a shorter period of time would be favored over historic small-scale commercial, recreational and subsistence fishermen. Furthermore, the ability of charter boat operations to increase effort is limited by demand for their services by paying customers; the ability of recreational fishermen to increase effort is limited by leisure time constraints, and subsistence fishermen are limited by both personal and/or households' rates of consumption of fresh fish and time constraints.

Puerto Rico

Preferred Alternative 2 of Action 5(c) would have no adverse economic impact on Puerto Rico's queen conch fishermen because queen conch fishing and transportation of queen conch is presently prohibited in the EEZ off Puerto Rico and this action would not change that prohibition. All queen conch landings in Puerto Rico are harvested from territorial waters.

The proposed Commercial ACL for parrotfish in Puerto Rico would be 95,985 pounds, which is equal to 75 percent of average annual commercial landings in Puerto Rico from 1999 to 2005. These landings are of parrotfish caught from federal and territorial waters combined. The proposed ACL is smaller than annual commercial landings for each year from 1999 to 2005, but larger than annual landings in 2006 and 2007 (Figure 7.1). If 2006 and 2007 landings are more representative of current parrotfish landings, there would be no overage of commercial parrotfish landings and **Preferred Alternative 2** would have no adverse economic impact on commercial parrotfish fishermen of Puerto Rico. However, if 1999 to 2005 is more accurate, then an overage would be expected in 2010, which would motivate Action 5(b)'s reduction in the length of the federal commercial fishing season in 2011. However, because public comment suggests parrotfish are harvested exclusively or almost exclusively in territorial waters, **Preferred Alternative 2**

of Action 5(b) may have little to no direct adverse economic impact and **Preferred Alternatives 3** and **3(c)** of Action 5(a) may have little to no indirect adverse economic impact on Puerto Rico's commercial and recreational parrotfish fishermen if there were a shortened fishing season in the Puerto Rico EEZ. In this situation, a shortened federal parrotfish fishing season in the Puerto Rico EEZ would have little to no positive impact on stock size (if assuming that the density of these species in territorial waters is not significantly different than in federal waters), even in the absence of any expansion of commercial effort in federal waters during those months when the Puerto Rico EEZ is not closed to commercial parrotfish fishing. With few to no commercial parrotfish fishermen shifting effort from federal to territorial waters, commercial parrotfish fishermen would not find themselves incurring displacement costs. Also, there would be no costs associated with increased targeting of other species or increased effort to catch parrotfish in a shortened federal fishing season. Commercial fishermen of Puerto Rico who harvest parrotfish are encouraged to comment on the economic impacts of this action.

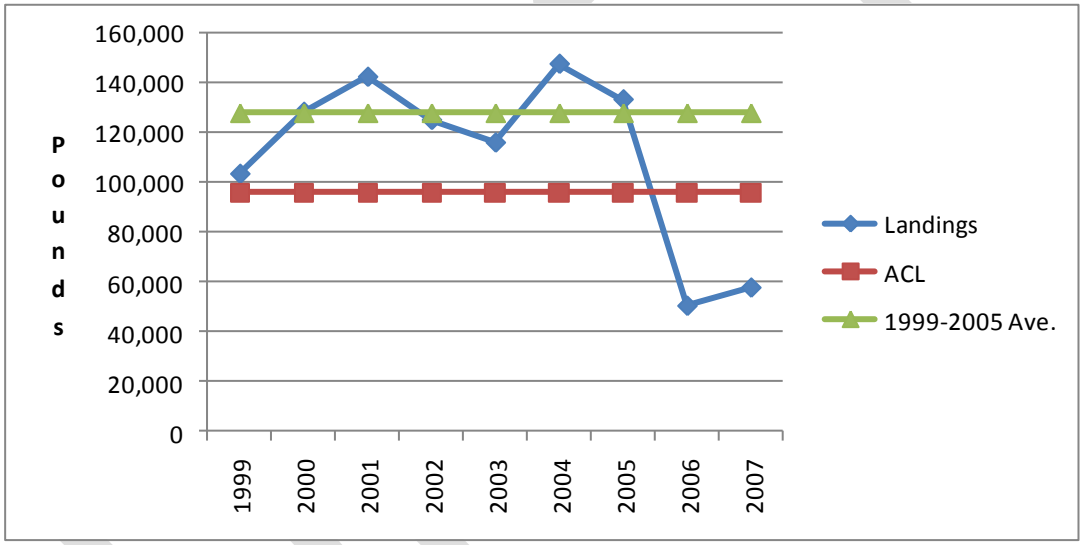


Figure 7.1. Adjusted Commercial Landings from 1999 to 2007, Average Annual Adjusted Commercial Landings from 1999 to 2005, and Proposed Commercial ACL of Parrotfish in Puerto Rico.

The proposed Recreational ACL for parrotfish in Puerto Rico would be 17,925 individuals, which would apply to both recreational and subsistence fishermen. The proposed ACL is larger than the recreational landings in 2000 and from 2004 to 2007 (Figure 7.2). If 2006 and 2007 landings are more representative of current recreational parrotfish landings, there would be no overage of recreational parrotfish landings in 2010 or subsequent years. Nonetheless, if 1999 to 2005 landings are more representative of current landings, then an overage could be expected in 2010, which would motivate Action 5(b)'s reduction of the length of the federal recreational parrotfish fishing season in the Puerto Rico EEZ in 2011 and possibly subsequent years. However, because public comment suggests parrotfish are harvested exclusively or almost exclusively in territorial waters, **Preferred Alternative 2** of Action 5(b) may have little to no direct economic

impact and **Preferred Alternatives 3** and **3(c)** of Action 5(a) may have little to no indirect economic impact on Puerto Rico's recreational parrotfish fishermen. In this situation, a shortened federal recreational fishing season would have little to no positive impact on stock size (if assuming that the density of these species in territorial waters is not significantly different than in federal waters), even in the absence of any expansion of recreational effort in federal waters during those months when the Puerto Rico EEZ is not closed to recreational parrotfish fishing. With few to no recreational parrotfish fishermen shifting effort from federal to territorial waters, there would be minimal to no displacement costs. Also, there would be minimal to no costs associated with recreational fishermen increasing either harvest of other species or effort to catch parrotfish in a shortened federal fishing season. The recreational bag limits specified by **Preferred Alternative 7** of Action 4(b) would also discourage an increase in recreational effort to catch parrotfish in federal waters and its associated costs. Recreational fishermen, including subsistence fishermen and charter fishing operations, of Puerto Rico are encouraged to comment on the economic impacts of this action.

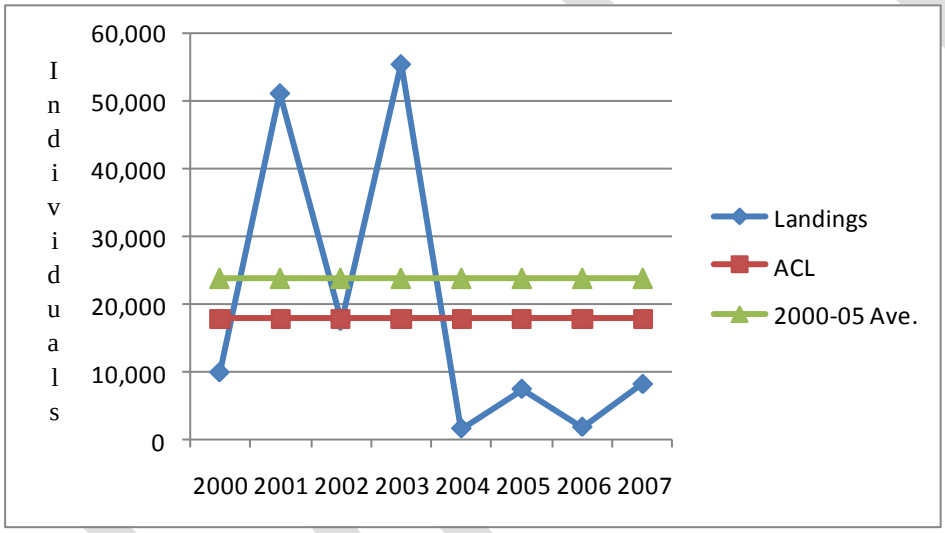


Figure 7.2. Recreational Landings from 2000 to 2007, Average Annual Recreational Landings from 2000 to 2005, and Proposed ACL of Parrotfish in Puerto Rico.

Commercial landings of current and proposed Snapper Unit 1 harvested from federal and territorial waters combined have shown a declining trend since 2003 (Figure 7.3). The proposed Puerto Rico Commercial Snapper 1 ACL is higher than annual landings in 2006 and 2007. Given the SFA implemented a seasonal closure of the EEZ to the possession of all species in Snapper Unit 1 (black, blackfin, vermilion and silk snapper) from October 1 through December 31, which was expected to reduce fishing mortality for all of these species, the decline is not unexpected. However, the magnitude of the decline was expected to be approximately 23 percent, but average annual landings of Snapper Unit 1 species declined by 55 percent from the seven-year period of 1999 to 2005 (334,924 pounds) to the two-year period of 2006 to 2007 (152,301 pounds) (CFMC 2005).

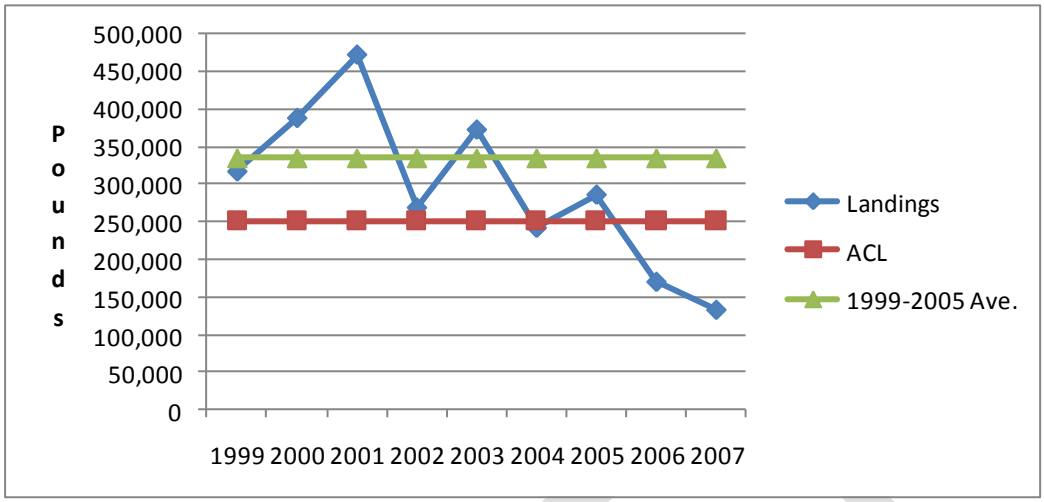


Figure 7.3. Adjusted Commercial Landings from 1999 to 2007, Average Annual Adjusted Commercial Landings from 1999 to 2005, and Proposed Commercial ACL of Proposed Snapper Unit 1 in Puerto Rico.

The declining trend and most recent annual landings suggest there would not be an overage of commercial Snapper Unit 1 landings in 2010 and subsequent years. Therefore, **Preferred Alternative 2** would not affect Puerto Rico's commercial fishermen who harvest Snapper Unit 1 in federal waters and would not have an adverse economic impact on these fishermen. However, if there were an overage, it is expected that Puerto Rico's commercial fishermen could mitigate for possible losses of catch because of a shortened federal commercial fishing season for Snapper Unit 1 in the Puerto Rico EEZ by increasing effort in territorial waters. In that situation, a shortened federal fishing season would have little to no positive impact on stock size (if assuming that the density of these species in territorial waters is not significantly different than in federal waters), even in the absence of any expansion of effort in federal waters during those months when the Puerto Rico EEZ is not closed to commercial Snapper Unit 1 fishing. However, there could be displacement costs, such as catch-and-landings changes, trip-level search and associated costs, crowding and congestion costs, and personal safety costs, although these may be temporary and minimal. Puerto Rico's commercial fishermen could also mitigate for a shortened federal Snapper Unit 1 fishing season, if there were one, by increasing harvest of other species and/or effort to catch the same number of or more Snapper Unit 1 species in a shortened federal fishing season; however, those behaviors would have associated costs as described in the beginning of this section. Commercial fishermen who could be affected by a shortened Snapper Unit 1 commercial fishing season in federal waters off Puerto Rico are encouraged to comment on the economic impacts of this action.

Puerto Rico's recreational landings of proposed Snapper Unit 1 from catches made in federal and territorial waters combined have varied considerably from 2000 to 2007, ranging from a low of 47,108 individuals in 2002 to a high of 182,850 individuals in 2007 (Figure 7.4). An annual average of 97,879 individuals was landed from 2000 to 2005,

while that average was 157,769 individuals from 2006 to 2007. This suggests 2010 recreational landings, which include subsistence landings, of Snapper Unit 1 could greatly exceed the proposed recreational ACL of 73,409 individuals. The resulting overage would result in a reduced federal fishing season for Snapper Unit 1 in the EEZ off Puerto Rico in 2010 and likely subsequent years. Therefore, **Preferred Alternative 2** would have an adverse economic impact on Puerto Rico's recreational and subsistence fishermen and charter fishing operations that currently target Snapper Unit 1 species in federal waters.

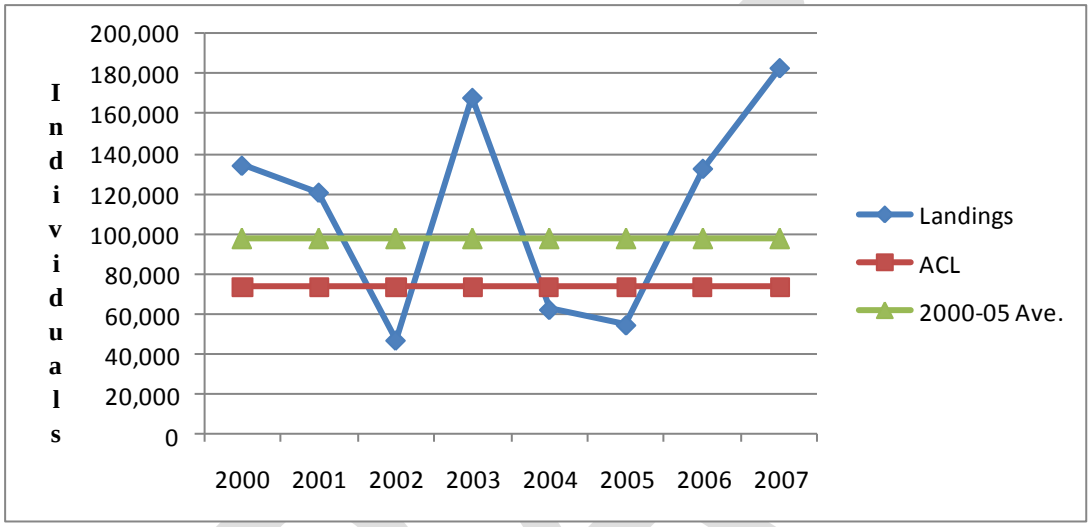


Figure 7.4. Recreational Landings, Average Annual Recreational Landings from 2000 to 2005, and Proposed Recreational ACL of Proposed Snapper Unit 1.

Charter fishing operations and recreational and subsistence fishermen could mitigate for economic losses incurred because of a reduction in the length of the federal recreational Snapper 1 fishing season in the Puerto Rico EEZ by shifting effort from federal waters to territorial waters or other parts of the EEZ that remain open to snapper fishing. There could be displacement costs, such as catch-and-landings changes, trip-level search and associated costs, crowding and congestion costs, and personal safety costs, although these may be temporary and minimal. Another way to reduce adverse impacts from a reduced federal recreational fishing season for Snapper Unit 1 would be to increase effort during the open season. However, the ability of charter boat operations to increase effort is limited by demand for their services by paying customers. The ability of recreational fishermen to increase effort is limited by leisure time constraints, and subsistence fishermen may be limited by their personal and/or households' rates of consumption of fresh fish. A third way for charter boat operations and recreational and subsistence fishermen to mitigate for an economic loss would be to target other species in territorial and/or federal waters, but that could adversely affect those stocks and reduce long-term economic benefits that derive from those resources. It is anticipated that few to no charter fishing operations, recreational and subsistence fishermen would stop or reduce fishing during the time the federal Snapper Unit 1 fishery in the Puerto Rico EEZ is closed

because it is expected they would continue or increase fishing in territorial waters. Charter fishing operations and recreational and subsistence fishermen are encouraged to comment on the economic impacts of a shortened recreational Snapper 1 fishing season in federal waters off Puerto Rico.

Puerto Rico's commercial landings of proposed Snapper Unit 2 from territorial and federal waters combined show a declining trend from 2003 to 2007 (Figure 7.5). Nonetheless, the proposed ACL is less than annual landings from 2000 to 2005 and in 2007, and less than the average of commercial landings from 2006 and 2007. This suggests there would be an overage of landings in 2010 and possibly subsequent years, and **Preferred Alternative 2** would result in a reduced fishing season for Snapper Unit 2 in the EEZ off Puerto Rico in 2011 and possibly subsequent years.

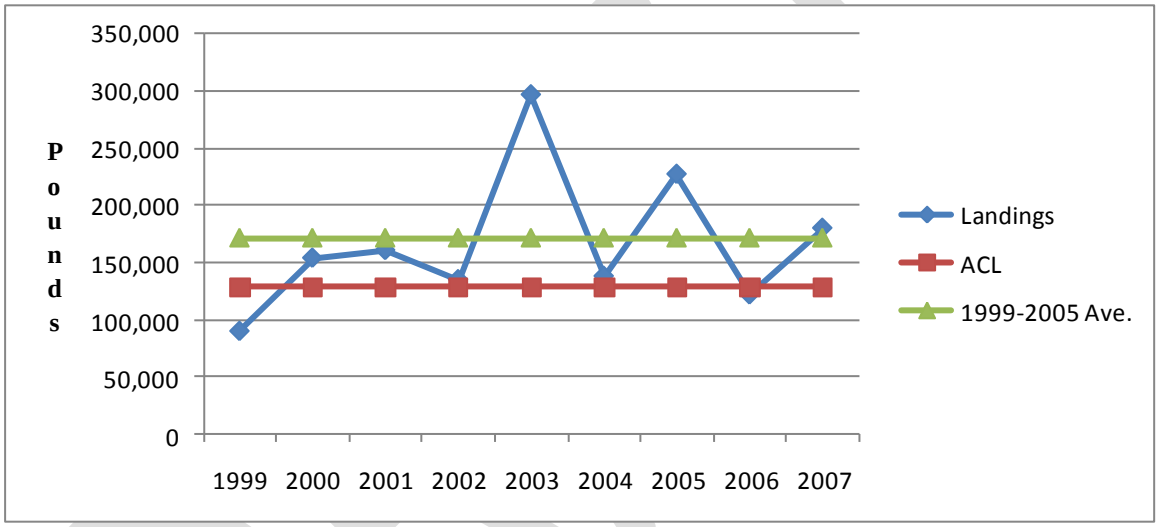


Figure 7.5. Commercial Adjusted Landings from 1999 to 2007, Average Annual Adjusted Commercial Landings from 1999 to 2005, and Proposed Commercial ACL for Proposed Snapper Unit 2 in Puerto Rico.

Preferred Alternative 2 would have an adverse economic impact on Puerto Rico commercial fishermen who currently harvest proposed Snapper Unit 2 species in federal waters off Puerto Rico. However, they could mitigate for loss of revenues from Snapper Unit 2 landings due to a shortened federal fishing season for Snapper Unit 2 by shifting effort from the Puerto Rico EEZ to territorial waters or other parts of the EEZ if they remain open to Snapper Unit 2 fishing. Such mitigating behavior, however, would have displacement costs, such as catch-and-landings changes, trip-level search and associated costs, crowding and congestion costs, and personal safety costs, which may be repeated in a number of years, although these may be minimal each year. Puerto Rico's commercial fishermen could also mitigate for a shortened federal Snapper Unit 2 fishing season by increasing harvest of other species and/or effort to catch the same number of or more Snapper Unit 2 species in a shortened federal fishing season; however, they would have associated costs as described in the beginning of this section. Commercial fishermen who

could be affected by a shortened Snapper Unit 2 commercial fishing season in federal waters off Puerto Rico are encouraged to comment on the economic impacts of this action.

Recreational landings of proposed Snapper Unit 2 in Puerto Rico from territorial and federal waters combined have varied considerably from 2000 to 2007; however, there is a declining trend since 2001. Landings fell from a high of 17,489 individuals in 2001 to a low of 557 in 2006 then rose to 6,824 in 2007 (Figure 7.6).

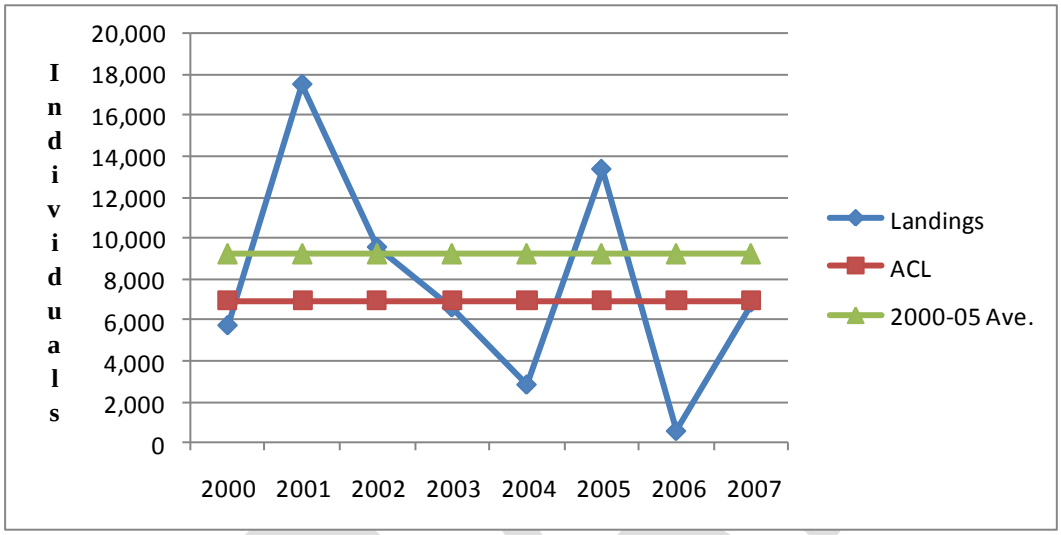


Figure 7.6. Recreational Landings, Average Annual Recreational Landings from 2000 to 2005, and Proposed Recreational ACL of Proposed Snapper Unit 2 in Puerto Rico.

The proposed ACL of 6,938 individuals exceeds annual landings in 2000, 2003, 2006 and 2007. If 2006 and 2007 landings are more representative of current and future landings than 2000 to 2005 landings, there would not be an overage of Snapper Unit 2 recreational landings and a shortened Snapper 2 recreational fishing season in the Puerto Rico EEZ. In that case, **Preferred Alternative 2** would not have an adverse economic impact on charter fishing operations, recreational fishermen or subsistence fishermen of Puerto Rico. However, if there were an overage and a reduction in a recreational Snapper Unit 2 fishing season in federal waters off Puerto Rico, charter fishing operations and recreational and subsistence fishermen, who target Snapper Unit 2 species in these federal waters, could mitigate for economic loss due to a shortened federal fishing season by shifting effort to territorial waters or other parts of the Caribbean EEZ if they remain open to snapper fishing, although there could be temporary and minimal displacement costs. Two others way to reduce adverse economic impacts from a reduced recreational fishing season for Snapper Unit 2, if any, would be to target other species in territorial and/or federal waters and increase effort during the time the federal recreational Snapper Unit 2 fishery is open. The associated costs of these other two mitigating behaviors are discussed at the beginning of this section. Charter fishing operations and recreational and subsistence fishermen are encouraged to comment on the economic impacts of a shortened recreational Snapper 2 fishing season in federal waters off Puerto Rico.

Commercial landings of Snapper Unit 3 (gray, lane, mutton, dog, schoolmaster and mahogany snapper) from territorial and federal waters combined ranged from over 300,000 pounds to over half a million pounds; from 1999 to 2005 however, in 2006 and 2007 annual landings were less than 200,000 pounds (Figure 7.7).

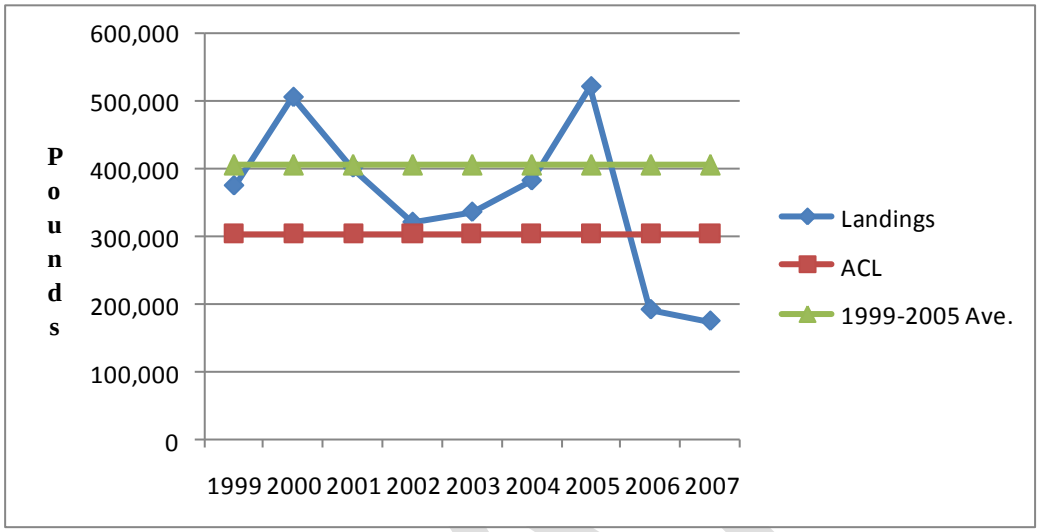


Figure 7.7. Commercial Adjusted Landings from 1999 to 2007, Average Annual Adjusted Commercial Landings from 1999 to 2005, and Proposed Commercial ACL for Snapper Unit 3 in Puerto Rico.

Among the regulations that implemented the SFA in 2005 was the seasonal closure of the EEZ to the possession of mutton snapper and land snapper from April 1 through June 30 each year, which was expected to reduce fishing mortality of both species by 29 percent. Annual landings of mutton snapper in 2006 were 66 percent less than they were in 2005, and annual landings of lane snapper were 62 percent less than in 2005 (Table 7.10). Because mutton and lane snapper combined comprise on average 99.8 percent of annual commercial landings of Snapper Unit 3, Table 7.10 suggests the seasonal closure of the mutton and lane snapper fisheries had a significant impact on commercial landings of Snapper Unit 3.

The proposed commercial ACL for Snapper Unit 3 is less than annual landings for every year from 1999 to 2005 and greater than annual landings in 2006 and 2007. If 2006 and 2007 commercial landings are representative of current and future Snapper Unit 3 landings, **Preferred Alternative 2** would not have an adverse economic impact on Snapper Unit 3 commercial fishermen of Puerto Rico. However, if there were an overage of Snapper Unit 3 landings, **Preferred Alternative 2** would result in a reduced commercial fishing season for Snapper Unit 3 in the Puerto Rico EEZ and possibly subsequent years. However, commercial fishermen could mitigate for loss of revenue from Snapper Unit 3 landings due to a shortened federal fishing season by shifting effort from federal waters off Puerto Rico to territorial waters or other parts of the EEZ if they

remain open to Snapper Unit 3 fishing. Such a mitigating behavior, however, would have displacement costs, although these may be temporary and minimal. Puerto Rico's commercial fishermen could also mitigate for a shortened federal Snapper Unit 3 fishing season by increasing harvest of other species and/or effort to catch the same number of or more Snapper Unit 3 species in a shortened federal fishing season; however, they would have associated costs as described in the beginning of this section. Commercial fishermen who could be affected by a shortened Snapper Unit 3 commercial fishing season in federal waters off Puerto Rico are encouraged to comment on the economic impacts of this action.

Table 7.10. Commercial Landings of Snapper Unit 3 Species in Puerto Rico, 1999 to 2005.

	Pounds						
Year	**Mutton**	**Lane**	**gray**	**dog**	**schoolmaster**	**mahogany**	**Total**
1999	123,488	251,866	13	100	187	54	375,708
2000	147,721	358,306	149	131	18	72	506,397
2001	130,200	269,479	78	2,260	42	10	402,069
2002	106,792	214,640	27	140	0	0	321,599
2003	131,181	202,682	2,324	27	394	16	336,624
2004	109,363	273,667	31	0	0	0	383,061
2005	121,952	400,121	28	0	0	0	522,101
2006	41,157	151,282	0	0	0	0	192,439
2007	44,422	130,672	0	414	26	0	175,534

Recreational landings of proposed Snapper Unit 3 in Puerto Rico from catches in federal and territorial waters combined have varied considerably from 2000 to 2007, ranging from a high of over 166,000 individuals in 2000 to a low of approximately 40,000 in 2004 (Figure 7.8).

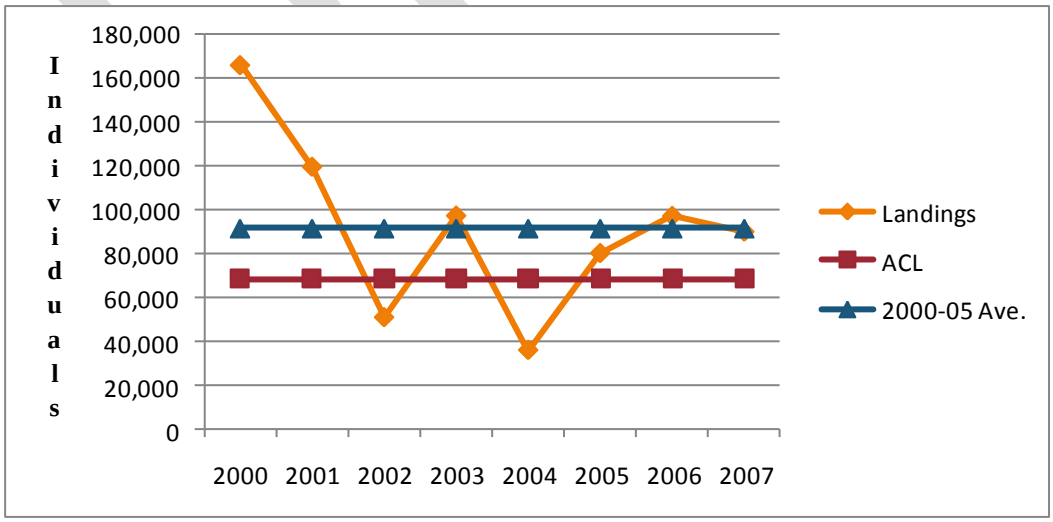


Figure 7.8. Annual Recreational Landings from 2000 to 2007, Average Annual Recreational Landings from 1999 to 2005, and Proposed Recreational ACL for Snapper Unit 3 in Puerto Rico.

Whether annual landings from 1999 to 2005 or from 2006 and 2007 are representative of current and future landings, there would be an overage of Snapper Unit 3 recreational landings, and **Preferred Alternative 2** would result in a reduced recreational fishing season for Snapper Unit 3 in the Puerto Rico EEZ in 2010 and likely subsequent years, which could have an adverse economic impact on recreational fishers of Puerto Rico. However, charter fishing operations and recreational and subsistence fishermen, who presently target Snapper Unit 3 species in federal waters, could mitigate for loss of economic benefits because of a reduced federal season for Snapper Unit 3 in the Puerto Rico EEZ by shifting effort to territorial waters or other parts of the EEZ that remain open to Snapper Unit 3 fishing, although there could be associated temporary displacement costs. Another way to reduce adverse economic impacts from a reduced recreational fishing season for Snapper Unit 3, if any, would be to target other species in territorial and/or federal waters or increase effort during the time the federal recreational Snapper Unit 3 fishery is open. The associated costs of these other mitigating behaviors are discussed at the beginning of this section. Charter fishing operations and recreational and subsistence fishermen are encouraged to comment on the economic impacts of a shortened recreational Snapper 3 fishing season in federal waters off Puerto Rico.

Puerto Rico's commercial landings of Snapper Unit 4 (yellowtail snapper) from territorial and federal waters combined ranged from under 282 thousand pounds to over 632 thousand pounds from 1999 to 2005 (Figure 7.9). Landings fell approximately 58 percent from 2005 to 2006 and fell to approximately 208,000 pounds in 2007.

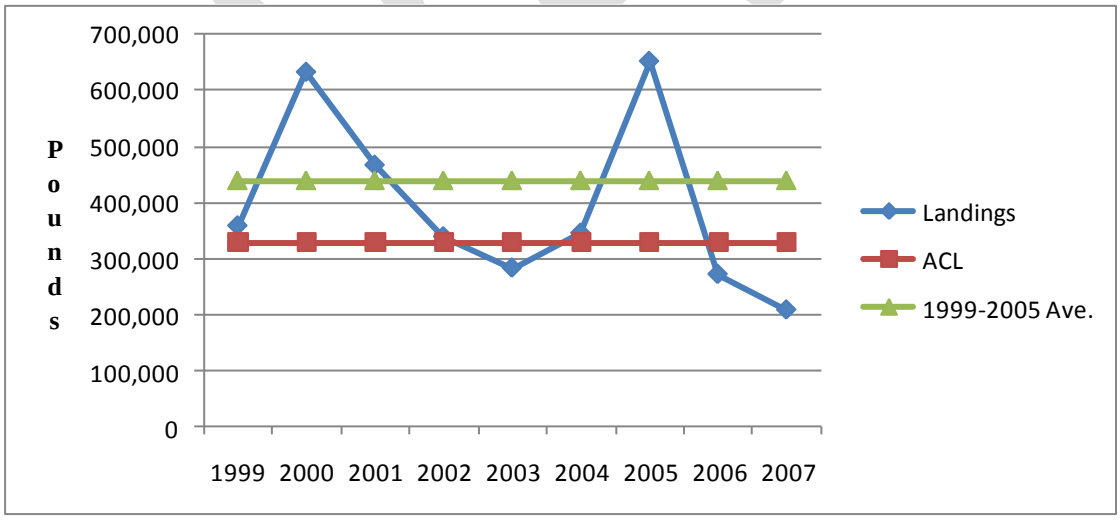


Figure 7.9. Commercial Adjusted Landings from 1999 to 2007, Average Annual Adjusted Commercial Landings from 1999 to 2005, and Proposed Commercial ACL for Snapper Unit 4 in Puerto Rico.

If 2006 and 2007 landings are representative of current and future commercial landings, **Preferred Alternative 2** would have no economic impact on Puerto Rico's Snapper Unit 4 commercial fishermen because the Commercial Snapper Unit 4 ACL would be greater

than annual landings and there would be no reduction of the Snapper Unit 4 fishing season in federal waters off Puerto Rico. However, if there were an overage, **Preferred Alternative 2** would result in a reduced commercial fishing season for Snapper Unit 4 in the Puerto Rico EEZ and possibly subsequent years. However, Puerto Rico's commercial fishermen could mitigate for loss of revenue due to a shortened commercial Snapper 4 fishing season by shifting effort from federal waters off Puerto Rico to territorial waters or to federal waters where the Snapper Unit 4 season remains open, although there could be associated displacement costs. Puerto Rico's commercial fishermen could also mitigate for a shortened federal Snapper Unit 4 fishing season by increasing harvest of other species and/or effort to catch the same number of or more Snapper Unit 4 species in a shortened federal fishing season; however, they would have associated costs as described in the beginning of this section. Commercial fishermen who could be affected by a shortened Snapper Unit 4 commercial fishing season in federal waters off Puerto Rico are encouraged to comment on the economic impacts of this action.

Recreational landings of proposed Snapper Unit 4 in Puerto Rico from catches in federal and territorial waters combined have varied considerably from 2000 to 2007, ranging from a high of almost 58,000 individuals in 2003 to a low of approximately 18,000 in 2006 (Figure 7.10). The proposed Recreational Snapper Unit 4 ACL exceeds annual landings in 2002, 2005 and 2006.

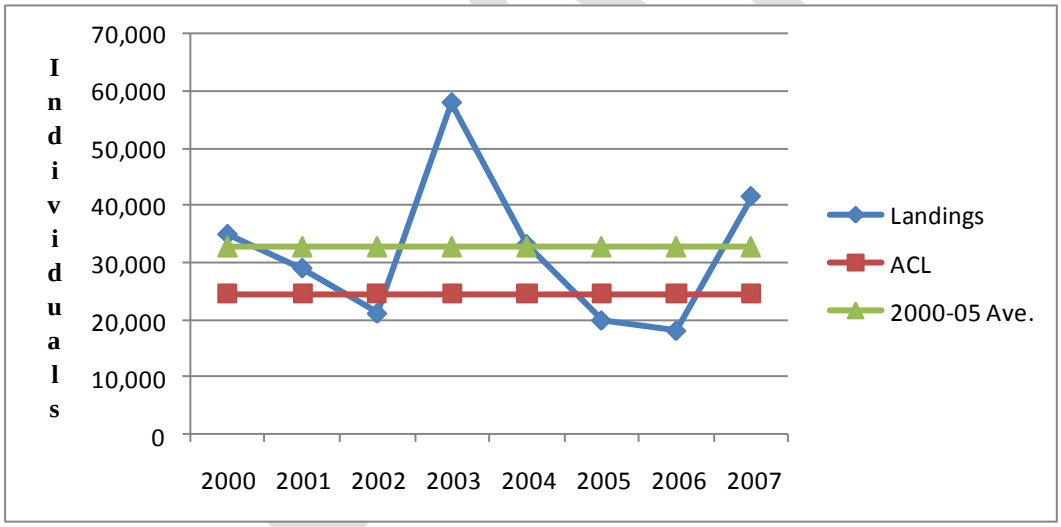


Figure 7.10. Annual Recreational Landings from 2000 to 2007, Average Annual Recreational Landings from 2000 to 2005, and Proposed Recreational ACL of Snapper Unit 4 in Puerto Rico.

If 2006 and 2007 landings are more representative of current and future landings than 2000 to 2005 landings, there would be an overage of Snapper Unit 4 (yellowtail snapper) recreational landings in 2010 and possibly subsequent years. **Preferred Alternative 2** of would result in a reduced recreational fishing season for Snapper Unit 4 in the Puerto Rico EEZ in 2011 and possibly subsequent years, which could have an adverse economic impact on charter fishing operations and recreational and subsistence fishermen of Puerto

Rico who fish for Snapper Unit 4 species in federal waters. If 2000 to 2005 landings are more representative of current and future landings, the overage would be greater than that suggested by 2006 and 2007 landings, and the 2011 fishing season would be shorter and subsequent seasons could be shorter. Charter fishing operations and recreational and subsistence fishermen, who presently target yellowtail snapper in federal waters off Puerto Rico, could mitigate for loss of economic benefits due to a reduced federal season by shifting effort to territorial waters or other parts of the EEZ that remain open to yellowtail snapper fishing, although there could be associated displacement costs. Two others way to reduce adverse economic impacts from a reduced recreational fishing season for Snapper Unit 4, if any, would be to target other species in territorial and/or federal waters and increase effort during the time the federal recreational Snapper Unit 4 fishery is open. The associated costs of these other two mitigating behaviors are discussed at the beginning of this section. Charter fishing operations and recreational and subsistence fishermen are encouraged to comment on the economic impacts of a shortened recreational Snapper 4 fishing season in federal waters off Puerto Rico.

Annual commercial aggregate grouper landings in Puerto Rico from 1999 to 2005 ranged from 189,074 pounds to 241,820 pounds, and fell substantially to under 80,000 pounds in both 2006 and 2007 (Figure 7.11). The proposed Commercial Grouper ACL is less than annual landings from 1999 to 2005, but substantially higher than annual commercial landings from 2006 to 2007. The following paragraphs explore possible reasons for such a decline after 2005 in order to assess if there would be an overage of landings in 2010 and subsequent years or not.

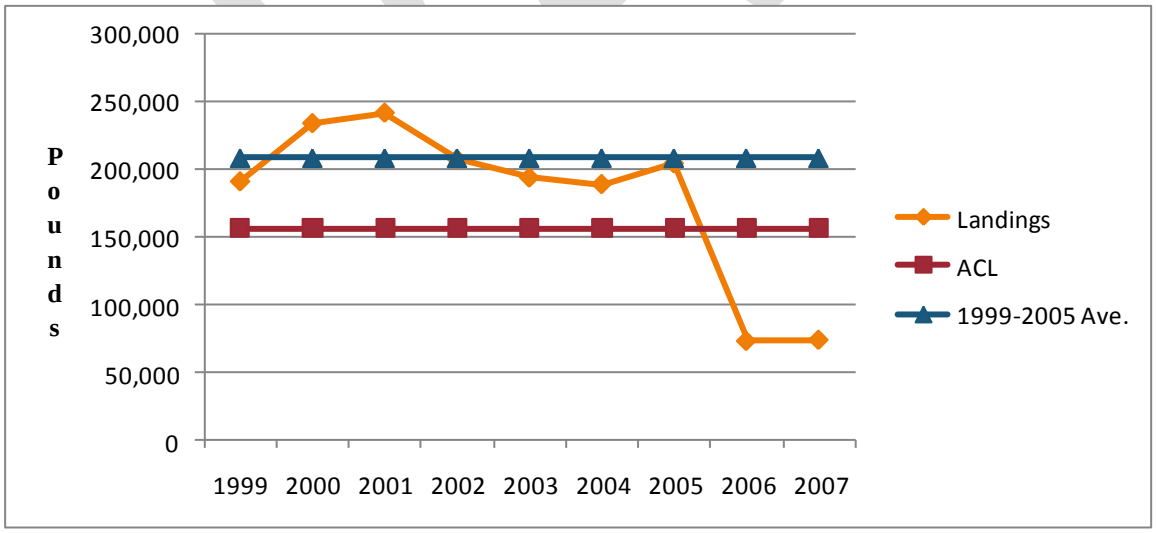


Figure 7.11. Annual Aggregate Grouper Landings from 1999 to 2007, Average Annual Aggregate Grouper Landings from 1999 to 2005, and Proposed Aggregate Grouper ACL for Puerto Rico.

Commercial landings of all grouper harvested from territorial and federal waters combined are composed of current Grouper Units 1 and 2, (proposed) Grouper Units 3, 4 and 5, and unclassified landings. Annual landings of Grouper Units 1, 3, 4, and 5 and

unclassified species all declined, especially Grouper Unit 3 which has comprised most of the grouper landings (Figure 7.12). Grouper Unit 1 (Nassau grouper) represents 8.36 percent and Grouper Unit 2 (goliath grouper) represents 0.35 percent of average commercial grouper landings from 1999 to 2005, although fishing for and possession of both Nassau and goliath grouper have been prohibited in territorial waters since 2004 and in federal waters since the mid 1990s. Grouper Unit 3 species comprised approximately 54 percent of average annual landings of all grouper from 1999 to 2005.

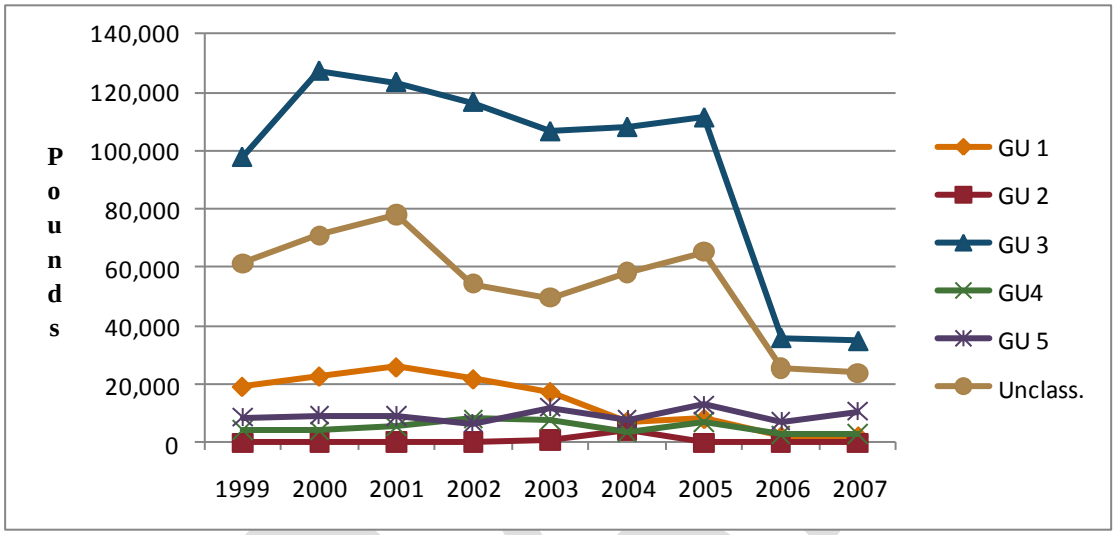


Figure 7.12. Annual Commercial Landings of Grouper Units 1 and 2, Proposed Grouper Units 3, 4 and 5, and Unclassified Grouper, 1999 to 2007.

Grouper Unit 3 would be composed of red hind, coney, rock hind and graysby grouper. Red hind has dominated commercial landings from1999 to 2007 (Table 7.11). Significant regulatory change has occurred over this time period, which has affected red hind landings. In 2004, Puerto Rico's DNER passed the regulation to prohibit fishing for and possession of red hind from December 1 to February 28 each year in territorial waters. Since implementation of the SFA, possession of red hind has been prohibited from December 1 to February 28 each year in federal waters off the west coast of Puerto Rico (Bajo de Sico, Tourmaline Bank, and Abrir La Sierra Bank). The closed areas cover approximately 24 percent of fishable habitat of the EEZ off Puerto Rico. Annual red hind landings fell 69 percent from 2005 to 2006 and the 2006 to 2007 average annual landings are less than a third of the average annual average from 1999 to 2005. Similarly, there was a substantial decline in average annual landings of coney grouper after 2005. The 2006 and 2007 declines in unclassified grouper landings can also be attributed to these seasonal closures.

Table 7.11. Commercial Landings of (Proposed) Grouper Unit 3, 1999 to 2007.

Year	Pounds				
	Red hind	Coney	Rock hind	Graysby	GU 3
1999	84,504	13,145	0	32	97,681
2000	106,703	20,239	198	0	127,140
2001	100,282	23,011	0	0	123,293
2002	94,343	22,137	0	34	116,514
2003	87,589	18,840	0	10	106,439
2004	90,386	17,502	4	0	107,892
2005	95,899	15,269	0	0	111,168
2006	29,794	5,985	0	0	35,779
2007	30,731	3,998	0	0	34,729

In light of recent regulatory changes, 2006 and 2007 commercial landings of grouper are expected to be more representative of current and future commercial landings of grouper. Therefore, the proposed Commercial Grouper ACL would be higher than 2010 and future annual landings, and **Preferred Alternative 2** would not have an adverse economic impact on commercial grouper fishermen of Puerto Rico. However, if there were an overage, **Preferred Alternative 2** would result in a reduced fishing season for grouper in the Puerto Rico EEZ and possibly subsequent years. However, Puerto Rico commercial grouper fishermen could mitigate for loss of revenue due to a shortened commercial grouper fishing season by shifting effort from federal waters off Puerto Rico to territorial waters or to federal waters where the grouper season remains open, although there could be associated temporary displacement costs. Puerto Rico's commercial fishermen could also mitigate for a shortened federal Grouper fishing season by increasing harvest of other species and/or effort to catch the same number of or more Grouper species in a shortened federal fishing season; however, they would have associated costs as described in the beginning of this section. Commercial fishermen who could be affected by a shortened Grouper commercial fishing season in federal waters off Puerto Rico are encouraged to comment on the economic impacts of this action.

Annual recreational landings of grouper in Puerto Rico from 2000 to 2005 averaged 110,094 individuals, but in 2006 and 2007 that average fell to 44,156 individuals (Figure 7.14). The proposed ACL of 82,571 individuals is higher than annual landings in 2006 and 2007.

DRAFT

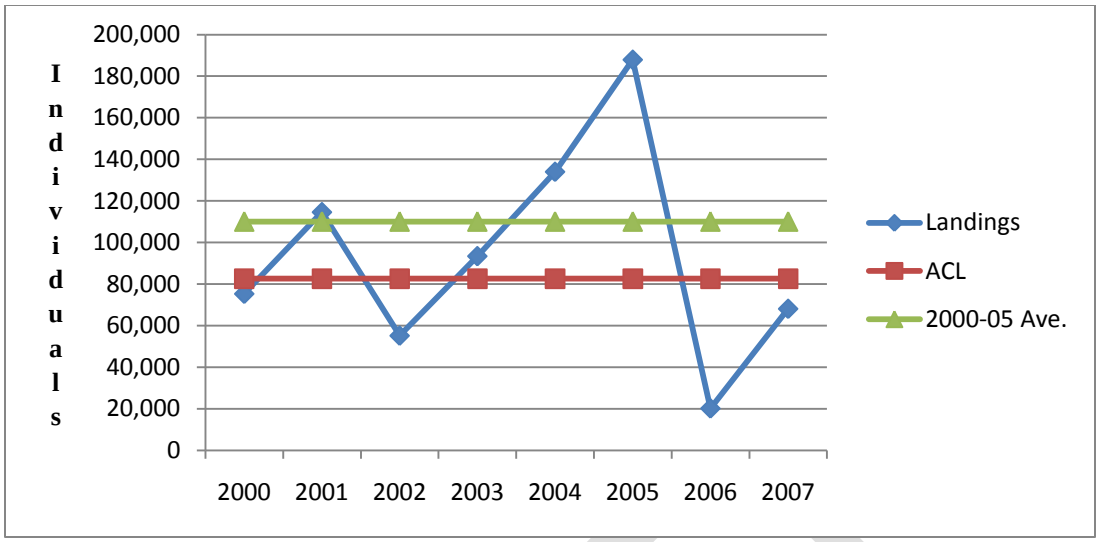


Figure 7.14. Recreational Landings, Average Annual Recreational Landings from 2000 to 2005, and Proposed Recreational ACL of Grouper in Puerto Rico.

In light of 2004 and 2005 federal and territorial regulations that affected grouper fishing, especially for red hind, it is expected that 2006 and 2007 landings are more representative of current and future landings than 2000 to 2005 landings. Hence, there would not be an overage of recreational grouper landings and shortened federal recreational season for grouper in the Puerto Rico EEZ, and **Preferred Alternative 2** would not have an adverse economic impact on charter fishing operations or recreational or subsistence fishermen of Puerto Rico. However, if there were an overage of recreational landings of grouper, charter fishing operations or recreational or subsistence fishermen, who presently target grouper in federal waters off Puerto Rico, could mitigate for loss of benefits due to a reduced federal season by shifting recreational effort to territorial waters or other parts of the EEZ that remain open to recreational grouper fishing, although there could be associated temporary displacement costs. Two others way to reduce adverse economic impacts from a reduced recreational fishing season for grouper, if any, would be to target other species in territorial and/or federal waters and increase effort during the time the federal recreational grouper fishery is open. The associated costs of these other two mitigating behaviors are discussed at the beginning of this section. Charter fishing operations and recreational and subsistence fishermen are encouraged to comment on the economic impacts of a shortened recreational grouper fishing season in federal waters off Puerto Rico.

St. Croix

Preferred Alternative 2 in combination with Action 3 that does not separate the recreational from the commercial sectors could have negative economic impacts on St. Croix's charter fishing operations and recreational and subsistence fishermen who fish in federal waters off St. Croix because they could be in competition with commercial fishermen who also fish in the same federal waters and there be a race to catch as many fish as possible before the federal fishing season is closed. In such a race, industrial-scale

commercial fishing operations with larger vessels and gears capable of catching more of the sub-unit/units in the same or a shorter period of time would be favored over St. Croix's historic small-scale commercial, charter fishing operations, and recreational and subsistence fishermen. However, such a race between commercial and recreational fishermen would not occur under the status quo because MRFSS is not presently conducted in the USVI and the proposed ACLs are for commercial landings only by default. However, if generation of annual recreational data were to begin, there could be sector conflicts because commercial and recreational landings for a unit would count against the same ACL. As of March 9, 2010, 12 of the USVI's recreational fishermen were registered with the National Angler Registry, and in 2009, there was one charter fishing operation. In 2008, there were 233 licensed commercial fishermen in St. Croix. Whether the two sectors are divided or not, industrial-scale commercial fishing operations would be favored over small-scale commercial fishing operations if there was a race to catch as many fish as possible in federal waters before a federal fishing season ended. St. Croix's charter fishing operators, recreational and subsistence fishermen and commercial fishermen are encouraged to comment on the potential economic impacts of ACLs that do not separate the commercial and recreational sectors or could potentially favor industrial fishing over traditional commercial fishing practices.

Recall that **Preferred Alternative 2g** of Action 2(b) would set the ACL for queen conch equal to the existing landings quota for the St. Croix District limit set by the VIDPNR. With an ACL equal to the District's existing landings quota of 50,000 pounds, there is expected to be little to no overage to trigger the accountability measure for queen conch and, consequently, only slight to no reductions in the length of the federal fishing season for queen conch. Moreover, it is expected that if there were a reduced federal fishing season, it would be irrelevant because St. Croix queen conch fishermen can meet the annual quota by fishing exclusively in territorial waters. It follows that **Preferred Alternative 2** would have no adverse economic impact on St. Croix's queen conch fishermen; however, it would have advantages to territorial and federal law enforcement who would be enforcing seasonal closures in accord with the same 50,000 annual landings quota.

Annual commercial landings of parrotfish that were harvested in either territorial or federal waters and landed in St. Croix from 1999 to 2007 have ranged from a low of 260,474 pounds to a high of 416,074 pounds. From 1999 to 2005, annual commercial landings showed a generally increasing trend and the average was 292,220 pounds (Figure 7.15). The proposed St. Croix parrotfish ACL would be 219,915 pounds.

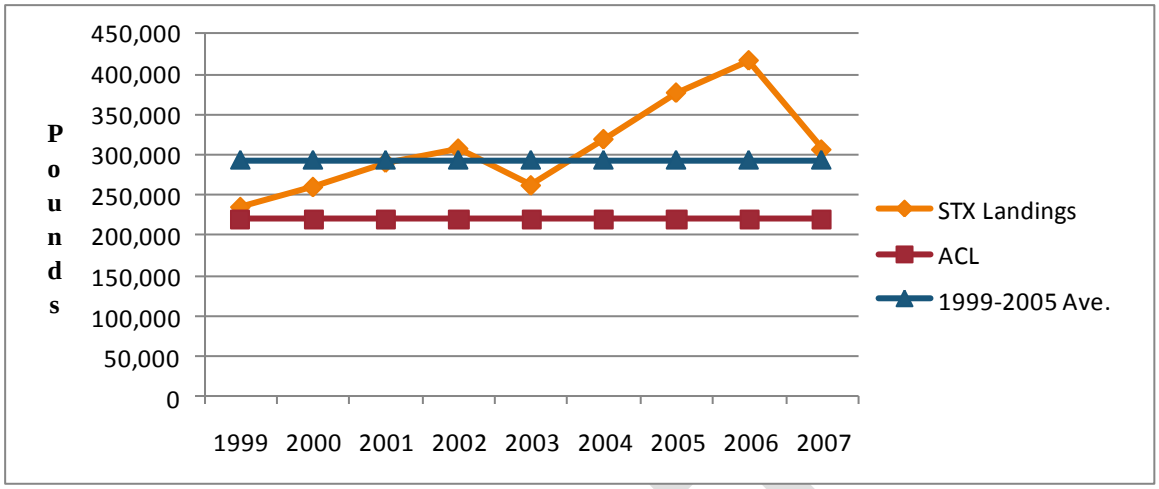


Figure 7.15. Commercial Landings of Parrotfish in St. Croix from 1999 to 2007 and Proposed St. Croix Parrotfish ACL.

The proposed St. Croix Parrotfish ACL is less than annual commercial landings of parrotfish for each year from 1999 to 2007, which suggests there would be an overage in 2010 and subsequently a shortened federal parrotfish fishing season in the St. Croix EEZ in 2011 and likely in subsequent years. However, average annual commercial landings of parrotfish in St. Croix prior to 2007 are not representative of current average annual landings.

Since implementation of the SFA, the use of trammel nets and gillnets has been prohibited in the EEZ, and since July 2006, the VIDPNR has prohibited the use of trammel and gill nets in territorial waters. These prohibitions have had a significant impact on St. Croix's parrotfish fishermen. According to the St. Thomas Fishermen's Association (May 7, 2009), gillnets and trammel nets had represented 90 percent of St. Croix's parrotfish landings prior to the bans, although commercial landings reported to VIDPNR suggest a smaller percent. Whether 90 percent or less, commercial parrotfish landings fell dramatically from 2006 to 2007, and since enforcement of the ban did not commence until 2008, commercial landings since 2008 may have continued to show a declining trend. A preliminary estimate of 2008 commercial parrotfish landings in St. Croix suggests a figure substantially less than 200,000 pounds, which is under the proposed ACL. Consequently, **Preferred Alternative 2** likely would not have an adverse economic impact on St. Croix's commercial fishermen who harvest parrotfish.

Figure 7.16 shows the percents of St. Croix's parrotfish and other finfish net landings by fishing zone from 2003 to 2006. During this time period, parrotfish was the most popular species taken by St. Croix's net fishing commercial fishermen.

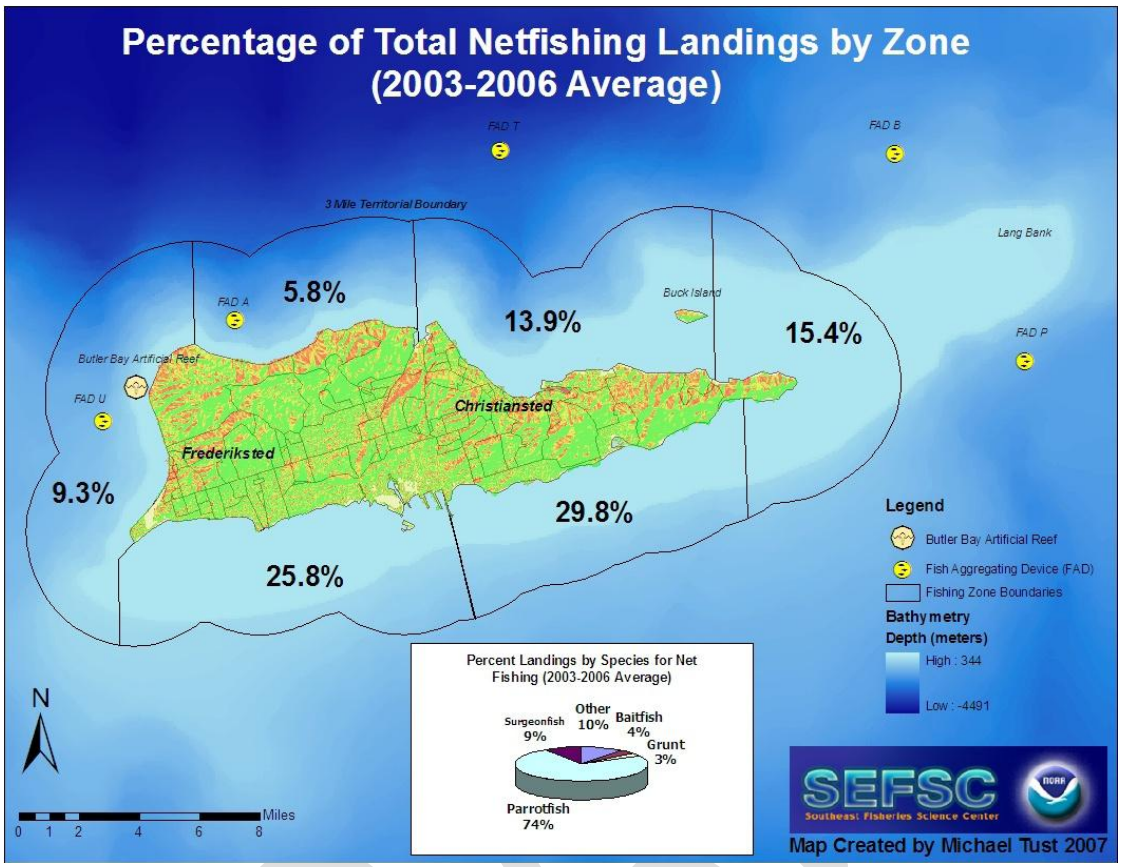


Figure 7.16. Percent of Finfish Landings by Zone, 2003 to 2006.

If there were an overage of parrotfish landings and resulting reduction in the St. Croix parrotfish fishing season in federal waters, Cruzan commercial fishermen could mitigate for loss of revenues or other benefits by shifting effort to territorial waters and/or other areas of the EEZ where the parrotfish fishery remains open, although they would experience displacement costs, such as catch-and-landings changes, trip-level search and associated costs, crowding and congestion costs, and personal safety costs. Two others way to reduce adverse economic impacts from a reduced federal fishing season for parrotfish in the St. Croix EEZ, if any, would be to target other species in territorial and/or federal waters and increase effort during the time the federal parrotfish fishery is open. The associated costs of the first of these other two mitigating behaviors are discussed at the beginning of this section (7.5.5.2). Commercial fishermen are encouraged to comment on the economic impacts of a shortened parrotfish fishing season in federal waters off St. Croix.

Deepwater snapper and reef fish are popular categories of fish among St. Croix's commercial fishermen. Approximately 42 percent and 85 percent of 215 Cruzan fishermen interviewed in 2004 targeted deepwater snapper and reef fish, respectively (Kojis 2004). The proposed St. Croix Snapper ACL would be 90,835 pounds, which is less than annual commercial snapper landings from territorial and federal waters combined from 2001 to 2007 (Figure 7.17).

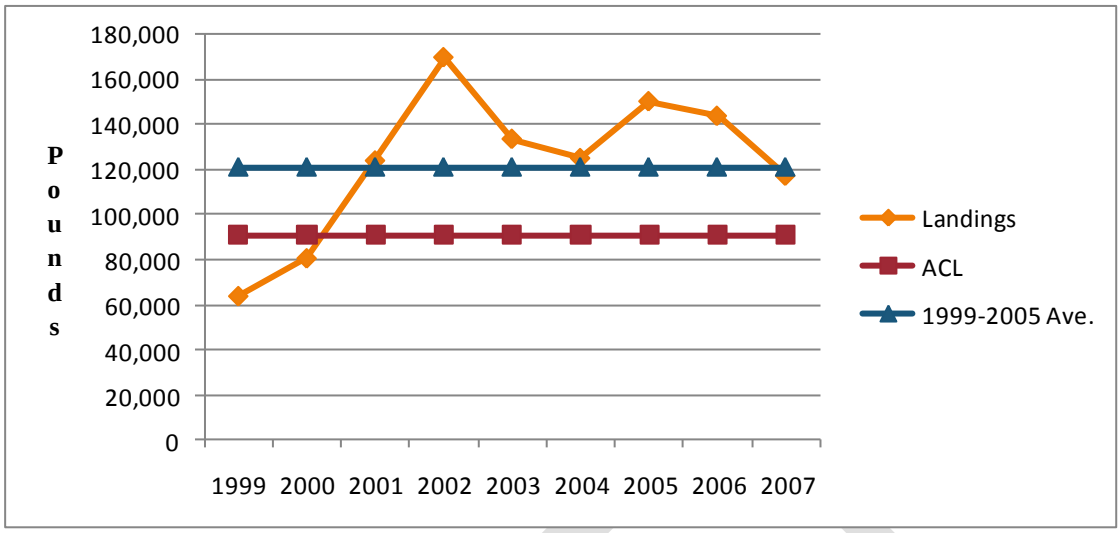


Figure 7.17. Commercial Landings of Snapper in St. Croix from 1999 to 2007 and Proposed St. Croix Snapper ACL.

Since implementation of the SFA in 2005, there have been seasonal closures of various snapper fisheries in the EEZ each year: mutton and lane snapper from April 1 to June 30 and black, blackfin, vermilion and silk snapper from October 1 through December 31. The reduction in snapper landings from 2005 to 2007 likely reflects in part these seasonal closures.

The most popular gear to harvest snapper for Cruzan commercial fishermen has been line fishing. From 1999 to 2007, line gear alone accounted for approximately 60 to 79 percent of snapper landings with known gear, and when combined with other gear, it accounted for 60 to 83 percent of landings with known gear (Table 7.12). Annual commercial landings of snapper taken by line fishing greatly increased from under 40,000 pounds in 1999 to over 169,000 pounds in 2002, and then varied from 117,344 to 150,278 pounds from 2003 to 2007.

Major deepwater snapper fishing areas are in both federal and territorial waters off the east coast of St. Croix (Figure 7.18). Deepwater snapper include the species of proposed Snapper Units 1 (silk, black, blackfin, vermilion and wenchman snapper) and 2 (queen and cardinal snapper).

DRAFT

Table 7.12. Annual Commercial Landings of Snapper by Line Fishing and as Percent of Landings with Known Gear, 1999 to 2007.

Year	Pounds								Percent Line Fishing	Percent Line Fishing Alone
	Line Fishing With or Without Other Gear							Landings with Known Gear		
	Alone	Diving	Seine Net	Gillnet	Cast Net	Traps	Total			
1999	38,591	533	0	0	0	188	39,312	64,099	61.3%	60.2%
2000	48,397	5	10	0	0	12	48,424	80,817	59.9%	59.9%
2001	74,054	186	108	0	0	6,573	80,921	123,697	65.4%	59.9%
2002	118,793	0	173	0	2,282	748	121,996	169,723	71.9%	70.0%
2003	91,680	0	10	0	0	65	91,755	133,620	68.7%	68.6%
2004	77,232	0	0	15	105	47	77,399	125,080	61.9%	61.7%
2005	104,516	0	0	0	40	87	104,643	150,278	69.6%	69.5%
2006	108,804	0	0	0	215	697	109,716	143,828	76.3%	75.6%
2007	93,051	3,276	260	0	219	151	96,957	117,344	82.6%	79.3%

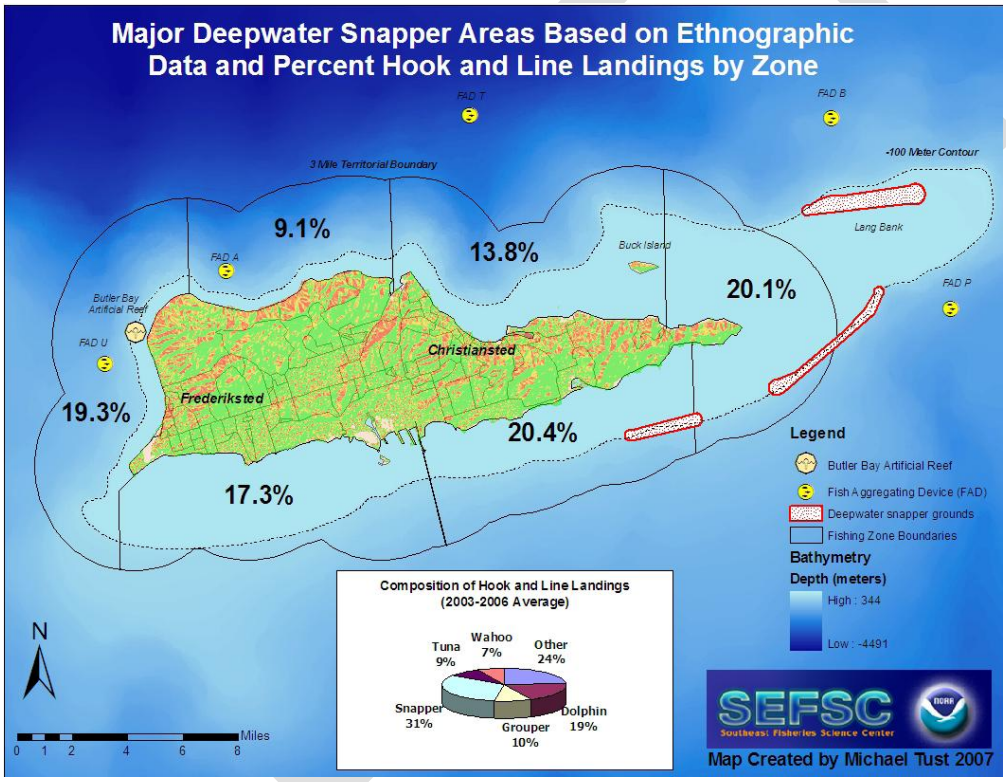


Figure 7.18. Major Deepwater Snapper Fishing Areas off St. Croix, 2003 to 2007.

Implementation of the SFA in 2005 and USVI regulations promulgated later prohibit the use of bottom longlines, traps, pots, gillnet and trammel net year-round in both federal and territorial waters of the Red Hind and Mutton Snapper Spawning Aggregation Areas. The Red Hind Spawning Aggregation Area is located on Lang Bank and covers an area of 11.7 square kilometers, and the Mutton Snapper Spawning Aggregation Area is found off the southwest coast and covers an area of 8.72 square kilometers. These gear prohibitions are

reflected in the decreased use of traps to harvest snapper since 2005 (Table 7.13). At the same time, there has been an increased use of both line fishing and diving (Table 7.14).

Table 7.13. Annual Commercial Landings of Snapper by Trap Fishing and as Percent of Landings with Known Gear, 1999 to 2007.

Year	Pounds								Percent Trap	Percent Trap Alone
	Traps With or Without Other Gear							Landings with Known Gear		
	Alone	Diving	Seine Net	Gillnet	Cast Net	Line F.	Total			
1999	17,512	128	285	180	0	188	18,293	64,099	28.5%	27.3%
2000	16,039	0	20	30	0	12	16,101	80,817	19.9%	19.8%
2001	19,098	86	75	0	0	6,573	25,832	123,697	20.9%	15.4%
2002	22,549	6	0	0	0	748	23,303	169,723	13.7%	13.3%
2003	13,806	0	0	0	0	65	13,871	133,620	10.4%	10.3%
2004	20,832	450	0	410	0	47	21,739	125,080	17.4%	16.7%
2005	18,418	725	0	103	0	87	19,333	150,278	12.9%	12.3%
2006	11,207	71	0	0	0	697	11,975	143,828	8.3%	7.8%
2007	7,861	15	0	0	0	151	8,027	117,344	6.8%	6.7%

Table 7.14. Annual Landings of Snapper by Diving and as Percent of Landings with Known Gear, 1999 to 2007.

Year	Pounds									Percent Trap	Percent Trap Alone
	Diving With or Without Other Gear								Landings with Known Gear		
	Alone	Gillnet	Seine Net	Cast Net	Trammel Net	Traps	Line F.	Total			
1999	5,085	23	25	0	0	128	533	5,794	64,099	9.0%	7.9%
2000	12,853	59	1,233	0	0	0	5	14,150	80,817	17.5%	15.9%
2001	17,247	356	1,352	0	0	86	186	19,227	123,697	15.5%	13.9%
2002	20,257	55	115	0	0	6	0	20,433	169,723	12.0%	11.9%
2003	23,801	90	0	0	0	0	0	23,891	133,620	17.9%	17.8%
2004	23,125	0	0	0	15	450	0	23,590	125,080	18.9%	18.5%
2005	22,264	5	0	0	469	725	0	23,463	150,278	15.6%	14.8%
2006	19,558	0	0	45	0	71	0	19,674	143,828	13.7%	13.6%
2007	10,272	0	0	133	30	15	3,276	13,726	117,344	11.7%	8.8%

Figures 7.19 and 7.20 depict major fishing grounds for St. Croix commercial fishermen who dive and/or use traps to harvest snapper and other finfish. Since the implementation of post SFA federal and territorial regulations, the percent of landings and popularity of these areas may have changed, especially those in federal waters off the east coast of St. Croix.

DRAFT

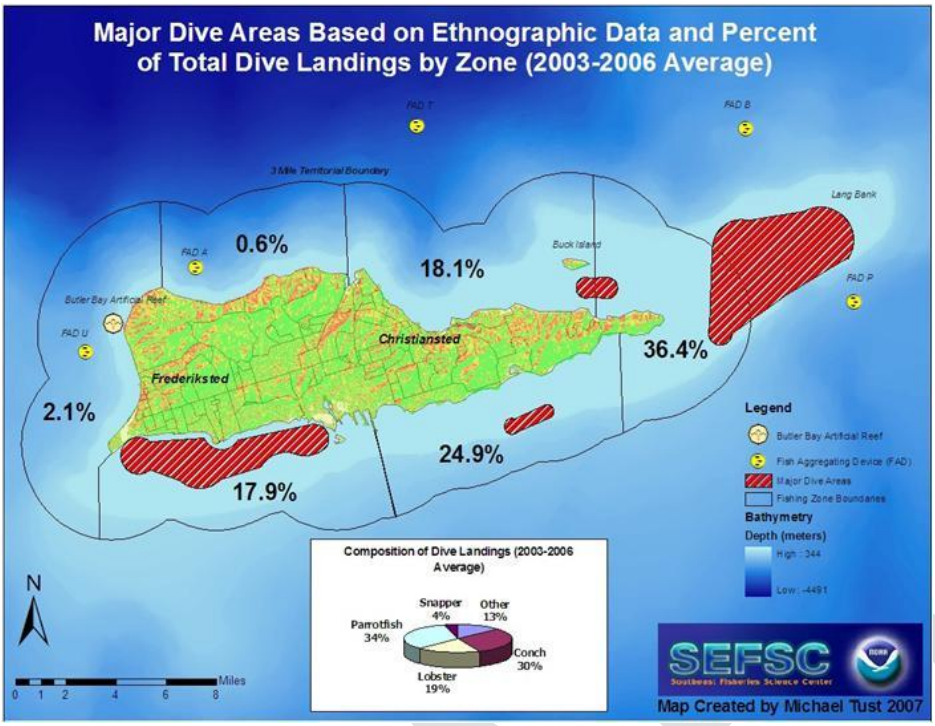


Figure 7.19. Major Dive Areas off St. Croix in Federal and Territorial Waters, 2003 to 2006.

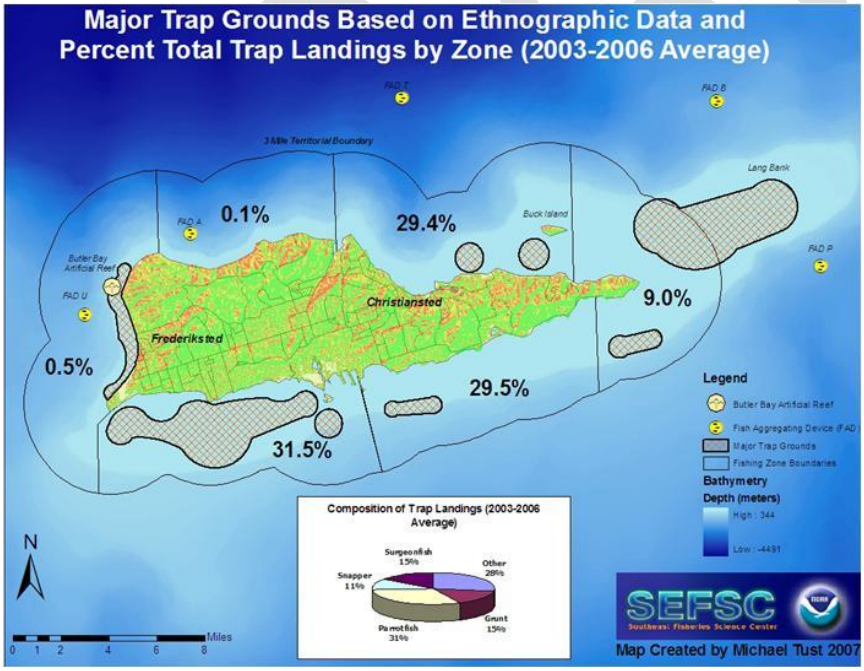


Figure 7.20. Major Trap Grounds off St. Croix in Federal and Territorial Waters, 2003 to 2006.

Gillnets and trammel nets have never been popular gears to harvest snapper in waters off St. Croix. From 1999 to 2007, gillnet and trammel net combined accounted for less than 3 percent of annual landings with known gear. In 2007, gillnet use accounted for 0.2 percent of annual landings whose gears were known and trammel net accounted for 0.9 percent. Hence, unlike the parrotfish fishery, the prohibitions on the use of gillnets and trammel nets in the EEZ and USVI waters did not significantly affect commercial snapper landings in St. Croix.

Preferred Alternative 2 would likely have an adverse economic impact on commercial, fishermen of St. Croix who presently target snapper in the EEZ off St. Croix; however, the magnitude of the impact is dependent on the level of current landings of snapper and the percent of those landings that derive from federal waters. As stated in section 5.3.1, St. Croix has 98-nm^2 of fishable habitat in territorial waters and a 21-nm^2 area off its east coast that resides in the EEZ; hence, approximately 18 percent of fishable habitat is within federal waters and the remaining 82 percent in territorial waters of St. Croix. However, Figure 7.18 suggests significant portions of the deepwater snapper fishing areas lie within federal waters, which is also evidenced by monthly trip ticket reports. For example, in the 2000 to 2001 fishing season, 55 percent of the reported commercial snapper activities in St. Croix occurred in federal waters, according to the monthly trip ticket reports (CFMC 2005). The economic analysis for the regulatory implementation of the SFA estimated the seasonal closure of the EEZ to the possession of black, blackfin, vermilion and silk snapper from October 1 through December 31 would reduce annual landings of these species by 23 percent. The seasonal closure of the EEZ to the possession of mutton snapper and lane snapper from April 1 through June 30 was expected to reduce annual landings of these species by 29 percent. Closure of an area of Grammanik Bank from February 1 through April 30 of each year was also expected to adversely impact St. Croix's fishermen, although no estimate of the impact on snapper landings was generated.

The average difference between annual landings from 1999 to 2005 and the proposed St. Croix Snapper ACL is 30,279 pounds, and the overage ranges from a high of 78,913 pounds in 2002 to a low of -26,729 pounds in 1999. The average difference between annual landings from 2006 to 2007 and the proposed Snapper ACL is 39,751 pounds. If 2006 to 2007 landings are more representative of current snapper landings, there would be an expected overage of 39,751 pounds in 2010. **Preferred Alternative 2** would reduce the 2011 snapper fishing season in the St. Croix EEZ by 3.64 months, assuming 130,586 pounds are landed over 12 months, and average monthly landings are 10,882 pounds. However, prior to the SFA, an estimated 55 percent of snapper landings originated from the EEZ. For purposes here, it is estimated that the shortened federal fishing season would be 30 percent effective and the average price per pound of snapper is $7.50. Such a season reduction would translate to reduced commercial snapper landings of 11,925 pounds with an ex-vessel value of $89,440 in 2011 (Table 7.15). Over the 10-year period from 2011 to 2020, there would be an estimated loss of ex-vessel revenue of approximately $0.48 million. Reductions of the federal fishing season would continue until the 3-year average of landings was not greater than the St. Croix Snapper ACL of 90,835 pounds, with the losses of revenue continuously declining. Commercial fishermen

are encouraged to comment on the economic impacts of a shortened snapper fishing season in federal waters off St. Croix.

Table 7.15. Loss of Ex-Vessel Revenue to St. Croix Commercial Fishermen due to Shortened Snapper Fishing Season in St. Croix EEZ.

Year	Pounds								Revenue Loss	Present Value (2011 $)
	Landings	Overage	30 % Reduction	2-year Ave. Landings	2-year Ave. Overage	3-year Ave. Landings	3-year Ave. Overage	ACL		
2010	130,586	39,751	0					90,835	$0	$0
2011	118,661	27,826	11,925	124,623	33,789			90,835	$89,440	$89,440
2012	114,487	23,652	10,137			121,245	30,410	90,835	$76,024	$71,051
2013	112,122	21,287	9,123			115,090	24,255	90,835	$68,422	$59,762
2104	107,813	16,978	7,276			111,474	20,639	90,835	$54,573	$41,634
2015	105,282	14,447	6,192			108,406	17,571	90,835	$46,438	$30,943
2016	103,135	12,300	5,271			105,410	14,575	90,835	$39,534	$21,504
2017	101,038	10,203	4,373			103,151	12,316	90,835	$32,794	$14,561
2018	99,457	8,622	3,695			101,210	10,375	90,835	$27,712	$9,387
2019	98,097	7,262	3,112			99,530	8,695	90,835	$23,343	$6,032
2020	96,922	6,087	2,609			98,159	7,324	90,835	$19,565	$3,605
Total	1,057,013	148,663	63,713	124,623	33,789	963,674	146,159	908,350	477,845	347,919

The reduction in commercial landings of snapper would also affect St. Croix's fish markets and restaurants. According to the 2007 Economic Census, there were 4 establishments with 15 employees in the Specialty Food Store Industry (NAICS 4452) that includes fish markets, and there were 37 establishments in the Full-Service Restaurant Industry (NAICS). Table 7.15 does not incorporate any losses incurred by fish markets, restaurants or other establishments by the reduction of commercial snapper landings in St. Croix. St. Croix's fish markets, restaurants and other establishments are encouraged to comment on the economic impacts of a shortened snapper fishing season in the St. Croix EEZ.

St. Croix's commercial landings of grouper have varied considerably from 1999 to 2005, ranging from a low of 20,573 pounds in 1999 to a high of 46,776 pounds in 2004. After 2004 there has been a sharply declining trend (Figure 7.21). The proposed ACL of 26,855 pounds is higher than annual commercial landings from 2002 to 2006, but less than 2007 annual landings. Trip ticket data from 2000 to 2001 for St. Croix, suggest about 44 percent of reported commercial grouper catch came from the EEZ at that time.

DRAFT

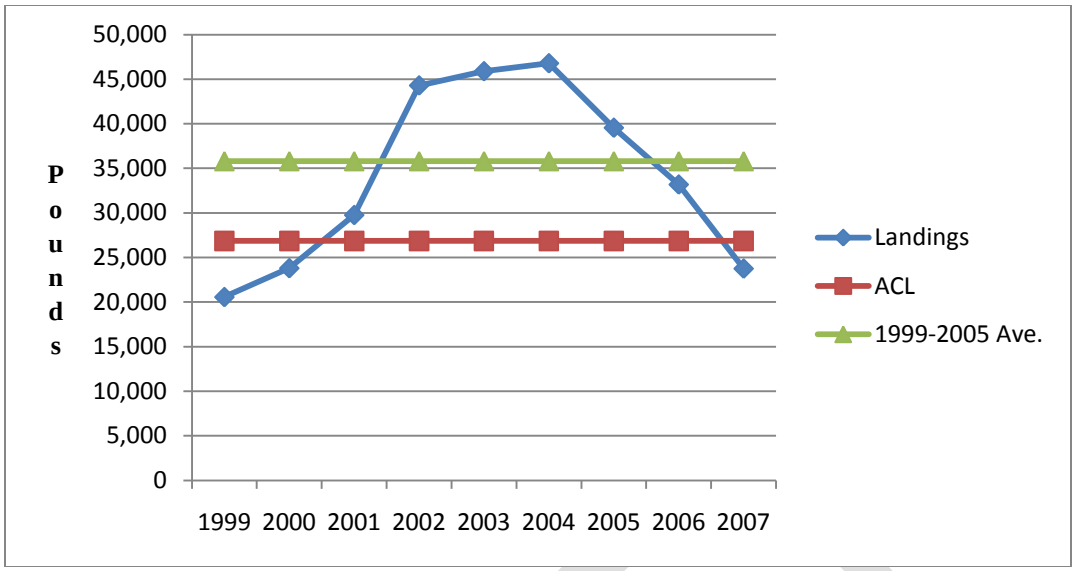


Figure 7.21. Annual Commercial Landings of Grouper, Average Annual Commercial Landings from 1999 to 2005, and Proposed Grouper ACL in St. Croix.

Relatively recent federal and territorial regulations have affected St. Croix's commercial grouper landings. Regulations that implemented the SFA in 2005 included establishment of the seasonal closure to the possession of all species except misty grouper, in the Grouper Unit 4 fishery (red, black, tiger, yellowfin and yellowedge grouper) from February 1 through April 30, and was expected to reduce annual landings of the unit, except misty grouper, by 24 percent. Since 2005, the use of bottom longlines, traps, pots, gillnet and trammel net is prohibited year-round in both federal and territorial waters of the Red Hind and Mutton Snapper Spawning Aggregation Areas. Commercial landings of grouper by gillnet declined substantially after 2001, and landings by both gillnet and trammel net declined significantly after the 2006 ban (Table 7.16). Landings by traps also declined significantly after 2005, which may be attributed to the gear prohibition in the Red Hind and Mutton Snapper Spawning Aggregation Areas as well as other restrictions.

An annual average of 28,475 pounds of grouper was commercially landed from 2006 to 2007. If 2006 and 2007 commercial landings of grouper are representative of current and future landings, the proposed St. Croix Grouper ACL of 26,855 pounds would be less than average annual commercial landings by 1,620 pounds. Therefore, 2010 commercial landings would produce an overage of 1,620 pounds. In response, **Preferred Alternative 2** would reduce the 2011 grouper fishing season in the St. Croix EEZ by seven-tenths of a month, assuming 28,475 pounds of grouper are landed over 12 months, and average monthly landings are 2,373 pounds. Assuming a 2011 average ex-vessel price of $7.5 per pound and that the early closure is 30 percent effective, there would be a 486 pound reduction in 2011 grouper landings with a ex-vessel value of $3,888 (Table 7.17).

Table 7.16. Commercial Landings of Grouper by Gillnet, Trammel Net and Traps, as Percent of Landings with Known Gear, and All Grouper Landings in St. Croix from 1999 to 2007.

Year	Pounds					% Gillnet, Trammel Net, and Trap Landings	All Landings (Pounds)
	Gillnet	Trammel Net	Traps	Total	All Known Gear		
1999	30	0	6,714	6,744	20,573	32.8%	20,561
2000	483	0	3,488	3,971	23,807	16.7%	23,807
2001	11,009	0	3,648	14,657	29,757	49.3%	29,763
2002	1,219	0	6,569	7,788	44,291	17.6%	44,291
2003	1,697	2	4,644	6,343	45,883	13.8%	45,883
2004	2,400	17	6,627	9,044	46,766	19.3%	46,776
2005	1,106	608	6,695	8,409	39,547	21.3%	39,551
2006	889	548	2,992	4,429	33,188	13.3%	33,188
2007	5	272	1,767	2,044	23,762	8.6%	23,762

Commercial fishermen are encouraged to comment on the economic impacts of a shortened snapper fishing season in federal waters off St. Croix. St. Croix's fish markets, restaurants and other establishments are also encouraged to comment on these impacts.

Table 7.17. Loss of Ex-Vessel Revenue to St. Croix Commercial Fishermen due to a Shortened Grouper Fishing Season in the St. Croix EEZ.

Year	Pounds								Revenue Loss	Present Value (2011 $)
	Landings	Overage	30 % Reduction	2-year Ave. Landings	2-year Ave. Overage	3-year Ave. Landings	3-year Ave. Overage	ACL		
2010	28,475	1,620	0					26,855	$0	$0
2011	27,989	1,134	486	28,232	1,377			26,855	$3,645	$3,645
2012	27,819	964	413			28,094	1,239	26,855	$3,098	$2,896
2013	27,723	868	372			27,843	988	26,855	$2,788	$2,436
2104	27,547	692	297			27,696	841	26,855	$2,224	$1,697
2015	27,444	589	252			27,571	716	26,855	$1,893	$1,261
2016	27,356	501	215			27,449	594	26,855	$1,611	$876
2017	27,271	416	178			27,357	502	26,855	$1,336	$593
2018	27,206	351	151			27,278	423	26,855	$1,129	$383
2019	27,151	296	127			27,209	354	26,855	$951	$246
2020	27,103	248	106			27,153	298	26,855	$797	$147
Total	274,609	6,059	2,597	28,232	1,377	247,652	5,957	268,550	$19,474	$14,179

St. Thomas/St. John

Preferred Alternative 2 in combination with Action 3 that does not separate the recreational from the commercial sectors could have negative economic impacts on St. Thomas and St. John's charter fishing operations and recreational and subsistence fishermen who fish in federal waters off St. Thomas/St. John because they could be in competition with commercial fishermen who also fish in the same federal waters and there be a race to catch as many fish as possible before the federal fishing season is closed. In

such a race, industrial-scale commercial fishing operations with larger vessels and gears capable of catching more of the sub-unit/units in the same or a shorter period of time would be favored over St. Croix's historic small-scale commercial, charter fishing operations, and recreational and subsistence fishermen. However, such a race would not occur under the status quo because MRFSS is not presently conducted in the USVI and the proposed ACLs are for commercial landings only by default. However, if generation of annual recreational data were to begin, there could be sector conflicts because commercial and recreational landings for a unit would count against the same ACL. As of March 9, 2010, 12 of the USVI's recreational fishermen were registered with the National Angler Registry. In 2008, there were nine charter fishing operations and 160 licensed commercial fishermen in St. Thomas/St. John.

Preferred Alternative 2 of Action 5(b) would have no economic impact on St. Thomas or St. John queen conch fishermen because queen conch fishing in and transportation of queen conch is presently prohibited in the EEZ off St. Thomas and St. John. All queen conch landings in St. Thomas and St. John are harvested from territorial waters.

Annual commercial landings of parrotfish harvested from both territorial and federal waters and landed in St. Thomas/St. John from 2000 to 2007 have ranged from a low of 35,273 pounds to a high of 58,548 pounds. From 2000 to 2005, annual commercial landings showed a generally increasing trend and the average was 48,849 pounds; however, after 2005 there has been a declining trend (Figure 7.22). Average annual landings from 2006 to 2007 are 42,528 pounds. The proposed St. Thomas/St. John Parrotfish ACL would be 36,637 pounds, which is less than annual commercial landings from 2006 to 2007, which suggests an overage of parrotfish landings would occur in 2010 and possibly subsequent years.

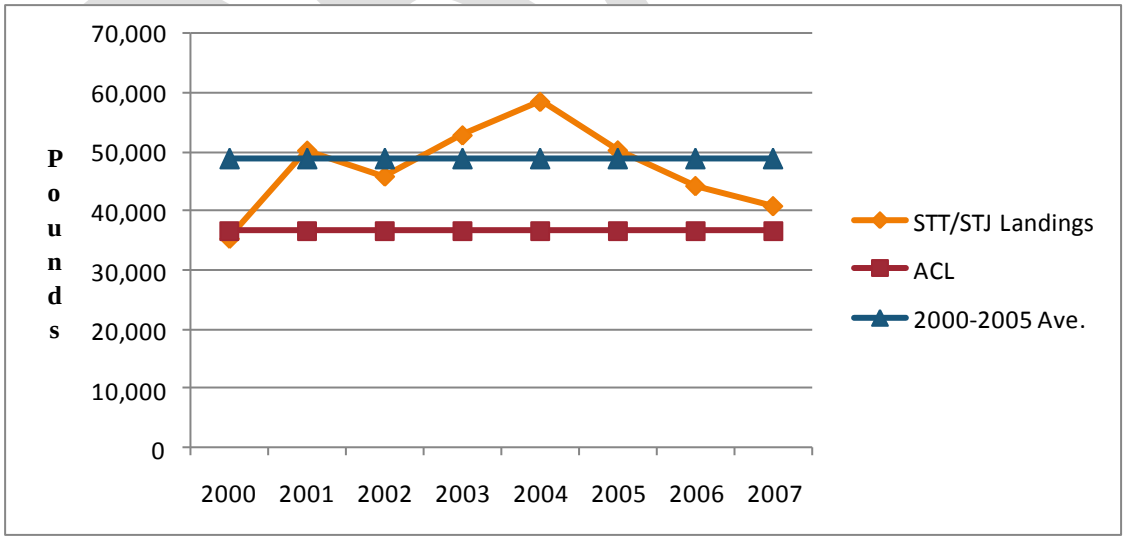


Figure 7.22. Annual Commercial Parrotfish Landings from 2000 to 2007, Average Annual Commercial Landings from 2000 to 2005, and Proposed Parrotfish ACL for St. Thomas/St. John.

Unlike St. Croix, the use of gillnet or trammel net to take parrotfish has not been popular in St. Thomas/St. John. From 2000 to 2007, traps accounted for an average of 94.3 percent of annual parrotfish landings (pounds), followed by diving which accounted for 4.1 percent and line fishing which accounted for 1.4 percent. Collectively, traps, diving and line fishing accounted for 99.8 percent of annual parrotfish landings. Hence, the prohibitions of the use of gillnet and trammel net in federal and territorial waters had essentially no impact on St. Thomas/St. John commercial parrotfish fishermen. However, post-SFA trap and other gear restrictions may be reflected in the decline of parrotfish landings since 2005.

Few commercial fishermen in St. John use traps. In 2001, for example, only three traps were in use by commercial fishermen of St. Thomas, as compared to 5,812 traps used by St. Thomas commercial fishermen (Impact Assessment, Inc. 2007). This suggests the large majority of parrotfish commercial landings are taken by St. Thomas fishermen. Consequently, the proposed St. Thomas/St. John Parrotfish ACL and any reduced federal parrotfish fishing season would likely have the largest adverse economic impact on commercial fishermen of St. Thomas.

If 2006 to 2007 average annual parrotfish landings represent current and future landings, there would be an overage of landings of 5,891 pounds in 2010, and **Preferred Alternative 2** would reduce the 2011 parrotfish fishing season in the St. Thomas/St. John EEZ by 1.7 months, assuming 42,528 pounds of parrotfish are landed over 12 months, and average monthly landings are 3,544 pounds. Assuming a 2011 average ex-vessel price of $5 per pound and the reduction of the federal fishing season is 30 percent effective, such a loss of landings would represent a loss of $8,837 (Table 7.18). Over the 10-year period from 2011 to 2020, there would be a total reduction of parrotfish landings of 9,442 pounds and associated revenue of $47,210. St. Thomas and St. John commercial fishermen who harvest snapper and others who make use of their catch are encouraged to comment on the economic impacts of a shortened parrotfish fishing season in federal waters of St. Thomas/St. John.

Commercial landings of snapper in St. Thomas/St. John have been relatively stable from 1999 to 2007, ranging from 140,863 to 175,338 pounds (Figure 7.23). The proposed Snapper ACL of 118,048 pounds is less than annual landings for each year during this time period. If the average of 2006 and 2007 annual landings is representative of current and future snapper landings, there would be an overage of snapper landings in 2010 of 39,350 pounds. Prior to the SFA, an estimated 50 percent of snapper landings in St. Thomas/St. John were of fish taken from federal waters. Since implementation of the SFA in 2005, there have been seasonal closures of various snapper fisheries in the EEZ each year: mutton and lane snapper from April 1 to June 30 and black, blackfin, vermilion and silk snapper from October 1 through December 31. The VIDPNR prohibits the possession of silk, black, blackfin, and vermilion snapper from October 1 through December 31 each year in the St. Thomas/St. John district. The reduction in snapper landings from 2005 to 2007 may reflect in part these seasonal closures.

Table 7.18. Loss of Ex-Vessel Revenue to St. Thomas/St. John Parrotfish Commercial Fishermen due to a Shortened Parrotfish Fishing Season in the St. Thomas/St. John EEZ.

Year	Pounds								Revenue Loss	Present Value (2011 $)
	Landings	Overage	30 % Reduction	2-year Ave. Landings	2-year Ave. Overage	3-year Ave. Landings	3-year Ave. Overage	ACL		
2010	42,528	5,891	0					36,637	$0	$0
2011	40,761	4,124	1,767	41,644	5,007			36,637	$8,837	$8,837
2012	40,142	3,505	1,502			41,144	4,507	36,637	$7,511	$7,511
2013	39,792	3,155	1,352			40,231	3,594	36,637	$6,760	$6,318
2104	39,153	2,516	1,078			39,696	3,059	36,637	$5,392	$4,709
2015	38,778	2,141	918			39,241	2,604	36,637	$4,588	$3,500
2016	38,460	1,823	781			38,797	2,160	36,637	$3,906	$2,603
2017	38,149	1,512	648			38,462	1,825	36,637	$3,240	$1,762
2018	37,915	1,278	548			38,174	1,537	36,637	$2,738	$1,216
2019	37,713	1,076	461			37,926	1,289	36,637	$2,306	$781
2020	37,539	902	387			37,722	1,085	36,637	$1,933	$500
Total	388,401	22,031	9,442	41,644	5,007	351,393	21,660	366,370	$47,210	$37,736

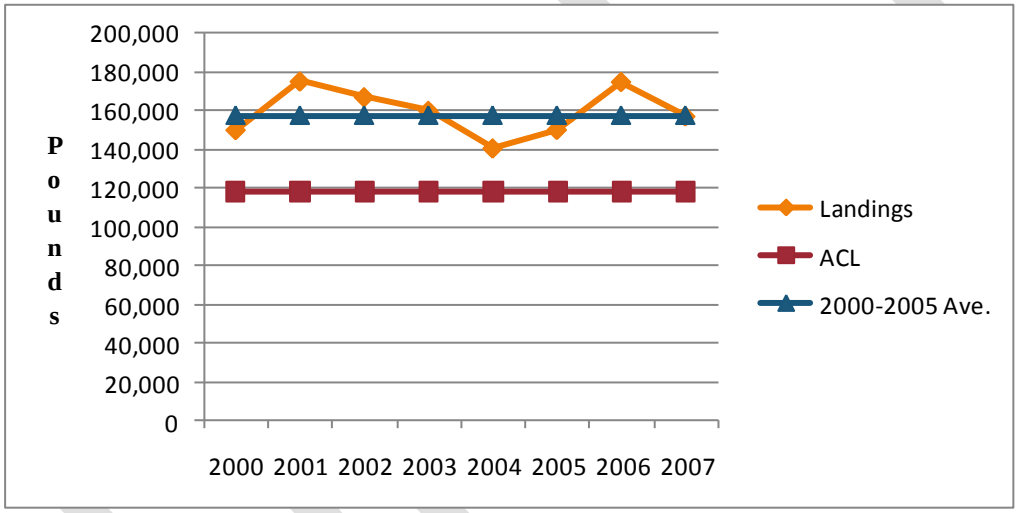


Figure 7.22. Annual Commercial Landings of Snapper from 2000 to 2007, Average Annual Landings from 200 to 2005, and Proposed Snapper ACL for St. Thomas/St. John.

An overage of snapper 39,350 pounds in 2010 would initiate a reduced federal fishing season in the St. Thomas/St. John EEZ in 2011. **Alternative 2** would reduce the 2011 parrotfish fishing season in the St. Thomas/St. John EEZ by three months, assuming 157,397 pounds of snapper are landed over 12 months, and average monthly landings are 13,116 pounds. Assuming an average ex-vessel price of $7 per pound and the reduction in the federal fishing season is 30 percent effective, there would be a loss of landings of 11,805 pounds in 2011 with an ex-vessel value of $82,635 (Table 7.19). Over the 10-year period from 2011 to 2020, there would be total loss of snapper landings of 63,069 pounds with an ex-vessel value of approximately $0.4 million. Commercial fishermen of St. Thomas/St. John, who harvest snapper in federal waters and others who economically benefit from the catch, are encouraged to comment on the economic impacts of a shortened fishing season for grouper in federal waters off St. Thomas/St. John.

Table 7.19. Loss of Ex-Vessel Revenue to St. Thomas/St. John Snapper Commercial Fishermen due to a Shortened Snapper Fishing Season in the St. Thomas/St. John EEZ.

Year	Pounds								Revenue Loss	Present Value (2011 $)
	Landings	Overage	30 % Reduction	2-year Ave. Landings	2-year Ave. Overage	3-year Ave. Landings	3-year Ave. Overage	ACL		
2010	157,397	39,350	0					118,048	$0	$0
2011	145,593	27,545	11,805	151,495	33,447			118,048	$82,635	$82,635
2012	141,461	23,413	10,034			148,150	30,103	118,048	$70,239	$65,644
2013	139,120	21,072	9,031			142,058	24,010	118,048	$63,215	$55,215
2104	134,855	16,807	7,203			138,478	20,430	118,048	$50,421	$38,466
2015	132,349	14,301	6,129			135,441	17,393	118,048	$42,904	$28,589
2016	130,223	12,175	5,218			132,476	14,428	118,048	$36,526	$19,868
2017	128,148	10,100	4,328			130,240	12,192	118,048	$30,299	$13,453
2018	126,582	8,534	3,658			128,318	10,270	118,048	$25,603	$8,673
2019	125,237	7,189	3,081			126,656	8,608	118,048	$21,567	$5,573
2020	124,073	6,025	2,582			125,298	7,250	118,048	$18,076	$3,330
Total	1,327,641	147,162	63,069	151,495	33,447	1,207,115	144,683	1,180,480	$441,485	$321,445

Annual commercial landings of grouper in St. Thomas/St. John have ranged from under 50,000 pounds to approximately 75,000 pounds from 2000 to 2007. The annual average from 2000 to 2005 is 61,023 pounds and the proposed St. Thomas/St. John Grouper ACL is 45,767 pounds. Annual landings from 2000 to 2007 have exceeded the proposed ACL (Figure 7.23).

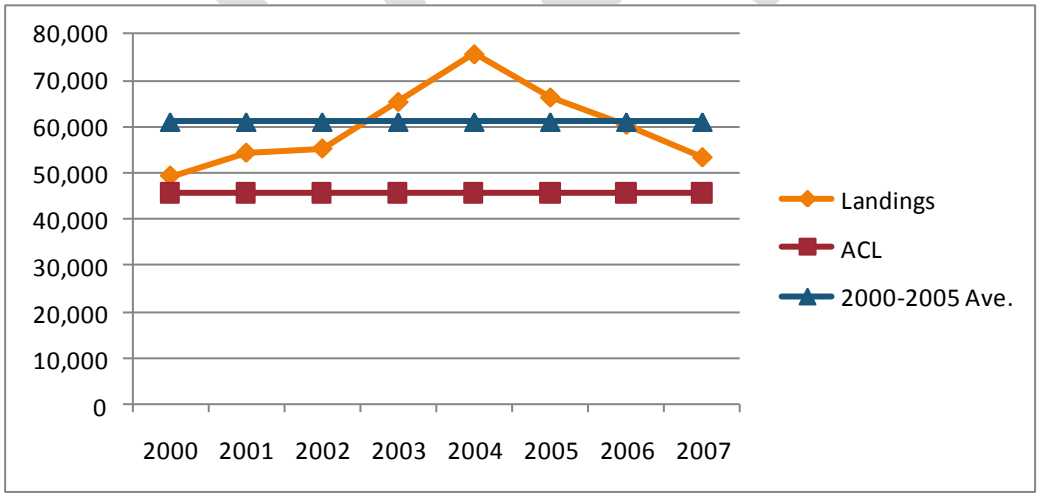


Figure 7.23. Annual Commercial Landings of Grouper from 2000 to 2007, Average Annual Landings from 2000 to 2005, and Proposed Grouper ACL for St. Thomas/St. John.

Prior to the SFA, 85 percent of grouper landings in St. Thomas were believed to originate from the EEZ. Since the SFA, a number of regulations have affected St. Thomas/St. John commercial fishermen who harvest grouper, which include: year-round fishing prohibition in the Hind Bank Marine Conservation District off St. Thomas;

closure of an area of Grammanik Bank from February 1 through April 30; establishment of the seasonal closure to the possession of all species except misty grouper, in the Grouper Unit 4 fishery (red, black, tiger, yellowfin and yellowedge grouper) from February 1 through April 30; and ban on the use of bottom longlines, traps, pots, gillnet and trammel net is prohibited year-round in both federal and territorial waters of the Red Hind and Mutton Snapper Spawning Aggregation Areas.

For purposes here, it is assumed the reduction of a grouper fishing season in federal waters off St. Thomas/St. Croix would be 40 percent effective. Hence, the overage of 11,046 pounds in 2010 would be reduced to 6,628 pounds in 2012, and so on. **Alternative 2** would reduce the 2011 grouper fishing season in the St. Thomas/St. John EEZ by 2.3 months, assuming 56,813 pounds of grouper are landed over 12 months, and average monthly landings are 4,734 pounds. Assuming an average ex-vessel price of $7.00 per pound of grouper, loss of ex-vessel revenue in 2011 would be $30,929, and over the 10-year period there would be total loss of landings of 10,979 pounds with an ex-vessel value of $76,854.

Commercial fishermen of St. Thomas/St. John, who harvest grouper in federal waters and those who economically benefit from the catch, are encouraged to comment on the economic impacts of a shortened fishing season for grouper in federal waters off St. Thomas/St. John.

Table 7.20. Loss of Ex-Vessel Revenue to St. Thomas/St. John Grouper Commercial Fishermen due to a Shortened Grouper Fishing Season in the St. Thomas/St. John EEZ.

Year	Pounds								Revenue Loss	Present Value (2011 $)
	Landings	Overage	40 % Reduction	2-year Ave. Landings	2-year Ave. Overage	3-year Ave. Landings	3-year Ave. Overage	ACL		
2010	56,813	11,046	0					45,767	$0	$0
2011	52,395	6,628	4,418	54,604	8,837			45,767	$30,929	$30,929
2012	49,744	3,977	2,651			52,984	7,217	45,767	$18,557	$17,343
2013	48,153	2,386	1,591			50,097	4,330	45,767	$11,134	$9,725
2104	47,199	1,432	954			48,365	2,598	45,767	$6,681	$5,097
2015	46,626	859	573			47,326	1,559	45,767	$4,008	$2,671
2016	46,282	515	344			46,702	935	45,767	$2,405	$1,308
2017	46,076	309	206			46,328	561	45,767	$1,443	$641
2018	45,953	186	124			46,104	337	45,767	$866	$293
2019	45,878	111	74			45,969	202	45,767	$519	$134
2020	45,834	67	45			45,888	121	45,767	$312	$57
Total	474,139	16,469	10,979	54,604	8,837	429,763	17,860	457,670	$76,854	$68,199

7.5.6 Framework Measures

Action 6 would reduce risks and associated economic damages caused by absence of an established organizational framework for the Council and NMFS in order to effectively manage fishery and derive the long-term sustainable benefits from a managed fishery. It

would not directly affect U.S. Caribbean fishermen, their families or communities, and any economic impacts are dependent upon future regulatory actions.

7.6 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 include, but are not limited to Council costs of documentation preparation, meeting, public hearings, and information dissemination; NMFS administration costs of document preparation, meetings and review, and annual law enforcement costs.

7.7 Determination of Significant Regulatory Action

Pursuant to E.O. 12866, a regulation is considered a "significant regulatory action" if it is expected to result in: (1) an annual effect of $100 million or more or adversely affect 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) create a serious inconsistency or otherwise interfere with an action taken or planned by another agency; (3) materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights or obligations of recipients thereof; or (4) raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this executive order.

This proposed rule is not expected to have an adverse effect of $100 million or more, create a serious inconsistency or otherwise interfere with an action taken by another agency, or materially alter the budgetary impact of programs or rights or obligations of recipients. However, ACLs are a controversial issue in the U.S. Caribbean and this proposed rule would create the first ACLs in the region.

DRAFT

8.0 SOCIAL IMPACT ASSESSMENT REQUIREMENTS AND DATA ISSUES

8.1 Introduction

Mandates to conduct Social Impact Assessments come from both the National Environmental Policy Act (NEPA) and the MSA. NEPA requires federal agencies to consider the interactions of natural and human environments by using a "...systematic, interdisciplinary approach which will ensure the integrated use of the natural and social sciences...in planning and decision-making" [NEPA section 102 (2) (a)]. Under the Council on Environmental Quality's (CEQ 1986) Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act, a clarification of the terms "human environment" expanded the interpretation to include the relationship of people with their natural and physical environment (40 CFR 1508.14). Moreover, agencies need to address the aesthetic, historic, cultural, economic, social, or health effects which may be direct, indirect or cumulative (Interorganizational Committee on Guidelines and Principles for Social Impact Assessment 1994).

Recent amendments to the Magnuson-Stevens Act require FMPs to address the impacts of any management measures on the participants in the affected fishery and those participants in other fisheries that may be affected directly or indirectly through the inclusion of a fishery impact statement [MSA section 303 (a) (9)]. Most recently, with the addition of National Standard 8, FMPs must now consider the impacts upon fishing communities to the extent practicable to assure their sustained participation and minimize adverse economic impacts upon those communities [MSA section 301 (a) (8)]. Consideration of social impacts is a growing concern as fisheries experience increased participation and/or declines in stocks. With an increasing need for management action, the consequences of such changes need to be examined to minimize the negative impacts experienced by the populations concerned to the extent practicable.

8.2 Data Limitations and Methods

Social impacts are generally the consequences to human populations that follow from some type of public or private action. Those consequences may include alterations to "...the ways in which people live, work or play, relate to one another, organize to meet their needs and generally cope as members of a society..." (Interorganizational Committee on Guidelines and Principles for Social Impact Assessment 1994: 1). In addition, included under this interpretation are cultural impacts that may involve changes in values and beliefs, which affect the way people identify themselves within their occupation, communities, and society in general. Social impacts analyses help determine the consequences of policy action in advance by comparing the present with the projected impacts. Therefore, it is important that as much information as possible concerning a fishery and its participants be gathered for an assessment.

It is important to identify any foreseeable adverse effects on the human environment. With quantitative data often lacking, qualitative data can be used to provide a rough estimate of some of the impacts based on the best available science. In addition, when

there is a body of empirical findings available from the social science literature, it needs to be summarized and referenced in the analyses.

8.3 Summary of Social Impact Assessment

Descriptions of the affected communities and expected effects of the alternatives considered in this amendment are provided in sections 5 and 6, respectively.

DRAFT

9.0 REFERENCES

Agar, J.J. 2010. Personal Communication, March 9, 2010.

Agar, J.J., J. Waters, M. Valdés-Pizzini, M. Shivlani, T. Murray, J. Kirkley and D. Suman. 2008. U.S. Caribbean fish trap fishery socioeconomic study. Bull. Mar. Sci. 82: 315-331.

Allen, G.R. 1985. Butterfly and Angelfishes of the World, Volume 2. Mergus Publishers, Melle, Germany.

American Fisheries Society (AFS). 2001. AFS policy statement #31c. Long-lived reef fishes: The grouper-snapper complex. Obtained online at: http://www.fisheries.org/Public_Affairs/Policy_Statements/ps_31c.shtml

America's Second Harvest-The Nation's Food Bank Network. 2007. The almanac of hunger and poverty in Puerto Rico 2007. Obtained online at: http://feedingamerica.org/our-network/the-studies/~media/Files/research/almanac/WEBAlmanac_PR-ashx.

[The] Annie E. Casey Foundation and The Population Reference Bureau. 2002. A first look at children in the U.S. Virgin Islands. A Kids Count/PRB report on Census 2000. Obtained online at: http://www.eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/1a/97/e5.pdf.

Appeldoorn, R.S. 1994. Queen conch management and research: Status, needs and priorities. In: R.S. Appeldoorn and B. Rodríguez (Eds.), Queen Conch Biology, Fisheries and Mariculture. Fundación Científica Los Roques, Caracas, Venezuela, pp. 301-320.

Aranda, E.M. 2007. Emotional Bridges to Puerto Rico: Migration, Return Migration and the Struggles of Incorporation. Rowman & Littlefield Publishers, Inc., NY.

[The] Associated Press. 2007. Virgin Islands extends conch fishing ban due to overfishing concerns.July 27, 2007.

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

Ault, J.S., S.G. Smith, G.A. Meester, J. Luo, J.A. Bohnsack and S.L. Miller. 2002. Baseline multispecies coral reef stock assessment for the Dry Tortugas. NOAA Technical Memorandum NMFS-SEFSC-487. 117 pp.

Ayala, C.J. 1999. American Sugar Kingdom. University of North Carolina Press, Chapel Hill, NC.

DRAFT

Ayala, C.J. and R. Bernabe. 2007. Puerto Rico in the American Century: A History Since 1898. University of North Carolina Press, Chapel Hill, NC.

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.

Beanlands G.E. and P.N. Duinker. 1983. An ecological framework for environmental impact assessment in Canada. Institute for Resource and Environmental Studies, Dalhousie University, Halifax, Nova Scotia, and Federal Environmental Assessment Review Office, Hull, Quebec, 132 pp.

Bel, G. 2009. The first privatization policy in a democracy: Selling State-owned enterprises in 1948-1950 Puerto Rico. Research Institute of Applied Economics Working Papers 2009/15. Obtained online at: www.ub.edu/irea/working_papers/2009/200915.pdf.

Bennett, J. 2007. Procedures used in creation of price tables for the U.S. Virgin Islands commercial landings. NOAA-SEFSC.

Berg, C.J. and D.A. Olsen. 1989. Conservation and management of queen conch (*Strombus gigas*) fisheries in the Caribbean. In: J.F. Caddy (Ed.), Marine Invertebrate Fisheries: Their Assessment and Management. John Wiley and Sons, New York, pp. 421-422.

Boardman, C. and D. Weiler. 1979. Aspects of the life history of three deepwater snappers around Puerto Rico. Proc. Gulf Carib. Fish. Inst. 32: 158-172.

Böhlke, J.E. and C.C.G. Chaplin. 1993. Fishes of the Bahamas and Adjacent Tropical Waters, 2nd Edition. University of Texas Press, Austin, Texas.

Bohnsack, J.A. 1999. Incorporating no-take marine reserves into precautionary management and stock assessment. In: V.R. Restrepo (Ed.), Providing Scientific Advice to Implement Precautionary Approach Under the Magnuson-Stevens Fishery Conservation and Management Act. NOAA Tech. Memorandum NMFS-F/SPO-40: 8-16.

Boris, E. 1996. Needlewomen under the New Deal in Puerto Rico, 1920-1945. In: A. Ortiz (Ed.), Puerto Rican Women and Work: Bridges in Transnational Labor. Temple University Press, Pennsylvania, PA, pp. 33-54.

Bram, J., F.E. Martínez and C. Steindel. 2008. Trends and developments in the economy of Puerto Rico. Current Issues in Economics and Finance, Vol. 14, No. 2. Obtained online at: http://www.newyorkfed.org/research/current_issues/ci14-2.pdf

Brock, R.E. 1979. An experimental study on the effects of grazing by parrotfishes and role of refuges in benthic community structure. Mar. Biol. 51: 381-388.

DRAFT

Bryant, D., L. Burke, J. McManus and M. Spalding. 1998. Reefs at risk: A map-based indicator of threats to the world's coral reefs. World Resources Institute, Washington, D.C. 59 pp.
Bullock, L. and G. Smith. 1991. Memoirs of the Hourglass cruises VIII(2). Florida Department of Natural Resources, Florida Marine Research Institute, St. Petersburg, Florida. 223 pp.

Bullock, L.H., M.D. Murphy, M.F. Godcharles and M.E. Mitchell. 1992. Age, growth, and reproduction of the jewfish *Epinephelus itajara* in the eastern Gulf of Mexico. Fish. Bull. 90: 243-249.

Bullock, L.H., M.F. Godcharles and R.E. Crabtree. 1996. Reproduction of yellowedge grouper, *Epinephelus flavolimbatus*, in the eastern Gulf of Mexico. Bull. Mar. Sci. 55: 30-45.

Bush, D.M., R.M.T. Webb, J.G. Liboy, L. Hyman and W.J. Neal. 1995. Living with the Puerto Rico Shore. Duke University Press, Durham, NC.

Caribbean Fishery Management Council (CFMC). 1985. Fishery management plan, final environmental impact statement, and draft regulatory impact review for the shallow-water reef fish fishery of Puerto Rico and the U.S. Virgin Islands. Caribbean Fishery Management Council, San Juan, Puerto Rico. 69 pp. + Appendices.

Caribbean Fisheryes Management Council (CFMC). 1990. Amendment number 1 to the fishery management plan for the shallow-water reef fish fishery, preliminary environmental assessment and regulatory impact review. Caribbean Fishery Management Council, San Juan, Puerto Rico. 51 pp. + Appendices.

Caribbean Fishery Management Council (CFMC). 1991. Regulatory amendment to the shallow water reef fish fishery management plan. Caribbean Fishery Management Council, San Juan, Puerto Rico. 24 pp. + Appendix.

Caribbean Fishery Management Council (CFMC). 1993. Amendment 2 to the fishery management plan for the shallow-water reef fish fishery of Puerto Rico and the U.S. Virgin Islands. Caribbean Fishery Management Council, San Juan, Puerto Rico. 29 pp. + Appendices.

Caribbean Fishery Management Council (CFMC). 1996. Regulatory amendment to the fishery management plan for the reef fish fishery of Puerto Rico and the United States Virgin Islands concerning red hind spawning aggregation closures including a regulatory impact review and an environmental assessment. Caribbean Fishery Management Council, San Juan, Puerto Rico. 27 pp. + Appendices.

Caribbean Fishery Management Council (CFMC). 1998. Essential fish habitat (EFH) generic amendment to the fishery management plans (FMPs) of the U.S. Caribbean

DRAFT

including a draft environmental assessment. Caribbean Fishery Management Council, San Juan, Puerto Rico. 169 pp + Appendices.

Caribbean Fishery Management Council (CFMC). 1999. Amendment number 1 to the fishery management plan for corals and reef associated plants and invertebrates of Puerto Rico and the United States Virgin Islands for establishing a marine conservation district, including regulatory impact review and initial regulatory flexibility analysis and a final supplemental environmental impact statement. Caribbean Fishery Management Council, San Juan, Puerto Rico. 47 pp. + Appendices.

Caribbean Fishery Management Council (CFMC). 2001. Draft amendment 2 to the fishery management plan, queen conch resources of Puerto Rico and the United States Virgin Islands including a regulatory impact review and initial regulatory flexibility analysis and draft supplemental environmental impact statement. Caribbean Fishery Management Council, San Juan, Puerto Rico. 35 pp. + Appendices.

Caribbean Fishery Management Council (CFMC). 2004. Final environmental impact statement for the generic essential fish habitat amendment to: Spiny lobster fishery management plan (FMP), queen conch FMP, reef fish FMP, and coral FMP for the U.S. Caribbean, Vol. I and II. Caribbean Fishery Management Council, San Juan, Puerto Rico.

Caribbean Fishery Management Council (CFMC). 2005. Comprehensive amendment to the fishery management plans (FMPs) of the U.S. Caribbean to address required provisions of the Magnuson-Stevens Fishery Conservation and Management Act: Amendment 2 to the FMP for the spiny lobster fishery of Puerto Rico and the U.S. Virgin Islands; Amendment 1 to the FMP for queen conch resources of Puerto Rico and the U.S. Virgin Islands; Amendment 3 to the FMP for the reef fish fishery of Puerto Rico and the U.S. Virgin Islands; Amendment 2 to the FMP for the corals and reef associated invertebrates of Puerto Rico and the U.S. Virgin Islands. Caribbean Fishery Management Council, San Juan, Puerto Rico. 533 pp. + Appendices. Obtained online at: http://www.caribbeanfmc.com/SCANNED%20FMPS/06%20FINAL%20SFA%20-%20MAY%2003,2005/SFA-FMP.htm

Caribbean Fishery Management Council (CFMC). 2008. Final Amendment 4 to the fishery management plan for the spiny lobster fishery of Puerto Rico and the U.S. Virgin Islands and Amendment 8 to the fishery management plan for the spiny lobster fishery of the Gulf of Mexico and South Atlantic. Caribbean Fishery Management Council, San Juan, Puerto Rico. 155 pp. + Appendices

Caribbean Fishery Management Council CARICOM Fisheries Resource Assessment and Management Program (CFMC CFRAMP). 1999. Report on the queen conch stock assessment and management workshop, Belize City, Belize.

Caribbean Update. September 1, 2007. Obtained online at: www.caribbeanupdate.org.

DRAFT

Carpenter, R.C. 1990. Mass mortality of *Diadema antillarum*. II. Effects on population densities and grazing intensity of parrotfishes and surgeonfishes. Mar. Biol. 104: 79-86.

Center for Integrative Environmental Research. 2007. The U.S. economic impacts of climate change and the costs of inaction.

Cervigón, F., R. Cipriani, W. Fischer, L. Garibaldi, M. Hendrickx, A.J. Lemus, R. Márquez, J.M. Poutiers, G. Robaina and B. Rodriguez. 1992. Fichas FAO de identificación de especie para los fines de la pesca. Guia de campo de las especies comerciales marina y de aquas salobres de la costa septentrional de Sur América. Rome, Italy: FAO. Preparado con el financieamento de la Comisión de Comunida Europeas y de NORAD.

Chakalall, B., R. Mahon and P. McConney. 1998. Current issues in fisheries governance in the Caribbean Community (CARICOM). Mar. Policy 22: 29-44.

CIA. 2009. CIA-The world factbook. Obtained online at: www.cia.gov/library/publications/the-world-factbook/geos/rq,html.

Clay, P.M, S. Steinbeck and K. Wallmo. 2007. Assessing subsistence on a recreational scale: Results from a Marine Recreational Fisheries Statistics Add-on Survey for the Northeast U.S. NEED COMPLETE REFERENCE

Coleman, F.C., C.C. Koenig, A.M. Ecklund and C.B. Grimes. 1999. Management and conservation of temperate reef fishes in the grouper-snapper complex of the southeastern United States. In: J.A. Musick (Ed.), Life in the Slow Lane: Ecology and Conservation of Long-Lived Marine Animals. American Fisheries Society Symposium 23. Pp. 233-242.

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. Marine stocks at risk: Long-lived reef fishes: The grouper-snapper complex. Fisheries 25: 14-20.

Colin, P.I. 1978. Caribbean Reef Invertebrates and Plants. T.F.H. Publications, Inc., Ltd., Hong Kong. 512 pp.

Collazo, J. and Calderón, J.A. 1987/88. Status of fisheries in Puerto Rico 1979-1982. Corporation for the Development & Administration of the Marine, Lacustrine & Fluvial Resources of Puerto Rico, Fishery Research Laboratory, San Juan. Obtained online at: www.sefsc.noaa.gov/sedar/download/S14RD45%20PR%20stats%201979-82.pdf?id=DOCUMENT

Colón-Warren, A.E. and I. Alegría-Ortega. 1998. Shattering the illusion of development: The changing status of women and challenges for the feminist movement in Puerto Rico. Feminist Review 59: 101-117.

DRAFT

Connell, J.H. 1978. Diversity in tropical rain forests and coral reefs. Science 199: 1302-1310.

Corredor, J.E., J.M. Morell, J.M. Lopez, J.E. Capella and R.A. Armstrong. 2004. Cyclonic eddy entrains Orinoco River plume in eastern Caribbean. EOS 85: 197-208.

Council of Environmental Quality (CEQ). 1986. Regulations for implementing the procedural provisions of the National Environmental Policy Act. Executive Office of the President, 40 CFR Parts 1500-1508, July 1 reprint.

Council of Environmental Quality (CEQ). 1997. Considering cumulative effects under the National Environmental Policy Act. Executive Office of the President, Washington, D.C.

Cummings, N.J. and D. Matos-Caraballo. 2003. Summary information on commercial fishing operations in Puerto Rico from 1969 – 2001 and reporting rates needed to adjust commercial landings. Sustainable Fisheries Division Contribution No. SFD 2003-0022 and Caribbean Deepwater SEDAR Data Workshop Report 4 SEDAR Doc-4. Obtained online at: www.sefsc.noaa.gov/sedar/download/SEDAR4-DW-04.pdf?id=DOCUMENT

Dammann, A.E. 1969. Study of the fisheries potential of the Virgin Islands. Spec. Report, Contribution No. 1, Virgin Islands Ecological Research Station.

Dammann, A., J. Yntema, W. Brownell, R. Brody and A. Spanidorf. 1970. Exploratory fishing for a source of non-ciguatoxic sport and food fish. Carib. Res. Inst. Special Publications No. 2. 49 pp.

Dennis, G.D., Y. Sadovy and D. Matos-Caraballo. 1996. Seasonal and annual trends in commercial fisheries landings from Puerto Rico. Proc. Gulf Carib. Fish. Inst. 44: 690-705.

Dietz, J.L. 1986. Economic History of Puerto Rico: Institutional Change and Capitalist Development. Princeton University Press, Princeton, NJ.

Dietz, J.L. 2003. Puerto Rico: Negotiating Development and Change. Lynne Rienner Publishers, Inc., Boulder, CO.

Ditton, R.B. and D.J. Clark. 1994. Characteristics, attitudes, catch and release behavior, and expenditures of billfish tournament anglers in Puerto Rico. TAMU-WFSC-HD-94-01, Department of Wildlife and Fisheries Science, Texas A&M University, College Station, Texas.

Eastern Caribbean Center. 2002. Telephone survey of boat-based marine recreational fishing in the U.S. Virgin Islands, 2000. Report submitted to the Department of Planning and Natural Resources, Division of Fish and Wildlife, U.S. Virgin Islands.

Erdman, D.S. 1976. Spawning patterns of fishes from the northeastern Caribbean. Contrib. Agric. Pesq., Dep. Agric. Commonwealth of Puerto Rico 8: 1-37.

DRAFT

Feigenbaum, D.A. Friedlander and M. Bushing. 1989. Determination of the feasibility of fish attracting devices for enhancing fisheries in Puerto Rico. Bull. Mar. Sci. 44: 950-959.

Fernández, N.A., J.C. Burgos, C.F. Asenjo and I. Rosa. 1971. Nutritional status of the Puerto Rican population: master sample survey. The American Journal of Clinical Nutrition 24: 952-959.

Ferreira, B.P. and M.B. Peres. 2008. *Epinephelus flavolimbatus*. In: IUCN 2009. IUCN red list of threatened species. Version 2009.2. Obtained online at: <www.iucnredlist.org>.

Figuerola Fernández, M. and W. Torres Ruiz. 1997. Madurez y estacionalidad reproductiva de cuatro especies de peces de Arrecife de importancia comercial en Puerto Rico. Informe Final Laboratorio de Investigaciones Pesqueras, Puerto Rico Departamento de Recursos Naturales y Ambientales.

Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute (FWC FWRI). 2006. Queen conch: Florida's spectacular sea snail. Sea Stats May 2006. 4 pp.

Froese, R. and D. Pauly. 2002. FishBase. Obtained online at: http://www.fishbase.org.

Garcia-Moliner, G., I. Mateo, S. Maidment-Caseau, W. J. Tobias and B. Kojis. 2000. Recreational chartered fishing activity in the U.S. Caribbean. Proc. Gulf. Carib. Fish. Inst. 53: 307-317.

García-Moliner, G., W.R. Keithly, Jr. and I.N. Oliveras. 2001. Recreational SCUBA diving activity in the U.S. Caribbean. Proc. Gulf. Carib. Fish. Inst. 52: 363-371.

García Colón, I. 2002. Hegemony, land reform, and social space in Puerto Rico: Parcelas, a land distribution program for landless workers, 1940s-1960s. Ph.D. Dissertation, University of Connecticut.

García-Quijano, C.G. 2009. Managing complexity: Ecological knowledge and success in Puerto Rican small-scale fisheries. Human Organization 68: 1-17.

García-Sais, J.R., R.L. Castro-Gomez, J. Sabater-Clavell, R. Esteves, S. Williams and M. Carlo. 2010. Mesophotic benthic habitats and associated marine communities at Abrir La Sierra, Puerto Rico. Draft Final Report NOAA Grant FNA07NMF4410117. 115 pp.

Glazer, R.A. and C.J. Berg, Jr. 1992. Growth and mortality of the queen conch, *Strombus gigas*, in Florida. Proc. Gulf. Carib. Fish Inst. 42: 153-157.

Goenaga, C., and R. H. Boulon. 1991. The state of Puerto Rican and U.S. Virgin Island corals: an aid to managers. Special Report of the Caribbean Fishery Management Council. 64 pp.

DRAFT

Gordon, S. 2002. United States Virgin Islands queen conch stock assessment. Final report to Southeast Area Monitoring and Assessment Program-Caribbean. Obtained online at: http://bcrc.bio.umass.edu/vifishandwildlife/Fisheries/FisheriesReports/2002/SEAMAP_Conch2002.pdf

Griffith, D. and M. Valdés Pizzini. 2002. Fishers at Work, Workers at Sea. A Puerto Rican Journey through Labor and Refuge. Temple University Press, Philadelphia, PA.

Griffith, D., M. Valdés Pizzini and J.C. Johnson. 1992. Injury and therapy: Proletarianization in Puerto Rico's fisheries. American Ethnologist 19: 53-74.

Griffith, D., M. Valdés Pizzini and C. García Quijano. 2007. Entangled communities: Socioeconomic profiles of fishers, their communities, and their responses to marine protective measures in Puerto Rico (Volume 1: Overview). In: J.J. Agar and B. Stoffle (Eds.), NOAA series on U.S. Caribbean fishing communities. NOAA Technical Memorandum NMFS-SEFSC-556, 524 pp.

Gutierrez Sanchez, J., M. Valdés Pizzini and B. McCay. 1986. La pesca artesanaly las asociaciones de pescadores en Puerto Rico. University of Puerto Rico Sea Grant College Report, Mayaguez, Puerto Rico.

Halstead, B.W. 1970. Results of a field survey on fish poisoning in the Virgin and Leeward islands during 7-18th January 1970. UNDP/FAO Caribbean Fisheries Development Project, Barbados.

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 Fisheries Synopsis No. 125, Vol. 16. Rome, FAO. 382 pp., 522 figures, 31 color plates.

[The] Heinz Center. 2000. Improving federal fisheries management in the Caribbean region: A summary of views presented during the Caribbean Regional Roundtable. The H. John Heinz III Center for Science, Economics, and the Environment. Obtained online at: http://www.heinzctr.org/publications/PDF/Caribbean.PDF.

Helmer, E.H. 2003. Forest conservation and land development in Puerto Rico. Landscape Ecology 19: 29-40.

Herman, D. 2009. The three roots of Manifest Destiny. National Museum of the American Indian 10(4): 22-25.

Hilborn, R. and R.M. Peterman. 1996. The development of scientific advice with incomplete information in the context of the precautionary approach. In: Precautionary approach to fisheries. Part 2: Scientific papers. FAO Fish. Tech. Pap. (350/2): 77–101.

DRAFT

Hinkey, M.L., N. Quinn and R. Strickland. 1994. A survey of marine recreational services in the U.S. Virgin Islands. Final Report submitted to the Eastern Caribbean Center, University of Virgin Islands, PRU-T-92-001. 47 pp.

Hollander, G.M. 2008. Raising Cane in the 'Glades: The Global Sugar Trade and the Transformation of Florida. University of Chicago Press, Chicago, IL.

Holt, M. and K.R. Uwate. 2004. Estimates of the number of licensed commercial fishers per year in the U.S. Virgin Islands,1974/75 to 2003/2004. Bureau of Fisheries, Division of Fish and Wildlife, Department of Planning and Natural Resources, U.S. Virgin Islands. Obtained online at: http://bcrc.bio.umass.edu/vifishandwildlife/Fisheries/FisheriesReports/2004/CommFisherLicenseQty1974to2003.pdf

Hubbard, D.K., J.L. Sadd and H.H. Roberts. 1981. The role of physical processes in controlling sediment transport patterns on the insular shelf of St. Croix, U.S. Virgin Islands. In: E.D. Gomez et al. (Eds.), The Reef and Man: Proceedings of the Fourth International Coral Reef Symposium, Volume 1, Manila, Phillippines, May 18-22, 1981, pp. 399-404.

Hughes, T.P. 1994. Catastrophes, phase-shifts, and large-scale degradation of a Caribbean coral reef. Science 265: 1547-1551.

Humann, P. 1994. Reef fish identification, 2nd Edition. New World Publications, Inc., Jacksonville, FL, 396 pp + index.

Huntsman, G.R., J. Potts, R.W. Mays and D. Vaughn. 1999. Groupers (Serranidae, Epinephelinae): endangered apex predators of reef communities. In: J.A. Musick (Ed.), Life in the Slow Lane: Ecology and Conservation of Long-Lived Marine Animals. American Fisheries Society Symposium 23, Bethesda, MD, pp. 217-231.

Impact Assessment, Inc. 2007. Community profiles and socioeconomic evaluations of marine conservation districts: St. Thomas and St. John, U.S. Virgin Islands. NOAA Series on U.S. Caribbean Fishing Communities. NOAA Technical Memorandum NMFS-SEFSC-557, 123 pp. Agar, J. J. and B. Stoffle (Eds.).

International Committee on Guidelines and Principles for Social Impact Assessment. 1994. Guidelines and Principles for Social Impact Assessment. U.S. Department of Commerce, NOAA, NMFS. Obtained online at: http://www.nmfs.noaa.gov/sfa/social_impact_guide.htm

Island Resources Foundation. 1977. Marine environments of the Virgin Islands. Technical Supplement No. 1. Prepared for Virgin Islands Planning Office, Coastal Zone Management Program, St. Thomas, U.S. Virgin Islands.

DRAFT

Island Resources Foundation. 2002. Resource description report. Prepared for Virgin Islands Department of Planning and Natural Resources Division of Coastal Zone Management. Obtained online at: http://www.irf.org/mission/planning/Resource_Desc.doc

Jennings, C.A. 1992. Survey of non-charter boat recreational fishing in the U.S. Virgin Islands. Bull.Mar. Sci. 50: 342-351.

Johnson, D.H. 2008. Power and politics in the management of U.S. fisheries: Fisheries bio-economics and fisheries science as social technologies and technologies of power. Masters Thesis, University of Manchester.

Johnson, J.C. and D. C. Griffith. 1995. Promoting sportfishing development in Puerto Rico: Travel agents' perceptions of the Caribbean. Human Organization 54(3): 295-303.

Johnston, B.R. 1987. The political ecology of development: Changing resource relations and the impacts of tourism in St. Thomas, United States Virgin Islands. Ph.D. Dissertation, University of Massachusetts.

Jompa, J. and L.J. McCook. 2002. The effects of nutrients and hervibory on competition between a hard coral (*Porites cylindrica*) and a brown alga (*Lobophora variegata*). Limnol. Oceanogr. 47: 527-534.

Jory, D.E. and E.S. Iversen. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (south Florida)-black, red, and Nassau groupers. U.S. Fish Wildl. Serv. Biol. Rep. 82 (11.110). U.S. Army Corps of Engineers, TR EL-82-4. 21 pp.

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. 65 pp.

Kendall, M.S., M.E. Monaco, K.R. Buja, J.D. Christensen, C.R. Kruer, M. Finkbeiner and R.A. Warner. 2001. Methods used to map the benthic habitats of Puerto Rico and the U.S. Virgin Islands. Obtained online at: http://biogeo.nos.noaa.gov/projects/mapping/caribbean/startup.htm.

Kimmel, J.J. and R.S. Appeldoorn. 1992. A critical review of fisheries and fisheries management policy in Puerto Rico. Proc. Gulf Carib. Fish. Inst. 41: 349-360.

Kirkley, J.E., J.J. Agar, G. García-Moliner and J. Terry. 2008. U.S. Caribbean region assessment in national assessment of excess harvesting capacity in federally managed commercial fisheries. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-F/SPO-93, pp. 191-242.

Kjerfve, B. 1981. Tides of the Caribbean Sea. J. Geophys. Res. 86: 4243-4247.

DRAFT

Kojis, B. 2004. Census of the marine commercial fishers of the U.S. Virgin Islands. U.S. Virgin Islands, Department of Planning and Natural Resources (DPNR), St. Thomas.

Lapp, M. 1995. The rise and fall of Puerto Rico as a social laboratory, 1945-1965. Social Science History 19(2): 169-199.

Levy, T.A. 2007. The history of tobacco cultivation in Puerto Rico, 1899-1940. Ph.D. Dissertation, City University of New York.

Lohr, L. 2007. Conch season closed until 2008 because of overfishing. St. Thomas Source, July 30, 2007. Obtained online at: http://stthomassource.com/content/news/local-news/2007/07/30/conch-season-closed-until-2008-because-overfishing

Lohr, L. 2009. Council seeks input on catch limits. St. Thomas Source, April 22, 2009.

Macari, E.S. and L.R. Hoyos. 2005. Earthquake-induced liquefaction potential in western Puerto Rico using GIS technology. Geological Society of America Special Paper 2005, 385: 277-287.

Manickchand-Heileman, S.C. and D.A.T. Phillip. 2000. Age and growth of the yellowedge grouper, *Epinephelus flavolimbatus*, and the yellowmouth grouper, *Mycteroperca interstitialis*, off Trinidad and Tobago. Fish. Bull. 98: 290-298.

Mateo, I. 1999. Annual report recreational fishery assessment project F-8-9 Job 7: Angler telephone household survey. Division of Fish and Wildlife, DPNR, Government of the U.S. Virgin Islands. 6 pp.

Mateo, I., R.S. Appeldoorn and W. Rolke. 1998. Spatial variation in stock abundance of queen conch, *Strombus gigas*, (Gastropoda: Strombidae) in the west and east coast of Puerto Rico. Proc. Gulf Carib. Fish. Inst. 50: 32-47.

Mateo, I., R. Gomez and K.R. Uwate. 2000. Activity and harvest patterns in the U.S. Virgin Islands recreational fisheries. Recreational Fisheries Assessment Project. F-8. USVI Division of Fish and Wildlife. St. Thomas.

Matos-Caraballo, D. 1996. Puerto Rico fishery census, 1995-1996. Department of Natural and Environmental Resources, Final Report to the National Marine Fisheries Service, NOAA. 21 pp.

Matos-Carraballo, D. 1997. Status of the groupers in Puerto Rico, 1970-95. Proc. Gulf Carib. Fish. Inst. 47: 340-353.

Matos-Carraballo, D. 2000. Portrait of the commercial fishery of the red hind *Epinephelus guttatus* in Puerto Rico during 1992-1999. Proc. Gulf Carib. Fish. Inst. 53: 446-459.

DRAFT

Matos-Caraballo, D. 2001. Overview of Puerto Rico's small-scale fisheries statistics, 1998-2001. Proc. Gulf Carib. Fish. Inst. 52: 197-203.

Matos-Caraballo, D. 2004. Job 3. Comprehensive census of the marine fishery of Puerto Rico, 2002. Department of Natural and Environmental Resources, Final Report to the National Marine Fisheries Service, NOAA.

Matos-Carraballo. D. 2005. Final report: Bycatch study of Puerto Rico's marine commercial fisheries. SEDAR 14-RD05. Obtained online at: www.sefsc.noaa.gov/sedar/download/S14RD05%20PR%20Comm%20bycatch.pdf?id=DOCUMENT

Matos-Caraballo, D. 2007. Puerto Rico/NMFS Cooperative Fisheries Statistics Program April 2004-March 2007. NA04NMF4340063.

Matos-Caraballo, D. 2009. Comprehensive census of the marine fishery of Puerto Rico, 2008. Department of Natural and Environmental Resources Final Report to National Marine Fisheries Service, NOAA. 27 pp.

Matos-Carraballo, D. and J.M. Posada. 1998. Current status of the tiger grouper (*Mycteroperca tigris*) fishery at Vieques Island, Puerto Rico. Proc. Gulf Carib. Fish. Inst. 54: 669-679.

Matos-Carraballo, D., M. Cartagena-Haddock and N. Peńa-Alvarado. 2002. Comprehensive census of the marine commercial fishery of Puerto Rico 2002. Obtained online at: http://www.drna.gobierno.pr/oficinas/arn/recursosvivientes/negociado-de-pesca-y-vida-silvestre/laboratorio-de-investigaciones-pesqueras-1/publicaciones/Comprehensive%20census%20marine%20comm%20fish%20PR%202002-001.pdf

Matter, V.M. 2007. Recreational survey data for yellowfin grouper and mutton snapper in Puerto Rico and the U.S. Virgin Islands. Sustainable Fisheries Division Contribution No. SFD-2007-004. Obtained online at: http://www.sefsc.noaa.gov/sedar/download/Sedar14DW03_Rec%20Data.pdf?id=DOCUMENT.

McCaffrey, K.T. 1999. Culture, power and struggle: Anti-military protest in Vieques, Puerto Rico. Ph.D. Dissertation, City University of New York.

McFadden, D. 2008. Venomous lionfish prowls fragile Caribbean waters. The Clarksdale Press Register, April 14, 2008.

Messineo, J. 2004. Compilation and summary of commercial catch report forms in the U.S. Virgin Islands, 1974/1975 to 2004/2005. Bureau of Fisheries, Division of Fish and Wildlife, Department of Planning and Natural Resources, U.S.Virgin Islands.

DRAFT

Miller, M.W., M.E. Hay, S.L. Miller, D. Malone, E.E. Sotka and A.M. Szmant. 1999. Effects of nutrient versus herbivores on reef algae: A new method for manipulating nutrients on coral reefs. Limnol. Oceanogr. 44: 1847-1861.

Morelock, J.N., J. Capella, J.R. Garcia and M. Barreto. 2001. Puerto Rico-seas at the millenium. Carribbean Journal of Science. Obtained online at: http://rmocfis.uprm.edu/~morelock/pdfdoc/morlok2.pdf

Mowbray, L.S. 1950. The commercial game industries of Bermuda. Proc. Gulf Carib. Fish. Inst., 2nd Ann. Sess., Nov. 1949. Univ. Miami Mar. Lab.: 27-30.

MRAG Americas. 2006. A pilot program to assess methods of collecting bycatch, discard, and biological data in the commercial fisheries of the US Caribbean. Final Report, Southeast Regional Office, National Marine Fisheries Service, Cooperative Research Program, Grant No. NA04NMF4540214. 47 pp. + Appendix.

Muller-Karger, F.E., C.R. McClain, T.R. Fisher, W.E. Esaias and R. Varela. 1989. Pigment distribution in the Caribbean Sea: Observations from space. Prog. Oceanogr. 23: 23-64.

Mumby, P.J. 2006. The impact of exploiting grazers (Scaridae) on the dynamics of Caribbean coral reefs. Ecol. Appl. 16: 747-769.

Mumby, P.J., C.P. Dahlgren, A.R. Harborne, C.V. Kappel, F. Micheli, D.R. Brumbaugh, K.E. Holmes, J.M. Mendes, K. Broad, J.N. Sanchirico, K. Buch, S. Box, R.W. Stoffle and A.B. Gill. 2006. Fishing, trophic cascades, and the process of grazing on coral reefs. Science 311: 98-101.

Mumby, P.J., A. Hastings and H.J. Edwards. 2007. Thresholds and the resilience of Caribbean reef corals. Nature 450: 98-101.

National Marine Fisheries Service (NMFS). 2001a. Goliath grouper (*Epinephelus itajara*). Office of Protected Resources. Obtained online at: http://www.nmfs.noaa.gov/prot_res/species/concern/profiles/goliath_grouper.pdf

National Marine Fisheries Service (NMFS). 2001b. Nassau grouper (*Epinephelus striatus*). Office of Protected Resources. Obtained online at: http://www.nmfs.noaa.gov/prot_res/species/concern/profiles/nassau_grouper.pdf

National Marine Fisheries Service (NMFS). 2002. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments-2002. NOAA Technical Memorandum NMFS-NE-169. 319 pp.

National Marine Fisheries Service (NMFS). 2006. Draft recovery plan for the fin whale (*Balaenoptera physalus*). National Marine Fisheries Service, Silver Spring, MD.

DRAFT

National Marine Fisheries Service (NMFS). 2008. 2007 status of U.S. Fisheries. Obtained online at: http://www.nmfs.noaa.gov/sfa/domes_fish/StatusoFisheries/2007/2007StatusofUSFisheries_Report_to_Congress.pdf

National Marine Fisheries Service (NMFS), Highly Migratory Species (HMS). 2009. Final scoping summary for Amendment 4 to the consolidated Atlantic highly migratory species fishery management plan. Obtained online at: www.nmfs.noaa.gov/sfa/hms/Amendment_4_Caribbean/01-15-09_A4_Scoping_Summary_Final.pdf

National Ocean Service (NOS). February 2009. Coral reef habitat assessment for U.S. marine protected areas: U.S. Virgin Islands. Obtained online at: http://coris.noaa.gov/activities/habitat_assessment/pdfs/usvi.pdf

Nelson, J.S. 1984. Fishes of the World, 2nd Edition. John Wiley and Sons, Inc. New York. 523 pp.

Nelson, J.S. 1994. Fishes of the World, 3rd Edition. John Wiley and Sons, Inc. New York. 600 pp.

NOAA Satellite & Information Service. 1999. Georges pummels Caribbean, Florida Keys and U.S. Gulf Coast. Storm review (April 12, 1999 update). Obtained online at: http://lwf.ncdc.noaa.gov/oa/reports/georges/georges.html

Office of Technology Assessment (OTA). 1987. Integrated renewable resource management for U.S. insular areas: Summary. Washington, D.C. Congress of the United States, Office of Technology Assessment.

Ojeda-Serrano, E. R. Appeldoorn and I. Ruiz-Valentin. 2007. Reef fish spawning aggregations of the Puerto Rico shelf. Caribbean Coral Reef Institute. Obtained online at: http://ccri.uprm.edu/researcher/Ojeda/Ojeda_Final_Report_CCRI_SPAG's.pdf

Olcott, P. G. 1999. Puerto Rico and the U.S. Virgin Islands. In: Ground Water Atlas of the United States, Alaska, Hawaii, Puerto Rico and the U. S. Virgin Islands. USGS Rep. HA 730-N. Obtained online at: http://www.fiu.edu/orgs/caribgeol/

Olsen, D.A., D.W. Nellis and R.S. Wood. 1984. Ciguatera in the eastern Caribbean. Mar. Fish. Rev. 46: 13-18.

Osborn, M.F. and A.B. Lowther. 2001. Re-initiation of the Marine Recreational Fishery Statistics Survey in the U.S. Caribbean in 2000. Proc. Gulf Carib. Fish. Inst. 53: 286-317.

Paine, R. T. 1969. The Pisaster–Tegula interaction: prey patches, predator food preference, and intertidal community structure. Ecology 50: 950–961.

DRAFT

Pérez, R. 2000. Fragments of memory: The State and small-scale fisheries modernization in southern Puerto Rico. Ph.D. Dissertation, University of Connecticut.

Pérez, R. 2005. The State and small-scale fisheries in Puerto Rico. University of Florida Press, Gainesville, FL.

Picó, R. 1974. The Geography of Puerto Rico. Aldine Publishing Company, Chicago, IL.

Picó, F. 2006. History of Puerto Rico: A Panorama of Its People. Markus Wiener Publishers, Princeton, N.J.

Puerto Rico Coastal Zone Management Program. 2007. Southern and Caribbean regional meeting, Lafayette, LA, November 5-8, 2007. Obtained online at: http://coastalmanagement.noaa.gov/news/archivedmtgdocs/2007SCRMarchives/PR_state_updatef.pdf

Puerto Rico Department of Natural and Environmental Resources (PRDNER). 2004. Job 3, Comprehensive census of the marine fishery of Puerto Rico, 2002. Final Report to National Marine Fisheries Service. Obtained online at: http://www.sefsc.noaa.gov/sedar/download/S14RD29%20PR%20Census.pdf?id=DOCUMENT

Puerto Rico Department of Natural and Environmental Resources (PRDNER). 2008a. Eventos de varamientos y mortandad desde 1999 hasta 2007, prepared by Milagros Justiniano, Mayagüez, Puerto Rico, 29 pp.

Puerto Rico Department of Natural and Environmental Resources (PRDNER). 2008b. Puerto Rico Marine Recreational Fisheries Statistics Program. Grant F-42.6 annual report for the period of January 1, 2006 to December 31, 2006.

Puerto Rico Industrial Development Company (PRIDCO). 2009. Biotechnology industry overview. Obtained online at: http://www.pridco.com/english/industry_groups/biotechnology/5.30ind_grps_bio_over.html

Quint, H.H. 1958. American socialists and the Spanish-American War. American Quarterly 10(2): 131-141.

Rakitin, A. & D.L. Kramer. 1996. The effect of a marine reserve on the distribution of coral reef fishes in Barbados. Mar. Ecol. Prog. Ser. 131: 97-113.

Ralston, S. 1987. Mortality rates of snappers and groupers. In: J.J. Polovina and S. Ralston (eds.), Tropical Snappers and Groupers: Biology and Fishery Management. Westview Press, Boulder, Colorado. PAGE NUMBERS?????

DRAFT

Randall, J.E. 1963. Additional recoveries of tagged reef fishes from the Virgin Islands. Proc. Gulf Carib. Fish. Inst. 15: 155-157.

Randall, J.E. 1964. Contributions to the biology of the queen conch *Strombus gigas*. Bull. Mar. Sci. Gulf. Carib. 14: 246-295.

Randall, J.E. 1967. Food habits of reef fishes of the West Indies. Stud. Trop. Oceanogr. 5: 1-847.

Randall, J.E. 1990. Scaridae. In: J.C. Quero, J.C. Hureau, C. Karrer, A. Post and L. Saldanha (Eds.), Check-list of the Fishes of the Eastern Tropical Atlantic (CLOFETA), Volume 2. JNICT, Lisbon, SEI, Paris, and UNESCO, Paris. Pp. 883-887.

Reeson, P.H. 1975. The Biology, Ecology and Bionomics of the Parrotfishes, Scaridae. In: J.L. Munro (Ed.), Caribbean Coral Reef Fishery Resources, Chapter 13, ICLARM Studies and Reviews 7. International Center for Living Aquatic Resources Management, Manila, Philippines.

Renken, R.A., W.C. Ward, I.P. Gill, F. Gómez-Gómez, J. Rodríguez-Martínez, and others. 2004. Geology and hydrogeology of the Caribbean islands aquifer system of the Commonwealth of Puerto Rico and the U.S. Virgin Islands. U.S. Geological Survey. Obtained online at: http://pubs.usgs.gov/pp/pp1414/pdf/PLATE2.pdf

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, 54 pp.

Rhines, C. 2000. *Strombus gigas*: queen conch. University of Michigan, Museum of Zoology. Obtained online at: http://animaldiversity.ummz.umich.edu/site/accounts/information/strombus_gigas.html

Rielinger, D.M. 1999. Spawning aggregations in the Gulf of Mexico, South Atlantic and Caribbean: A source document for fisheries management. NEED COMPLETE REF

Rivas, L.R. 1970. Snappers of the western Atlantic. Comm. Fish. Rev. 32: 41-44.

Rivera, J.A. 1999. Queen conch CPUE assessment in PR and USVIs: Preliminary report. Obtained online at: http://www.sefsc.noaa.gov/sedar/download/S14RD33%20QC%20CPUE%20Assessmt%2099.pdf?id=DOCUMENT

Robertson, D.R. and R.R. Warner. 1978. Sexual patterns in the labroid fishes of the western Caribbean, II: The parrotfishes (Scaridae). Smithsonian Contributions to Zoology, Number 255. Smithsonian Institution Press, Washington DC, 26 pp.

DRAFT

Robins, C.R. and G.C. Ray. 1986. A Field Guide to the Atlantic Coast Fishes of North America. Houghton Mifflin Company, Boston, MA.

Rodríguez, C.E. 1989. Puerto Ricans Born in the U.S.A. Unwin Hyman, Boston MA.

Rodríguez-Ferrer, G., Y. Rodríguez-Ferrer and C. Lilyestrom. 2005. An overview of recreational fishing tournaments in Puerto Rico. Proc. Gulf. Carib. Fish. Inst. 56: 611-620.

Rodríguez-Pérez, R. 2005. Economic restructuring and the making of a mass of deracinated workers: A community in Mayagüez, Puerto Rico. Ph.D. Dissertation, SUNY Binghampton.

Rosario, A. 1993. Shallow-water reef fish monitoring, Caribbean/NMFS Cooperative SEAMAP Program. Annual Report April 1, 1992-March 31, 1993. Fisheries Research Laboratory, Puerto Rico Department of Natural Resources. 73 pp.

Rosario, A. 1995. Queen conch stratification survey. SEAMAP-C Report to CFMC.

Rosario, A., J. Rojas, E. Piñeiro, M. Figuerola, N. Peña and W. Torres. 2006. Reproductive cycle and maturation size of silk snapper (*Lutjanus vivanus*). Final report to Caribbean Fishery Management Council.

Rothenberger, P., J. Blondeau, C. Cox, S. Curtis, W.S. Fisher, V. Garrison, Z. Hillis-Starr, C.F.G. Jeffrey, E. Kadison, I. Lundgren, W.J. Miller, E. Muller, R. Nemeth, S. Paterson, C. Rogers, T. Smith, A. Spitzack, M. Taylor, W. Toller, J. Wright, D. Wusinich-Mendez and J. Waddell. 2008. The state of coral reef ecosystems of the U.S. Virgin Islands. In: J. Waddell and A.M. Clarke (Eds.), The state of coral reef ecosystems of the United States and Pacific Associated States, 2008. NOAA Technical Memorandum NOS NCCOS 73. NOAA/NCCOS Center for Coastal Monitoring and Assessment's Biogeography Team. Silver Spring, MD.

Ruiz-Marrero, C. June 23, 2009. Puerto Rico: Biotech Island. Counterpunch.org.

Ruiz-Marrero, C. July 13, 2004. Puerto Rico's biotech harvest. Alternet.org. Obtained online at: www.grain.org/research/contamination.cfm?id=141#

Sadovy, Y. 1991. A preliminary assessment of the export trade in marine aquarium organisms in Puerto Rico. Report submitted to the Caribbean Fishery Management Council, Fisheries Research Laboratory, Mayagüez, Puerto Rico. 43 pp.

Sadovy, Y. 1993. The Nassau grouper, endangered or just unlucky? Reef Encounter 13, July. Obtained online at: www.scrfa.org/server/studying/doc/Sadovyreef-encounterpdf1983.pdf.

Sadovy, Y. and A-M. Eklund. 1999. Synopsis of biological data on the Nassau grouper, *Epinephelus striatus* (Bloch, 1792), and the jewfish, *E. itajara* (Lichtenstein, 1822).

NOAA Technical Report NMFS 146. Obtained online at: http://spo.nwr.noaa.gov/tr146.pdf

Sadovy, Y., P.L. Colin and M.L. Domeier. 1994. Aggregation and spawning in the tiger grouper, *Mycteroperca tigris* (Pisces: Serranidae). Copeia 1994: 511-516.

Sandt, V.J. and A.W. Stoner. 1993. Ontogenetic shift in habitat by early juvenile conch *Strombus gigas*: patterns and potential mechanism. Fish. Bull. 91: 516-525.

Schneider, F. 2004. The size of the shadow economies of 145 countries all over the world: First results over the period 1999 to 2003. Forschungsinstitut zur Zukunft der Arbeit Institute for the Study of Labor, Discussion Paper Series, IZA DP No. 1431.

Sefton, N. and S.K. Webster. 1986. Field Guide to Caribbean Reef Invertebrates. Sea Challenges, California. 116 pp.

Sjöö, G.L. and E. Mörk. 2008. Anthropogenic influence on macroalgal nutrient dynamics-implications for potential bottom-up effects on secondary production in the western Indian Ocean. Presentation at the 8th International Coral Reef Symposium, July 2008.

Smith, C.L. 1959. Hermaphroditism in some serranid fishes from Bermuda. Pap. Mich. Acad. Sci., Arts. Lett. 44: 111-118.

Smith, C.L. 1961. Synopsis of biological data on groupers (Epinephelus and allied genera) of the western North Atlantic. FAO Fish. Biol. Synop. No. 23. 61 pp.

Smith, J.E. 2008. Nutrients and herbivores: What do we know about their relative importance on coral reefs? Presentation at the 8th International Coral Reef Symposium, July 2008.

South Atlantic Fishery Management Council (SAFMC). 1999. Stock assessment and fishery evaluation report fo rthe snapper grouper fishery of the South Atlantic. NEED COMPLETE REFERENCE

Southeast Data, Assessment, and Review (SEDAR). 2007. Caribbean queen conch. SEDAR 14, Stock Assessment Report 3. North Charleston, SC: SEDAR. Available online at: www.sefsc.noaa.gov/sedar/download/S14SAR3%20Queen%20Conch%20Report.pdf?id=DOCUMENT.

Southeast Data, Assessment, and Review (SEDAR). 2009. Caribbean fisheries data evaluation: SEDAR procedures workshop 3. San Juan, Puerto Rico, January 26-29, 2010. 183 pp. + References. Available online at: http://www.sefsc.noaa.gov/sedar/download/CaribData_Final.pdf?id=DOCUMENT

DRAFT

St. Thomas Fishermen's Association (STFA). 2008. Study of by-catch from fishing operations. Final report, Marine Fisheries Initiative (MARFIN), NOAA Award Number NA06NMF4330052.

Steneck, R.S. 1986. The ecology of coralline algal crusts: Convergent patterns and adaptive strategies. Ann. Rev. Ecol. Syst. 7: 273-303.

Steneck, R.S. 1997. Crustose corallines, other algal functional groups, herbivores and sediments: Complex interactions along reef productivity gradients. Proc. 8th Int. Coral Reef Sym. 1: 695-700.

Stoffle, B., J.R. Waters, S. Abbott-Jamieson, S. Kelley, D. Grasso, J. Freibaum, S. Koestner, N. O'Meara, S. Davis, M. Stekedee and J. Agar. 2009. Can an island be a fishing community: An examination of St. Croix and its fisheries. NOAA Technical Memorandum NMFS-SEFSC-593, 57pp.

Stoner, A.W. 1997. The status of queen conch, *Strombus gigas:* Research in the Caribbean. Mar. Fish. Rev. 59:14-22.

Stoner, A.W. and J.M. Waite. 1990. Distribution and behavior of queen conch *Strombus gigas* relative to seagrass standing crop. Fish. Bull. US 88: 573-585.

Stoner, A.W. and M. Ray-Culp. 2000. Evidence for Allee effect in an over-harvested marine gastropod: density-dependent and egg production. Mar. Ecol. Prog. Ser. 202: 297-302.

Streelman, J.T., M. Alfaro, M.W. Westneat, D.R. Bellwood and S.A. Karl. 2002. Evolutionary history of the parrotfishes: biogeography, ecomorphology, and comparative diversity. Evolution 56: 961-971.

Suárez-Caabro, J.R. 1975. Puerto Rico's fishery statistics 1968-1969. Puerto Rico Department of Agriculture, Cabo Rojo, Puerto Rico.

Swartz, S.L., J. Stamates, C. Burks and A.A. Mignucci-Giannoni. 2001. Acoustic and visual survey of cetaceans in the waters of Puerto Rico and the Virgin Islands: February-March 2001. NOAA Technical Memorandum NMFS-SEFSC-463, 62 pp.

Tabash, F.A.B. and L.M. Sierra. 1996. Assessment of *Lutjanus vivanus* in the north Caribbean coast of Costa Rica. NAGA, The ICLARM Quarterly, October, 1996. Pp. 48-51.

Taylor, J.B. 2000. Caribbean drug trafficking and the western hemisphere. Colegio Interamericano de Defense, Washington DC. Obtained online at: http://library.jid.org/en/mono39/taylor.htm

DRAFT

Terry, J., J. Walden and J. Kirkley. 2008. National assessment of excess harvesting capacity in federally managed commercial fisheries. NOAA Technical Memorandum NMFS-F/SPO-93, 368 pp.

Thompson, R. and J.L. Munro. 1974a. The biology, ecology and bioeconomics of Caribbean reef fishes: Serranidae (hinds and groupers). Res. Rep. Zool. Dept. Univ. West Indies 3 (Part Vb), Kingston, Jamaica. 82 pp.

Thompson, R. and J.L. Munro. 1974b. The biology, ecology and bioeconomics of the snappers, Lutjanidae. In: J.L. Munro (ed.), Caribbean Coral Reef Fisheries Resources. ICLARM Stud. Rev. 7, pp. 94-109.

Tobias, W. and K. Dupigny. 2009. Survey of the U.S. Virgin Islands recreational fishing boats that target billfish and other pelagic species. Final report (Grant No. Billfish-2005-16) submitted to the GSMFC. 73 pp. + Appendices.

Toller, W., C. O'Sullivan and R. Gomez. 2005. Survey of fishing tournaments in the U.S. Virgin Islands, October 1, 2000 to September 30, 2005. Obtained online at: http://bcrc.bio.umass/edu/vifishandwildlife/Fisheries/FisheriesReport/2005/F8TournamentSurvey.pdf

Toller, W. and W. Tobias. 2005. Management implications for restrictions on the use of gill and trammel nets in St. Croix, U.S. Virgin Islands. Proceedings of the 58th Gulf and Caribbean Fisheries Institute, 518 pp. Obtained online at: http://www.vifishandwildlife.com/Fisheries/Fisheries Reports/2004/

Toro Tulla, H.J. 2007. Economic development and labor market inequality in Puerto Rico. Ph.D. Dissertation, University of California, Berkeley, CA.

Trumble, R.J., D. Olsen and N. Cummings. 2006. A pilot program to assess methods of collecting bycatch, discard, and biological data in the commercial fisheries of St. Thomas, U.S. Caribbean. Cooperative research report, Grant #NA05NMF4540042, 63 pp. + Appendices.

U.S. Census Bureau. 2000. Census 2000. Obtained online at http://www.census.gov/main/www/cen2000.html

U.S. Department of Commerce, Bureau of Fisheries. 1933. Report of the United States Commissioner of Fisheries for the fiscal year 1923 with appendices. U.S. Government Printing Office, Washington DC.

U.S. Environmental Protection Agency (EPA). 2000. Guidance for assessing chemical contaminant data for use in fish advisories. Volume 2 Risk assessment and fish consumption limits. Third Edition. Obtained online at: http://www.epa.gov/waterscience/fish/advice/volume2/v2cover.pdf

DRAFT

U.S. Government Accountability Office (GAO). 2006. Puerto Rico. Fiscal relation with the federal government and economic trends during the phaseout of the possessions tax credit. Washington, DC. Obtained online at: http://www.gao.gov/new.items/d06541.pdf

Valdés-Pizzini, M. A. Acosta, D.C. Griffith and M. Ruiz_Perez. 1992. Assessment of the socioeconomic impact of fishery management options upon gill net and trammel net fishermen in Puerto Rico: An interdisciplinary approach (Anthropology and Fisheries Biology) for the evaluation of management alternatives. Final Report for NOAA/NMFS (Saltonstall Kennedy Program) Grant Number NA17FL0100-01.

Valdés-Pizzini, M., J. J. Agar, K. Kitner, C. García-Quijano, M. Tust and F. Forrestal. 2010. Cruzan fisheries: A rapid assessment of the historical, social, cultural and economic processes that shaped coastal communities' dependence and engagement in fishing in the island of St. Croix, U.S. Virgin Islands. NOAA Series on U.S. Caribbean Fishing Communities. NOAA Technical Memorandum NMFS-SEFSC-597, 144 pp.

Valle-Esquivel, M. 2002. U.S. Caribbean queen conch (*Strombus gigas*) data update with emphasis on the commercial landings statistics. Sustainable Fisheries Division Contribution SFD-01/02-169.

Valle-Esquivel, M. 2003. Aspects of the population dynamics, stock assessment, and fishery management strategies of the queen conch, *Strombus gigas*, in the Caribbean. Ph.D. Dissertation, University of Miami.

Virgin Islands Daily News. April 8, 2009. St. Croix conch season to close early, DPNR says. Obtained online at: www.virginislandsdailynews.com/index.pl/article?id=17634780

Volety, A.K., M. Savarese, S.G. Tolley, W.S. Arnold, P. Sime, P. Goodman, R.H. Chamberlain and P.H. Doering. 2009. Eastern oysters (*Crassostrea virginica*) as an indicator for restoration of Everglades ecosystems. Ecol. Indic. 9 Suppl. 1: 120-136.

Waritan, M. and P. Fong. 2008. Environmental stress changes the relative importance of top-down (herbivorous fishes) and bottom-up (nutrients) forces regulating community structure and resilience of coral reefs. Presentation at the 8th International Coral Reef Symposium, July 2008.

Weiler, D. and J.A. Suárez-Caabro. 1986. Overview of Puerto Rico's small-scale fisheries statistics. CODREMAR Technical Report, Number 1, Volume 1. Obtained online at: http://www.sefsc.noaa.gov/sedar/download/S14RD41%20PR%20small%20Scale%201972-78.pdf?id=DOCUMENT

White, D.B., D.M. Wyanski, B.M. Eleby and C.G. Lilyestrom. 2002. Tiger grouper (*Mycteroperca tigris*): profile of a spawning aggregation. Bull. Mar. Sci. 70: 233-240.

DRAFT

Wilkinson, C. and D. Souter. 2008. Status of Caribbean coral reefs after bleaching and hurricanes in 2005. Global Coral Reef Monitoring Network, and Reef and Rainforest Research Center, Townsville, Australia, 152 pp.

World Resources Institute. 2006. Earth trends: The environmental information portal, agriculture and food, country profile for Puerto Rico. Obtained online at: http://earthtrends.wri.org/text/agriculture-food/country-profile-148.html

DRAFT

10.0 LIST OF PREPARERS

Dr. William Arnold, DOC/NOAA/NMFS/SERO, 263 13th Avenue S, St. Petersburg, FL
Dr. Denise Johnson, DOC/NOAA/NMFS/SERO, 263 13th Avenue S, St. Petersburg, FL
Dr. Joseph Kimmel, DOC/NOAA/NMFS/SERO, 263 13th Avenue S, St. Petersburg, FL
Britni Tokotch, DOC/NOAA/NMFS/SERO, 263 13th Avenue S, St. Petersburg, FL
Kate Michie, DOC/NOAA/NMFS/SERO, 263 13th Avenue S, St. Petersburg, FL
Graciela Garcia-Moliner, Caribbean Fisheries Management Council, 268 Muñoz Rivera Ave, Suite 1108, San Juan, PR
Heather Blough, DOC/NOAA/NMFS/SERO, 263 13th Avenue S, St. Petersburg, FL
Jennifer Lee, DOC/NOAA/NMFS/SERO, 263 13th Avenue S, St. Petersburg, FL
Jason Rueter, DOC/NOAA/NMFS/SERO, 263 13th Avenue S, St. Petersburg, FL
Dr. Nick Farmer, DOC/NOAA/NMFS/SERO, 263 13th Avenue S, St. Petersburg, FL
Dr. Todd Gedamke, DOC/NOAA/NMFS/SEFSC, 75 Virginia Beach Dr., Miami, FL
Andy Strelcheck, DOC/NOAA/NMFS/SERO, 263 13th Avenue S, St. Petersburg, FL
David Dale, DOC/NOAA/NMFS/SERO, 263 13th Avenue S, St. Petersburg, FL
Shepherd Grimes, USEC/GC, 263 13th Avenue S, St. Petersburg, FL
Mara Levy, USEC/GC, 263 13th Avenue S, St. Petersburg, FL
Carolyn Sramek, DOC/NOAA/NMFS/SERO, 263 13th Avenue S, St. Petersburg, FL
Brent Stoffle, DOC/NOAA/NMFS/SEFSC, 75 Virginia Beach Dr., Miami, FL
Juan Agar, DOC/NOAA/NMFS/SEFSC, 74 Virginia Beach Dr., Miami, FL
Dr. Jim Berkson, Virginia Tech University, Blacksburg, VA
David Keys, DOC/NOAA/NMFS/SERO, 263 13th Avenue S, St. Petersburg, FL
Anik Clemens, DOC/NOAA/NMFS/SERO, 263 13th Avenue S, St. Petersburg, FL
Scott Sandorf, DOC/NOAA/NMFS/SERO, 263 13th Avenue S, St. Petersburg, FL

DRAFT

11.0 LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THE STATEMENT ARE SENT

Department of Commerce Office of General Counsel
National Marine Fisheries Service Office of General Counsel
National Marine Fisheries Service Office of General Counsel Southeast Region
National Marine Fisheries Service Southeast Regional Office
National Marine Fisheries Service Southeast Fisheries Science Center
National Marine Fisheries Service Silver Spring Office
National Marine Fisheries Service Office of Law Enforcement
United States Coast Guard
United States Fish and Wildlife Service
United States Army Corps of Engineers
United States Department of the Interior
United States Department of Homeland Security
United States Department of State
United States Environmental Protection Agency
Marine Mammal Commission
Caribbean Environmental Protection Division
Division of Coastal Zone Management
USVI Department of Planning and Natural Resources
Puerto Rico Department of Natural and Environmental Resources
Puerto Rico Department of Agriculture
Puerto Rico Junta de Calidad Ambiental (Environmental Quality Board)
Puerto Rico Junta de Planificación (Planning Board)
PEW Environmental Foundation
Environmental Defense
Ocean Conservancy
Surfrider Foundation
St. Thomas Fishermen's Association
St. Croix Commercial Fishermen's Association

DRAFT

12.0 INDEX

ABC, 6
Abrir La Sierra, 37, 39, 311, 313, 349, 377
Acceptable Biological Catch, 6, 27, 29, 33, 55, 56, 58, 59, 60, 61, 62, 64, 65, 66, 67, 68, 69, 73, 74, 106, 108, 256, 260, 264, 265, 268, 269, 270, 272, 273, 328, 406
Accountability Measure (AM), 2, 3, 6, 9, 10, 12, 14, 16, 18, 19, 24, 25, 27, 29, 31, 33, 61, 73, 76, 77, 81, 87, 88, 89, 90, 91, 95, 99, 100, 101, 102, 103, 104, 105, 106, 108, 109, 257, 274, 276, 277, 278, 282, 283, 284, 285, 287, 291, 299, 300, 301, 302, 304, 305, 306, 308, 319, 320, 322, 336, 416, 418, 422, 423, 425, 426, 427, 429, 439, 440, 441, 444, 451
Actions, 2, 3, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 34, 51, 52, 53, 54, 55, 61, 62, 64, 76, 77, 78, 81, 82, 83, 84, 85, 87, 88, 89, 90, 91, 92, 93, 94, 95, 97, 98, 99, 100, 103, 104, 105, 106, 107, 109, 232, 253, 254, 255, 257, 270, 274, 275, 276, 277, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 296, 297, 298, 299, 300, 301, 302, 304, 305, 312, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 351, 352, 362, 363, 367, 368, 412, 419, 420, 421, 422, 423, 424, 425, 426, 430, 431, 432, 433, 434, 436, 437, 438, 439, 440, 446, 447, 448, 449, 450, 451, 452, 453, 454
Administrative Impacts, 15, 24, 305, 412
Administrative Procedure Act, 455
Administrative Procedures Act, 6, 251, 455
Aggregate, 12, 13, 18, 19, 21, 22, 23, 59, 63, 67, 70, 72, 77, 78, 79, 81, 87, 89, 90, 94, 95, 97, 98, 99, 126, 132, 258, 260, 262, 264, 265, 266, 279, 280, 281, 282, 283, 284, 289, 290, 291, 293, 319, 325, 327, 328, 335, 348
Algae, 6, 93, 97, 115, 116, 117, 132, 133, 134, 135, 136, 143, 144, 145, 293, 309, 383, 464
Annual Catch Limit (ACL), 2, 3, 6, 10, 11, 12, 13, 14, 17, 18, 19, 20, 24, 27, 29, 31, 33, 42, 44, 54, 55, 56, 58, 60, 62, 63, 64, 65, 66, 67, 68, 69, 73, 74, 75, 76, 77, 79, 80, 81, 82, 84, 85, 87, 88, 89, 90, 91, 95, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 108, 109, 247,뫰255, 256, 257, 260, 261, 265, 269, 272, 273, 274, 275, 276, 277, 278, 279, 281, 283, 284, 285, 286, 296, 298, 299, 300, 301, 302, 304, 305, 306, 308, 312, 317, 319, 320, 321, 322, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 350, 351, 352, 353, 354, 355, 359, 360, 361, 363, 364, 365, 366, 368, 406, 415, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 447, 448, 449, 450, 451, 453, 454
Annual Catch Limit Working Group, 6, 33, 34, 420, 431
Annual Catch Target, 6, 27, 29, 106
Aquarium, 38, 118, 121, 122, 124, 131, 175, 387, 409
Area, 7, 20, 27, 29, 36, 38, 39, 40, 43, 46, 48, 61, 67, 77, 88, 105, 106, 108, 112, 114, 117, 121, 124, 125, 136, 137, 138, 139, 141, 142, 145, 146, 148, 149, 150, 166, 180, 195, 228, 229, 235, 239, 248, 249, 251, 278, 286, 287, 289, 303, 304, 309, 310, 311, 312, 313, 315, 318, 319, 320, 321, 326, 335, 356, 359, 367, 414, 415, 419, 421, 422, 423, 427, 446, 460
Artisanal, 90, 140, 146, 161, 218, 274, 286, 316, 319, 331
Average Catch, 6, 18, 19, 20, 21, 22, 23, 24, 34, 40, 54, 55, 56, 59, 63, 65, 67, 68, 69, 71, 74, 77, 78, 79, 82, 83, 84, 85, 92, 94, 98, 102, 104, 105, 113, 123, 136, 167, 180, 186, 203, 210, 251, 257, 258, 259, 262, 263, 266, 267, 270, 271, 273, 279, 280, 290, 299, 300, 302, 304, 314, 371, 372, 373, 375, 376, 377, 378, 380, 381, 383, 384, 386, 387, 388, 389, 390, 391, 392, 406, 411, 415, 431, 432, 434, 436, 437, 438, 439, 447, 448, 449, 450, 451, 454, 455, 456, 461, 462
Bag Limit, 2, 10, 12, 13, 14, 21, 22, 23, 34, 35, 36, 38, 94, 95, 96, 97, 98, 99, 100, 108, 109, 220, 255, 293, 296, 297, 298, 299, 311, 313, 315, 335, 336, 339, 415, 417, 420, 421, 422, 425, 427
Bajo de Sico, 37, 39, 195, 310, 311, 312, 313, 349
Baseline, 15, 17, 21, 24, 25, 59, 63, 66, 67, 71, 98, 99, 104, 253, 258, 263, 267, 271, 278, 294, 296, 302, 307, 318, 371
$B_{CURRENT}$, 6
Biological impacts, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30
Biological opinion (BiOp), 321
Biomass, 6, 16, 17, 18, 19, 20, 21, 22, 23, 24, 37, 39, 48, 54, 55, 59, 65, 70, 72, 73, 74, 77, 78, 82, 83, 84, 85, 92, 94, 98, 105, 108, 112, 136, 138, 139, 149, 195, 257, 258, 260, 261, 262, 265, 266, 269, 270, 273, 279, 280, 289, 290, 302, 310, 311, 312, 313, 317, 349, 371, 375, 376, 377, 378, 379, 380, 381, 383, 384, 386, 389, 391, 411, 415, 431, 432, 434, 435, 436, 437, 439, 447, 448, 449, 450, 451, 452, 453
Black Grouper, 10, 15, 51, 53, 119, 123, 124, 125, 253, 254, 255, 325, 431
Black Snapper, 48, 118, 127, 169, 171, 196, 407
Blackfin Snapper, 70, 118, 127, 128, 129, 130, 131, 169, 170, 171, 173, 174, 182, 196, 212, 243, 258, 311, 313, 407
Blue Parrotfish, 60, 92, 97, 98, 118, 133, 182, 292, 294, 296, 327, 333, 334, 408
Blue Whale, 136, 138
B_{MSY}, 6, 55, 65
bottom longlines, 39
Bycatch, 4, 42, 143, 382, 383, 390, 405, 411, 412, 413, 414, 415, 416, 417

DRAFT

Cardinal Snapper, 11, 15, 52, 53, 119, 130, 190, 192, 193, 245, 253, 255, 309, 325, 355, 431
Caribbean Fishery Management Council, i, 6, 9, 10, 24, 31, 32, 35, 36, 37, 38, 39, 40, 41, 48, 54, 55, 60, 61, 62, 64, 66, 68, 69, 102, 111, 112, 113, 114, 115, 116, 117, 118, 138, 139, 140, 145, 146, 183, 186, 203, 207, 215, 219, 251, 252, 288, 302, 303, 309, 318, 325, 326, 328, 336, 339, 359, 373, 374, 377, 387, 413, 415, 418, 419, 420, 422, 423, 429, 441, 444, 446, 448
Catch, 6, 8, 10, 11, 13, 15, 16, 17, 20, 21, 27, 31, 34, 35, 42, 43, 44, 45, 49, 54, 55, 56, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 79, 81, 89, 90, 91, 93, 95, 97, 98, 99, 100, 101, 103, 104, 120, 129, 152, 156, 157, 158, 160, 161, 162, 167, 186, 187, 194, 196, 202, 206, 207, 210, 218, 219, 220, 223, 226, 227, 231, 232, 250, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 277, 278, 279, 280, 282, 285, 286, 289, 291, 293, 294, 295, 296, 297, 298, 299, 300, 301, 303, 305, 310, 311, 313, 315, 317, 319, 322, 323, 325, 327, 328, 330, 331, 334, 335, 336, 337, 338, 339, 340, 341, 342, 345, 347, 350, 351, 354, 360, 362, 364, 365, 367, 376, 381, 382, 389, 406, 411, 413, 414, 415, 416, 421, 422, 425, 427, 430, 431, 432, 433, 435, 436, 439, 445, 447, 452, 453, 454, 464
Catch Per Unit Effort, 6, 44, 386, 438, 439, 453
CEQ, 369
Charter, 12, 22, 43, 44, 45, 46, 49, 81, 95, 99, 100, 156, 195, 196, 197, 199, 204, 220, 297, 335, 337, 339, 341, 343, 346, 347, 351, 362, 380, 412, 435, 438, 454
Ciguatera, 42, 124, 132, 175, 384, 414
Climate, 3, 112, 147, 316, 375
Climate Change, 114, 147, 316, 375
Closure, 25, 34, 35, 36, 38, 39, 120, 121, 122, 124, 125, 127, 128, 129, 130, 131, 161, 170, 196, 284, 287, 303, 310, 311, 312, 313, 315, 339, 344, 359, 361, 367, 416, 417, 421, 431, 442
Coastal Household Telephone Survey, 6, 44
Coastal Zone Management Act, 6, 455
Code of Federal Regulations, 6, 174, 180, 214, 369, 376, 411, 412, 417, 440, 453, 457, 461
Commercial, 2, 10, 11, 12, 19, 20, 21, 22, 23, 32, 34, 35, 36, 37, 41, 47, 48, 49, 51, 52, 53, 56, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 78, 79, 80, 81, 83, 84, 87, 89, 90, 91, 94, 95, 97, 98, 100, 101, 109, 115, 119, 120, 121, 122, 124, 128, 130, 131,뫰139, 140, 143, 146, 147, 148, 149, 150, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 164, 165, 166, 167, 168, 169, 170, 171, 173, 174, 175, 176, 177, 179, 180, 181, 182, 183, 184, 186, 187, 188, 190, 191, 192, 194, 200, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 229, 231, 232, 234, 237, 243, 244, 245, 246, 247, 248, 250, 253, 254, 279, 281, 282, 283, 285, 286, 289, 291, 293, 294, 295, 296, 297, 298, 300, 303, 305, 309, 311, 312, 313, 315, 316, 319, 321, 322, 325, 327, 329, 330, 331, 333, 334, 335, 337, 338, 339, 340, 342, 344, 345, 346, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 359, 360, 361, 362, 363, 364, 365, 366, 367, 372, 376, 379, 380, 381, 382, 383, 390, 391, 394, 412, 413, 414, 415, 416, 417, 418, 421, 422, 423, 425, 426, 427, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 461, 464
Comprehensive SFA Amendment, 16, 17, 37, 39, 41, 43, 48, 55, 56, 57, 58, 59, 61, 64, 65, 66, 71, 72, 73, 74, 83, 84, 118, 212, 252, 256, 258, 260, 262, 263, 264, 267, 268, 270, 272, 275, 276, 325, 326, 327, 412, 414
Coral, 21, 22, 36, 39, 40, 61, 62, 75, 93, 95, 97, 114, 116, 120, 121, 123, 124, 125, 132, 133, 134, 135, 136, 143, 144, 145, 146, 160, 195, 196, 206, 250, 269, 281, 292, 293, 301, 309, 311, 314, 315, 371, 373, 374, 376, 378, 379, 380, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 415, 453, 454, 457, 459, 463
Coral Reef Protection, 459
Coral Reefs, 39
Council, 37, 39, 462
Council on Environmental Quality, 6, 307, 308, 314, 317, 369, 376, 458
CPUE, 6
Crustose Coralline Algae, 6, 144, 145
Cumulative Effects Analysis, 4, 6, 307, 308, 310, 314, 317
Current Fishing Mortality Rate, 6, 65
Data, 2, 4, 6, 7, 10, 11, 12, 15, 16, 17, 18, 19, 24, 27, 28, 29, 30, 33, 34, 41, 42, 43, 44, 45, 48, 51, 53, 54, 55, 56, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 76, 78, 79, 80, 81, 82, 87, 88, 95, 98, 101, 102, 103, 104, 118, 120, 123,뫰135, 141, 142, 143, 156, 157, 195, 196, 216, 221, 223, 234, 250, 254, 255, 257, 258, 259, 260, 262, 263, 264, 265, 266, 267, 268, 270, 271, 272, 276, 280, 281, 289, 290, 291, 293, 295, 299, 300, 303, 306, 309, 321, 322, 325, 327, 329, 334, 335, 336, 352, 360, 363, 369, 371, 376, 382, 383, 387, 388, 390, 391, 405, 406, 407, 409, 412, 413, 415, 416, 419, 420, 421, 422, 425, 426, 427, 432, 433, 434, 435, 437, 438, 439, 440, 442, 445, 446, 447, 451, 453, 454, 456, 460, 462, 463, 464
Data Quality Act, 6, 456
Depth, 51, 52, 92, 114, 115, 116, 119, 121, 122, 123, 124, 125, 127, 128, 130, 131, 133, 134, 136, 147, 160, 186, 309, 323, 413, 414, 425, 436
Distribution, 10, 20, 35, 51, 114, 117, 119, 128, 129, 131, 139, 140, 156, 189, 190, 205, 230, 232, 261, 266, 270, 273, 285, 301, 308, 309, 314, 377, 383, 385, 389, 411, 416, 421, 449, 463
Draft Environmental Impact Statement, i, 2, 5, 6, 9, 32
Ecological Impacts, 21, 24, 25, 257

DRAFT

Ecology, 3, 4, 10, 11, 15, 19, 20, 21, 22, 23, 24, 25, 27, 28, 29, 30, 51, 53, 54, 60, 62, 67, 73, 74, 75, 76, 93, 114, 227, 253, 255, 257, 260, 261, 265, 266, 269, 270, 272, 273, 279, 280, 281, 282, 292, 293, 299, 300, 301, 305, 372, 375, 376, 377, 378, 379, 380, 384, 386, 389, 390, 411, 412, 415, 417, 458
Ecosystem, 8, 10, 13, 19, 21, 22, 91, 93, 95, 97, 143, 253, 261, 266, 270, 273, 275, 280, 285, 286, 308, 331, 337, 411, 415, 459, 460
Ecosystems, 21, 54, 75, 93, 97, 136, 144, 160, 257, 269, 292, 307, 308, 310, 314, 317, 318, 387, 391, 417, 455, 459
EFH, 6, 462
EIS, 6
Elkhorn Coral, 136, 143, 145
Endangered species, 317
Endangered Species Act, 6, 136, 137, 138, 139, 140, 141, 142, 145, 317, 456
Environmental Assessment, 6, 38, 39, 40, 372
Environmental Effects Abroad of Major Federal Actions, 458
Environmental Impact Statement, 2, 5, 6, 9, 38, 40, 412, 462
Environmental justice, 460
Environmental Justice, 460
Environmental Protection Agency, 5, 6, 201, 305, 390, 458
Essential fish habitat, 308
Essential Fish Habitat, 6, 40, 112, 115, 195, 308, 309, 311, 318, 372, 373, 374, 462
Exclusive Economic Zone, 6, 20, 21, 22, 36, 37, 38, 39, 40, 45, 46, 49, 50, 62, 67, 77, 82, 84, 85, 86, 88, 91, 92, 95, 97, 98, 99, 105, 112, 127, 128, 129, 131, 132, 137, 138, 141, 142, 143, 145, 146, 160, 161, 170, 174, 180, 186, 188, 190, 194, 196, 198, 203, 214, 219, 251, 276, 277, 282, 286, 287, 292, 293, 294, 295, 296, 297, 298, 302, 303, 304, 305, 311, 326, 327, 328, 329, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 346, 347, 349, 350, 351, 353, 354, 355, 359, 360, 361, 362, 363, 364, 365, 366, 367, 413, 414, 415, 420, 422, 423, 431, 432, 433, 434, 435, 436, 437, 438, 439, 445, 447, 448, 449, 450, 451, 452, 453, 454
Federal Regulations, 6, 33, 38, 39, 40, 59, 100, 118, 412, 418, 461
Federalism, 459, 460
Feed, 308, 317
Fin Whale, 136, 138, 139, 383
Final Environmental Impact Statement, 6, 9, 40, 112, 115, 318
Finding of No Significant Impact, 6, 38
Fish Aggregation Device, 6
Fish Filleted or Used for Bait but Identified, 6, 46, 451
Fish Identified but Released Alive, 6, 46
Fish Returned for Identification, 6, 9, 12, 13, 18, 19, 20, 21, 22, 23, 24, 32, 34, 35, 38, 39, 45, 46, 48, 49, 58, 77, 78, 79, 81, 82, 83, 84, 85, 92, 93, 94, 98, 99, 100, 101, 102, 105, 107, 112, 114, 115, 118, 119, 120, 121, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 136, 138, 142, 143, 144, 145, 160, 161, 172, 178, 180, 185, 188, 190, 196, 220, 221, 222, 223, 242, 261, 266, 270, 273, 274, 279, 280, 281, 285, 289, 290, 292, 297, 300, 301, 302, 307, 311, 329, 332, 336, 341, 353, 371, 372, 373, 375, 376, 377, 378, 379, 380, 381, 383, 384, 385, 386, 387, 388, 389, 390, 391, 411, 414, 415, 416, 424, 425, 426, 427, 429, 430, 432, 434, 435, 436, 437, 439, 441, 444, 445, 448, 451, 452, 453, 457, 459
Fisheries Advisory Committee, 6, 100
Fishery Management Plan, 2, 3, 6, 9, 14, 26, 27, 28, 29, 30, 31, 32, 34, 35, 36, 37, 38, 39, 40, 49, 105, 106, 107, 108, 109, 115, 118, 278, 306, 310, 317, 319, 320, 321, 373, 374, 384, 415, 423, 440, 446, 458
Fishery Management Unit, 2, 3, 4, 6, 9, 10, 15, 21, 22, 27, 34, 37, 38, 39, 42, 51, 52, 53, 76, 78, 83, 84, 87, 90, 93, 94, 106, 118, 119, 126, 131, 132, 186, 199, 253, 254, 255, 274, 275, 276, 277, 279, 283, 284, 285, 287, 288, 289, 290, 324, 405, 407, 420, 424, 426, 430, 446, 447
Fishing mortality, 317
FMP, 37, 39
FMSY, 6, 56, 65, 406
Food and Agricultural Organization, 6, 375, 378, 388, 412
Fork Length, 6, 9, 27, 29, 72, 106, 127, 128, 129, 131, 135, 136, 171, 313, 379, 385, 393, 413
F_{OY}, 6, 65
Framework, 3, 4, 9, 10, 14, 26, 27, 28, 29, 30, 31, 32, 105, 106, 107, 109, 110, 254, 305, 306, 307, 324, 367, 372, 423, 440
Gear, 13, 20, 25, 27, 29, 36, 38, 39, 40, 71, 78, 82, 90, 91, 92, 93, 105, 106, 108, 125, 129, 132, 138, 139, 140, 141, 142, 143, 145, 146, 147, 152, 154, 159, 160, 161, 173, 179, 182, 186, 187, 191, 193, 195, 204, 208, 210, 213, 214, 216, 217, 218, 219, 220, 223, 227, 229, 230, 231, 232, 255, 256, 274, 281, 282, 285, 286, 293, 301, 311, 313, 314, 315, 316, 317, 318, 319, 321, 323, 330, 331, 332, 337, 352, 355, 356, 357, 359, 361, 362, 363, 364, 372, 413, 414, 416, 423, 425, 426, 435, 437, 438, 439, 440, 453, 454, 461, 463
Genetically Modified, 7, 235
Geology, 3, 112, 386
Gillnet, 73, 137, 190, 217, 268, 311, 332, 356, 359, 361, 362, 364, 367, 453
Goliath Grouper, 39, 40, 61, 62, 70, 74, 75, 76, 118, 120, 121, 194, 256, 262, 265, 276, 278, 309, 311, 313, 315, 327, 349, 373, 383, 407, 449
Grammanik Bank, 38, 39, 124, 303, 311, 359, 367, 421
Green Sea Turtle, 136, 140, 141, 142
Gross Domestic Product, 6, 233, 236, 240, 249
Gross National Income, 7, 233
Gross National Product, 7, 154, 235, 236
Grouper, 2, 9, 10, 11, 12, 13, 15, 16, 18, 19, 21, 22, 23, 31, 32, 33, 39, 40, 41, 42, 48, 51, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 69, 70, 71, 72, 73, 74,

DRAFT

75, 76, 77, 78, 79, 80, 81, 83, 84, 87, 88, 89, 90, 94, 95, 96, 97, 98, 99, 100, 118, 119, 120, 121, 122, 123, 124, 125, 126, 132, 137, 159, 166, 167, 168, 175, 176, 177, 178, 179, 180, 181, 182, 194, 198, 199, 202, 213, 214, 220, 243, 244, 245, 246, 247, 253, 254, 255, 256, 257, 262, 263, 264, 265, 266, 273, 274, 275, 276, 278, 279, 280, 281, 282, 283, 284, 285, 286, 288, 289, 290, 291, 297, 298, 303, 308, 309, 310, 311, 312, 313, 315, 319, 325, 326, 327, 328, 329, 330, 331, 332, 333, 335, 348, 349, 350, 351, 360, 361, 362, 365, 366, 367, 371, 375, 378, 381, 383, 388, 391, 407, 408, 413, 420, 421, 425, 426, 431, 432, 433, 447, 449, 450, 463
Grouper Unit, 10, 15, 33, 40, 51, 53, 55, 60, 61, 62, 64, 70, 75, 77, 78, 89, 118, 167, 175, 176, 177, 178, 180, 181, 194, 198, 199, 213, 214, 262, 265, 276, 284, 309, 310, 311, 312, 313, 315, 319, 325, 327, 348, 349, 350, 361, 367, 420, 425, 426, 431, 432
Habitat, 3, 6, 11, 21, 22, 40, 51, 52, 91, 99, 105, 114, 115, 116, 117, 127, 132, 133, 137, 138, 140, 141, 142, 143, 144, 145, 146, 188, 244, 255, 256, 261, 266, 273, 281, 287, 293, 297, 302, 303, 304, 308, 309, 311, 315, 317, 318, 319, 320, 326, 333, 334, 349, 359, 384, 388, 456, 457, 459, 462, 464
Harvest, 9, 10, 12, 13, 18, 20, 21, 22, 23, 25, 31, 32, 34, 35, 36, 37, 38, 42, 44, 45, 48, 49, 52, 53, 61, 67, 70, 71, 74, 75, 76, 78, 79, 81, 82, 87, 88, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 121, 144, 146, 160, 162, 186, 190, 193, 195, 198, 202, 210, 214, 216, 218, 219, 224, 231, 253, 254, 256, 259, 261, 262, 263, 265, 267, 269, 271, 272, 273, 279, 280, 281, 282, 288, 289, 291, 292, 293, 296, 299, 301, 306, 309, 310, 311, 313, 315, 316, 317, 320, 321, 322, 323, 326, 329, 330, 331, 333, 334, 335, 336, 337, 338, 339, 340, 342, 345, 347, 350, 353, 355, 357, 359, 364, 365, 366, 367, 371, 381, 387, 413, 415, 420, 421, 426, 431, 432, 433, 434, 435, 438, 439, 447, 448, 449, 450, 451, 454
Hawksbill Sea Turtle, 136, 140, 141
Highly Migratory Species, 7, 49, 50, 161, 162, 194, 195, 311, 384
Humpback Whale, 136, 137, 138
Information Quality Act, 456
Initial Regulatory Flexibility Analysis, 7, 374, 462
Instantaneous Fishing Mortality, 6, 46, 113, 123, 198, 372, 373, 375, 377, 380, 381, 383, 384, 385, 386, 387, 388, 389, 390, 391, 406, 411, 416, 445
Interdisciplinary Plan Team, 7, 32
International Union for the Conservation of Nature, 7, 138, 377
Inter-tropical Convergence Zone, 7, 113
Invasive Species, 459
Island, 9, 10, 12, 13, 20, 44, 78, 79, 82, 84, 85, 86, 88, 91, 102, 111, 112, 114, 125, 128, 131, 138, 139, 140, 141, 142, 146, 147, 149, 154, 180, 182, 195, 203, 206, 215, 217, 218, 219, 222, 223, 224, 225, 226, 227, 228, 229, 230, 232, 235, 236, 237, 241, 248,뱀249, 250, 279, 280, 281, 282, 286, 288, 292, 295, 300, 314, 315, 316, 331, 332, 333, 377, 379, 380, 382, 387, 389, 391, 419, 427, 432, 434
Landings, 11, 12, 14, 17, 18, 19, 20, 24, 34, 35, 41, 42, 43, 44, 45, 51, 52, 53, 54, 56, 57, 58, 59, 63, 65, 66, 67, 68, 69, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 83, 84, 85, 87, 88, 89, 95, 98, 100, 101, 102, 103, 104, 105, 125, 131, 132, 151, 152, 153, 154, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 190, 191, 192, 193, 194, 196, 197, 198, 199, 200, 201, 206, 210, 211, 212, 213, 214, 215, 216, 217, 218, 229, 232, 243, 244, 245, 246, 247, 258, 259, 260, 263, 264, 267, 268, 271, 272, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 287, 288, 289, 290, 291, 292, 294, 295, 296, 298, 299, 300, 302, 303, 304, 305, 312, 317, 318, 320, 321, 322, 325, 326, 327, 328, 329, 330, 332, 333, 334, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 359, 360, 361, 362, 363, 364, 365, 366, 367, 372, 376, 391, 419, 421, 425, 426, 431, 432, 434, 436, 437, 439, 446, 447, 448, 449, 450, 451, 454
Lang Bank, 36, 37, 38, 67, 112, 296, 311, 315, 356, 463
Leatherback Sea Turtle, 136, 140, 142
License, 21, 22, 23, 35, 49, 91, 94, 100, 152, 154, 162, 196, 297, 298, 311, 335, 425, 426, 431, 436, 438, 440, 445, 457
Life History, 41, 59, 74, 115, 118, 261, 265, 269, 309, 315, 321, 372
Limit, 6, 9, 13, 20, 21, 22, 23, 34, 35, 36, 75, 77, 81, 91, 94, 95, 97, 98, 99, 100, 105, 106, 138, 186, 190, 201, 218, 219, 224, 256, 278, 293, 297, 299, 302, 304, 310, 311, 313, 315, 321, 328, 336, 352, 413, 421, 424, 432, 434, 438, 445
Logbook, 48, 221
Loggerhead Sea Turtle, 136, 140, 143
Magnuson Stevens Act, 7, 9, 10, 24, 25, 31, 32, 33, 54, 55, 76, 79, 88, 101, 103, 104, 201, 250, 278, 299, 301, 317, 320, 321, 369, 372, 374, 386, 411, 412, 457
Magnuson-Stevens Act, 462
Marine Conservation District, 7, 36, 311, 366, 374, 379
Marine Mammal Protection Act, 7, 136, 137, 138, 139, 140, 460, 461
Marine mammals, 461
Marine Mammals, 27, 29, 106, 136, 137, 308, 411, 415, 461
Marine Protected Areas, 37, 460
Marine Recreational Fisheries Statistics Survey, 7, 43, 44, 45, 46, 48, 49, 52, 56, 59, 60, 62, 63, 64, 65, 71, 81, 82, 98, 195, 196, 221, 258, 263, 267, 271, 291, 294, 295, 321, 323, 334, 352, 363, 412, 425, 435, 451, 454
Marine Recreational Information Program, 7, 43
Maximum Fishing Mortality Threshold, 7, 27, 29, 38, 39, 54, 55, 56, 57, 65, 72, 106, 108, 257, 258, 260, 262, 263, 266, 267, 270, 272

Maximum Sustainable Yield, 6, 7, 27, 29, 32, 38, 39, 54, 55, 56, 57, 59, 60, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 76, 79, 80, 90, 106, 108, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 272, 273, 276, 277, 283, 285, 325, 326, 327, 328, 329, 415
MFMT, 7, 38, 39
Midnight Parrotfish, 60, 92, 97, 98, 118, 131, 132, 199, 293, 294, 296, 327, 333, 334, 408, 420
Minimum Stock Size Threshold, 7, 27, 29, 38, 39, 54, 106, 108
Misty Grouper, 10, 51, 53, 118, 122, 176, 177, 178, 179, 181, 182, 243, 253, 255, 325, 361, 367, 407, 431
Mitigate, 307, 320
Mortality, 6, 7, 16, 17, 35, 40, 42, 55, 59, 65, 70, 72, 73, 74, 120, 121, 122, 124, 125, 127, 128, 129, 130, 131, 133, 134, 135, 136, 141, 144, 253, 257, 258, 260, 262, 263, 264, 265, 266, 267, 268, 269, 270, 272, 301, 312, 317, 339, 344, 375, 377, 385, 411, 412, 413, 414, 415, 417, 422, 425, 426, 437
MRFSS, 7
MSFCMA, 7, 455, 456
MSST, 7, 38, 39
MSY, 6, 7, 38, 39
Nassau Grouper, 33, 38, 40, 61, 62, 70, 71, 74, 75, 78, 118, 122, 123, 162, 167, 180, 181, 182, 193, 198, 199, 214, 245, 248, 256, 262, 266, 276, 284, 309, 315, 327, 349, 380, 383, 387, 407, 413, 425
National Anger Registry, 46, 331, 335, 352, 363
National Environmental Policy Act, 5, 7, 32, 40, 305, 307, 369, 376, 458, 462
National Marine Fisheries Service, i, 2, 3, 6, 7, 9, 10, 14, 24, 31, 33, 34, 40, 41, 46, 48, 55, 59, 60, 62, 64, 66, 68, 69, 70, 81, 100, 102, 109, 118, 120, 121, 122, 123, 136, 137, 138, 139, 140, 141, 142, 144, 145, 147, 161, 162, 167, 168, 169, 194, 195, 196, 197, 198, 201, 202, 219, 223, 226, 227, 228, 229, 251, 252, 258, 262, 310, 315, 317, 318, 319, 320, 321, 323, 324, 325, 328, 336, 367, 368, 371, 372, 374, 375, 376, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 393, 394, 411, 412, 416, 418, 434, 436, 437, 439, 447, 455, 456, 457, 458, 460, 461, 462, 463
National Marine Sanctuaries Act, 7, 457
National Oceanic and Atmospheric Administration, 7, 42, 114, 136, 148, 180, 181, 201, 252, 310, 315, 317, 318, 371, 372, 377, 378, 379, 380, 381, 382, 383, 384, 386, 387, 388, 389, 390, 391, 393, 418, 447, 455, 456, 457, 458, 460, 461
National Standard, 7, 33, 54, 88, 369, 386
National Standard 1, 33, 34, 54, 70, 71, 72, 74, 76, 79, 81, 257, 258, 260, 261, 262, 264, 265, 267, 268, 269, 270, 272, 273, 386
NEPA, 7, 369, 462
Net, 18, 19, 26, 28, 71, 73, 75, 76, 77, 88, 110, 141, 154, 160, 161, 182, 186, 190, 193, 210, 213, 214, 216, 217, 220, 234, 274, 276, 278, 284, 285, 306, 311, 312, 316, 317, 318, 324, 332, 353, 356, 359, 361, 362, 364, 367, 391, 414, 437, 453, 458
NOAA Fisheries, 455, 456, 461
NOAA Fisheries Service, 310, 318
Non-governmental Organization, 7
Oceanography, 3, 112
Office of Management and Budget, 7, 456, 461
Optimum yield, 7, 317
Optimum Yield, 6, 7, 27, 29, 32, 33, 38, 39, 54, 55, 56, 58, 59, 60, 62, 63, 64, 65, 66, 67, 68, 69, 73, 74, 75, 76, 90, 106, 108, 255, 257, 260, 261, 265, 269, 272, 273, 274, 276, 277, 285, 306, 317, 320, 326, 328, 415
Optimum yield (OY), 320
Overage, 14, 24, 25, 60, 62, 64, 66, 67, 68, 69, 102, 103, 104, 298, 301, 305, 325, 328, 336, 337, 338, 340, 341, 342, 343, 344, 346, 347, 348, 350, 351, 352, 353, 354, 359, 361, 363, 364, 365, 367, 439
Overfished, 10, 18, 19, 32, 33, 38, 39, 54, 55, 59, 64, 65, 70, 76, 118, 153, 262, 278, 280, 316, 317, 319, 420, 421, 435, 449, 463
Overfishing, 7, 9, 10, 18, 19, 26, 27, 28, 29, 31, 32, 33, 34, 35, 38, 54, 55, 56, 57, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 78, 95, 104, 106, 108, 118, 140, 144, 146, 162, 191, 247, 255, 257, 258, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 272, 273, 274, 276, 280, 282, 283, 284, 286, 301, 306, 314, 316, 317, 319, 320, 325, 326, 328, 371, 381, 406, 417, 435, 442, 445, 447, 449, 463
Overfishing Limit, 7, 27, 29, 33, 54, 57, 59, 60, 62, 64, 66, 67, 68, 69, 72, 73, 74, 90, 106, 108, 257, 260, 261, 264, 265, 268, 269, 272, 273, 277, 285, 325, 326, 328, 406, 415
Overfishing Threshold, 54, 56, 57, 60, 62, 64, 65, 66, 68, 69, 72
OY, 7, 38, 39
Paperwork Reduction Act, 7, 461
Parrotfish, 2, 9, 10, 11, 12, 13, 16, 21, 22, 23, 31, 32, 33, 41, 42, 47, 48, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 81, 83, 84, 92, 93, 94, 95, 96, 97, 98, 99, 100, 118, 131, 132, 133, 134, 135, 136, 144, 145, 148, 149, 167, 182, 183, 184, 185, 186, 199, 200, 210, 215, 216, 217, 244, 245, 246, 247, 255, 256, 257, 266, 267, 268, 269, 270, 274, 275, 276, 278, 280, 281, 286, 288, 292, 293, 294, 295, 296, 297, 298, 299, 303, 308, 309, 310, 313, 315, 325, 326, 327, 329, 330, 331, 332, 333, 334, 335, 337, 338, 339, 352, 353, 354, 359, 363, 364, 365, 408, 415, 420, 421, 424, 426, 430, 431, 432, 446, 447, 448, 449, 451, 463
Pelagic, 43, 48, 126, 129, 132, 137, 148, 149, 150, 166, 167, 202, 206, 219, 220, 253, 309, 390
Permit, 35, 49, 50, 203, 220, 321, 412, 425, 437, 438, 439, 451, 452, 453, 457
Physical Impacts, 19, 20, 24, 26, 27, 28, 29, 30
Population, 10, 36, 48, 92, 93, 119, 120, 121, 122, 124, 125, 128, 129, 131, 134, 136, 137, 138, 139, 142,

DRAFT

147, 203, 228, 229, 239, 242, 243, 248, 249, 250, 253, 257, 261, 265, 266, 270, 273, 279, 292, 301, 315, 336, 371, 375, 377, 391, 411, 415, 420
Pot, 71, 137, 437
pots, 39
Precaution, 61, 74, 75, 76, 256, 260, 261, 265, 269, 272, 273, 372, 378, 386, 406, 412
Preferred Alternative, 10, 12, 13, 14, 15, 16, 17, 19, 20, 21, 23, 24, 25, 51, 52, 53, 54, 59, 60, 61, 62, 66, 67, 71, 72, 73, 74, 75, 76, 77, 81, 82, 84, 85, 87, 88, 90, 91, 93, 97, 98, 99, 100, 102, 103, 104, 105, 161, 183, 186, 215, 228, 254, 255, 256, 258, 259, 260, 261, 263, 264, 265, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 281, 282, 283, 284, 285, 286, 287, 288, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 301, 302, 304, 305, 319, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 340, 341, 342, 343, 344, 346, 347, 350, 351, 352, 353, 359, 361, 362, 363, 364, 414, 425, 426
Primary Constituent Element, 7, 144
Princess Parrotfish, 92, 118, 134, 199, 408
Proportional Standard Error, 7, 44
Proxy, 16, 17, 18, 19, 38, 54, 55, 56, 57, 58, 59, 60, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 74, 76, 79, 80, 108, 255, 257, 258, 259, 260, 261, 262, 263, 265, 266, 267, 269, 270, 271, 272, 273, 276, 282, 299, 301, 325, 326, 327, 328, 329, 422, 425, 426, 437, 454
Puerto Rico, i, 2, 3, 7, 8, 9, 10, 12, 13, 16, 18, 19, 20, 21, 22, 23, 34, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 51, 52, 53, 56, 59, 60, 62, 63, 64, 65, 66, 67, 68, 69, 71, 77, 78, 79, 80, 81, 82, 83, 84, 85, 87, 88, 89, 90, 91, 94, 96, 98, 99, 100,뱀101, 105, 111, 112, 114, 115, 116, 117, 120, 121, 122, 124, 125, 127, 128, 129, 130, 131, 132, 134, 136, 137, 138, 139, 140, 141, 142, 143, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 156, 157, 158, 159, 160, 161, 162, 164, 165, 167, 168, 170, 172, 173, 178, 180, 182, 183, 185, 186, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 200, 201, 202, 206, 207, 212, 218, 219, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 238, 241, 242, 243, 244, 245, 247, 248, 249, 251, 252, 253, 258, 262, 263, 267, 270, 271, 274, 276, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 294, 296, 297, 298, 302, 303, 304, 308, 309, 310, 311, 312, 313, 314, 316, 318, 319, 321, 322, 325, 326, 327, 328, 329, 330, 331, 333, 334, 335, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 371, 372, 373, 374, 375, 376, 377, 378, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 412, 413, 415, 420, 421, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 437, 438, 440, 446, 447, 448, 449, 450, 451, 452, 454, 455
Puerto Rico DNER, 7, 41, 43, 44, 46, 48, 49, 116, 127, 130, 141, 142, 143, 145, 152, 153, 154, 162, 171, 180, 181, 190, 194, 195, 198, 321, 385, 394
Queen Conch, 9, 10, 11, 17, 31, 33, 34, 35, 36, 37, 38, 39, 41, 43, 49, 54, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 81, 91, 105, 107, 108, 109, 115, 116, 117, 118, 186, 187, 188, 189, 195, 200, 202, 210, 217, 218, 219, 244, 245, 246, 247, 255, 256, 257, 270, 271, 272, 273, 276, 277, 278, 286, 287, 302, 304, 306, 308, 309, 310, 311, 312, 313, 315, 317, 318, 319, 320, 321, 322, 323, 327, 328, 329, 332, 337, 352, 363, 371, 372, 374, 377, 378, 381, 386, 387, 388, 389, 391, 417, 420, 421, 431, 439, 446, 447, 453, 463
Queen Parrotfish, 92, 118, 134, 408
Quota, 12, 13, 19, 20, 27, 29, 35, 38, 81, 88, 95, 105, 106, 109, 218, 219, 225, 279, 280, 281, 282, 291, 292, 301, 310, 328, 332, 352, 420, 424, 433, 434, 445
Rainbow Parrotfish, 13, 60, 62, 92, 93, 97, 98, 118, 133, 185, 294, 295, 296, 299, 333, 334, 335, 408, 424, 426, 430, 446
Reauthorized Magnuson Stevens Act, 7, 10, 11, 14, 33, 54, 56, 65, 118, 321
Recreational, 2, 7, 9, 10, 12, 13, 19, 20, 21, 22, 23, 32, 35, 36, 37, 41, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 56, 59, 60, 61, 62, 63, 64, 65, 71, 81, 82, 83, 84, 87, 90, 91, 93, 94, 95, 96, 97, 98, 99, 100, 115, 119, 120, 121, 122, 124, 128, 145, 146, 149, 156, 160, 161, 174, 190, 194, 195, 196, 197, 198, 199, 200, 201, 202, 219, 220, 221, 253, 254, 257, 258, 263, 267, 271, 279, 281, 282, 285, 286, 288, 289, 291, 293, 294, 295, 296, 297, 298, 299, 309, 310, 311, 313, 315, 319, 321, 322, 325, 327, 329, 330, 331, 333, 334, 335, 337, 338, 339, 340, 341, 343, 345, 346, 347, 350, 351, 362, 375, 376, 377, 379, 380, 381, 382, 384, 385, 387, 390, 411, 412, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 430, 431, 432, 433, 434, 435, 436, 437, 440, 451, 453, 454, 464
Red Grouper, 118, 121, 175, 177, 179, 198, 265, 407, 420
Redband Parrotfish, 92, 118, 134, 183, 184, 408
Redfin Parrotfish, 92, 118, 135, 184, 408
Redtail Parrotfish, 92, 118, 135, 184, 408
reef fish, 39
Reef Fish, 3, 9, 10, 11, 12, 14, 15, 21, 22, 23, 36, 38, 39, 40, 43, 48, 49, 52, 53, 61, 94, 95, 96, 107, 108, 109, 118, 119, 126, 131, 137, 148, 149, 150, 159, 160, 167, 186, 205, 210, 212, 219, 250, 253, 274, 281, 288, 290, 292, 294, 296, 302, 303, 306, 308, 309,뱀310, 311, 312, 313, 314, 315, 317, 318, 319, 320, 321, 322, 323, 326, 354, 371, 373, 374, 375, 379, 384, 385, 386, 387, 390, 405, 417, 446, 447, 453, 454, 463
Reference Point, 2, 3, 10, 11, 12, 13, 14, 16, 17, 18, 19, 20, 27, 29, 31, 32, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 74, 77, 78, 79, 81, 82,

DRAFT

89, 90, 91, 105, 106, 255, 256, 257, 258, 259, 260, 262, 263, 265, 266, 267, 269, 270, 271, 276, 278, 279, 280, 281, 282, 283, 284, 285, 286, 288, 289, 290, 308, 325, 327, 328, 415, 421, 423
Regional Administrator, 7, 107, 108, 109, 306, 307, 461
Regulatory Flexibility Act, 7, 324, 459, 462
Regulatory Impact Review, i, 7, 107, 324, 458
Regulatory Planning and Review, 458
RIR, 7, 458
Scalar, 61, 421, 432, 434
Scientific and Statistical Committee, 4, 7, 11, 14, 24, 33, 55, 60, 61, 62, 64, 66, 67, 68, 69, 74, 93, 102, 104, 107, 269, 273, 275, 300, 304, 325, 328, 336, 405, 406, 419, 420, 438, 439, 453
Sea turtles, 457
SEAMAP, 7, 378, 387, 412
Season, 14, 25, 27, 29, 34, 35, 36, 37, 38, 39, 40, 61, 75, 81, 95, 103, 104, 105, 106, 108, 113, 116, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 137, 139, 140, 142, 143, 161, 167, 170, 186, 195, 196, 218, 220, 278, 298, 301, 302, 303, 304, 305,뱀310, 311, 312, 313, 315, 317, 320, 321, 326, 328, 330, 331, 332, 333, 336, 337, 338, 339, 340, 341, 342, 343, 344, 346, 347, 349, 350, 351, 352, 353, 354, 355, 359, 360, 361, 362, 364, 365, 366, 367, 376, 381, 391, 416, 417, 421, 422, 431, 436, 439
Sector, 2, 13, 19, 20, 43, 45, 46, 48, 50, 81, 82, 87, 90, 91, 95, 100, 154, 160, 223, 224, 230, 231, 233, 235, 236, 239, 240, 249, 281, 285, 286, 289, 291, 329, 352, 363, 368, 419, 421, 422, 425, 426, 431, 432, 434, 435, 436, 437, 451, 454
SEDAR, 7, 33, 34, 41, 44, 48, 51, 52, 78, 129, 153, 162, 200, 320, 376, 382, 388, 407, 463
Sei Whale, 136, 139
Seine, 160, 182, 210, 213, 214, 216, 413
SFA, 7
Silk Snapper, 48, 118, 128, 129, 149, 167, 169, 170, 171, 173, 174, 181, 182, 190, 193, 196, 197, 243, 339, 355, 359, 364, 387, 389, 407, 431
Small Business Act, 461
Small Business Administration, 7, 461, 462
snapper, 39
Snapper, 2, 9, 10, 11, 12, 13, 15, 16, 18, 19, 21, 22, 23, 31, 32, 33, 36, 39, 40, 41, 42, 44, 48, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 83, 84, 87, 88, 89, 90, 94, 95, 96, 97, 98, 99, 100, 118, 126, 127, 128, 129, 130, 132, 137, 148, 149, 150, 159, 160, 166, 167, 168, 169, 170, 171, 172, 173, 174, 182, 190, 191, 192, 193, 196, 197, 201, 202, 205, 206, 212, 213, 220, 243, 244, 245, 246, 247, 248, 250, 253, 254, 255, 256, 257, 258, 259, 260, 261, 274, 275, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 297, 298, 303, 308, 309, 310, 311, 312, 313, 315, 319, 325, 326, 327, 328, 329, 330, 331, 332, 333, 335, 339, 340, 341, 342, 343, 344, 345, 346, 347, 354, 355, 356, 357, 359, 360, 361, 362, 364, 365, 366, 367, 371, 375, 382, 388, 407, 410, 413, 420, 421, 425, 426, 431, 433, 434, 436, 439, 440, 445, 450, 463
Snapper Unit, 11, 15, 33, 40, 53, 55, 78, 80, 118, 167, 169, 170, 171, 172, 173, 190, 191, 196, 197, 201, 212, 258, 309, 310, 311, 313, 315, 325, 326, 328, 329, 330, 339, 340, 341, 342, 343, 344, 345, 346, 347, 355, 421, 425, 426, 431, 433, 434
snappers, 39
Socioeconomic, 10, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 60, 67, 73, 74, 75, 76, 95, 245, 250, 251, 260, 265, 269, 272, 312, 314, 318, 371, 378, 379, 391, 414
Socioeconomic Impacts, 10, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 60, 67, 73, 74, 75, 76, 95, 245, 250, 251, 260, 265, 269, 272, 312, 314, 318, 371, 378, 379, 391, 414
Southeast Fisheries Science Center, 7, 14, 24, 42, 48, 59, 60, 61, 62, 64, 66, 68, 69, 81, 88, 101, 102, 104, 300, 304, 322, 325, 328, 336, 371, 372, 378, 379, 389, 391, 393, 394, 415, 419, 421, 438, 439, 447, 453, 463
Spearfishing, 13, 92, 93, 98, 125, 141, 161, 256, 281, 313, 416, 423, 424, 425, 426, 440
Species, 2, 3, 6, 7, 9, 10, 12, 13, 15, 16, 18, 19, 21, 22, 25, 27, 29, 31, 32, 33, 34, 35, 38, 39, 40, 41, 42, 43, 44, 45, 48, 49, 51, 52, 53, 54, 55, 56, 59, 61, 62, 64, 65, 70, 71, 72, 73, 74, 75, 76, 78, 79, 80, 81, 83, 84, 87, 88, 89, 91, 92, 93, 94, 95, 97,뱀98, 99, 100, 102, 103, 106, 107, 115, 116, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 144, 145, 146, 147, 149, 150, 159, 160, 162, 165, 166, 167, 169, 170, 171, 173, 174, 175, 176, 177, 178, 179, 180, 182, 183, 185, 186, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 201, 202, 205, 206, 208, 210, 212, 213, 214, 215, 216, 217, 218, 219, 220, 231, 243, 244, 245, 246, 247, 248, 250, 251, 253, 254, 255, 256, 257, 258, 260, 261, 262, 263, 264, 265, 266, 267, 269, 270, 272, 273, 276, 278, 279, 280, 281, 282, 283, 284, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 301, 302, 305, 308, 309, 311, 312, 313, 314, 315, 317, 318, 319, 320, 321, 322, 325, 327, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 350, 351, 353, 354, 355, 359, 361, 367, 377, 378, 380, 383, 384, 390, 411, 412, 413, 414, 415, 417, 420, 421, 424, 426, 432, 433, 434, 435, 437, 438, 439, 445, 446, 447, 449, 453, 456, 457, 459, 463, 464
Species Complex, 2, 3, 10, 12, 13, 15, 16, 17, 18, 19, 42, 51, 52, 53, 54, 55, 56, 59, 60, 61, 62, 63, 64, 65, 70, 72, 73, 74, 75, 79, 80, 87, 95, 126, 143, 182, 253, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 272, 273, 274, 276, 278, 279,뱀280, 281, 282, 288, 289, 291, 293, 311,

DRAFT

324, 325, 371, 375, 389, 420, 423, 424, 426, 430, 446
Sperm Whale, 136, 140
St. Croix, USVI, 8, 9, 10, 13, 20, 21, 34, 35, 36, 37, 38, 40, 41, 42, 48, 49, 59, 60, 62, 63, 66, 67, 68, 69, 74, 77, 78, 82, 83, 84, 85, 91, 98, 99, 105, 111, 112, 114, 131, 132, 138, 139, 140, 141, 142, 143, 144, 146, 160, 190, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 236, 237, 238, 239, 240, 241, 248, 249, 250, 273, 277, 278, 286, 287, 292, 295, 296, 297, 302, 303, 304, 309, 310, 311, 315, 316, 318, 319, 325, 326, 327, 328, 331, 332, 333, 334, 335, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 367, 379, 389, 390, 391, 394, 420, 424, 426, 429, 431, 437, 444, 445, 446, 449, 451, 452, 453, 463
St. John, USVI, 7, 8, 9, 10, 13, 20, 21, 22, 34, 40, 41, 42, 48, 49, 59, 60, 62, 63, 66, 67, 68, 78, 82, 83, 84, 85, 91, 98, 99, 105, 111, 112, 114, 116, 124, 127, 128, 130, 131, 146, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 217, 218, 219, 220, 221, 236, 237, 238, 239, 240, 241, 248, 249, 250, 252, 286, 287, 295, 296, 297, 302, 303, 304, 315, 316, 317, 318, 319, 325, 326, 327, 328, 331, 332, 333, 334, 335, 362, 363, 364, 365, 366, 367, 379, 429, 437, 442, 449, 451, 452, 453
St. Thomas Fishermen's Association, 7, 82, 210, 332, 353, 389, 394, 419, 441
St. Thomas, USVI, 7, 8, 9, 10, 13, 20, 21, 22, 34, 36, 38, 39, 40, 41, 42, 48, 49, 51, 59, 60, 61, 62, 63, 66, 67, 68, 78, 82, 83, 84, 85, 86, 91, 98, 99, 105, 111, 112, 123, 124, 125, 127, 128, 130, 131, 139, 140, 146, 202, 203, 204, 205, 206, 207, 209, 210, 211, 212, 213, 214, 215, 217, 218, 219, 220, 221, 236, 237, 238, 239, 240, 241, 248, 249, 250, 251, 286, 287, 295, 296, 297, 302, 303, 304, 311, 315, 316, 317, 318, 319, 325, 326, 327, 328, 331, 332, 333, 334, 335, 353, 362, 363, 364, 365, 366, 367, 379, 380, 381, 389, 390, 394, 413, 419, 421, 429, 437, 441, 442, 449, 451, 452, 453
Staghorn Coral, 136, 143, 144, 145
Status, 10, 31, 32, 33, 54, 55, 59, 64, 69, 70, 73, 97, 101, 104, 118, 136, 196, 223, 235, 243, 251, 255, 258, 262, 266, 270, 276, 293, 299, 301, 314, 315, 317, 318, 320, 352, 363, 371, 375, 377, 381, 382, 384, 389, 392, 406
Status Determination Criteria, 10, 31, 32, 55
Stock, 2, 3, 6, 7, 10, 13, 15, 16, 17, 27, 28, 29, 30, 34, 44, 51, 53, 54, 55, 59, 61, 64, 65, 70, 72, 73, 74, 78, 82, 109, 116, 117, 137, 138, 146, 169, 179, 191, 253, 257, 258, 260, 261, 262, 264, 265, 266, 269, 270, 272, 273, 279, 280, 306, 311, 317, 320, 321, 324, 338, 340, 371, 372, 374, 378, 381, 383, 388, 391, 406, 420, 424, 426, 430, 437, 446
Stock assessment, 7, 321
Stock Complex, 10, 12, 13, 15, 16, 34, 42, 54, 55, 56, 59, 60, 61, 62, 63, 64, 65, 70, 72, 73, 74, 79, 80, 87, 95, 146, 169, 179, 191, 256, 257, 274, 278, 279, 280, 288, 289, 291, 293, 311, 325, 430, 446
Stock Complexes, 2, 3, 51, 53, 55, 253, 311, 324, 420, 424, 426, 430, 446
Stoplight Parrotfish, 92, 118, 136, 215, 408
Striped Parrotfish, 118, 132, 133, 408, 430, 446
Supplemental Environmental Impact Statement, 7, 38
Sustainable Fisheries Act, 7, 9, 10, 11, 16, 17, 32, 37, 39, 56, 59, 61, 65, 70, 74, 76, 119, 326, 332, 339, 344, 349, 353, 355, 356, 357, 359, 361, 364, 366, 374, 412, 419, 421
TAC, 8
Take, 320, 321
Takings, 459
Technical Monitoring and Compliance Team, 8, 33
Tiger Grouper, 118, 124, 125, 175, 176, 179, 382, 388, 391, 408
Time, 11, 12, 15, 16, 17, 20, 35, 41, 43, 48, 49, 51, 54, 56, 57, 58, 59, 61, 63, 65, 66, 67, 71, 74, 75, 78, 81, 82, 87, 90, 91, 92, 93, 101, 105, 107, 109, 113, 115, 116, 117, 119, 120, 121, 122, 123, 124, 125, 127, 128, 129, 131, 132, 134, 143, 150, 152, 153, 154, 155, 157, 158, 159, 160, 161, 162, 166, 170, 171, 180, 190, 193, 201, 204, 216, 217, 219, 222, 223, 225, 232, 234, 239, 240, 243, 249, 254, 258, 259, 261, 262, 263, 265, 266, 267, 269, 270, 271, 272, 273, 274, 275, 276, 282, 283, 284, 285, 286, 292, 298, 300, 301, 302, 304, 305, 306, 307, 312, 313, 314, 316, 318, 319, 320, 321, 323, 325, 327, 330, 331, 332, 337, 341, 343, 346, 348, 349, 351, 352, 353, 354, 357, 360, 363, 364, 406, 417, 422, 455, 456
Total Allowable Catch, 8, 27, 29, 106, 108
Tourmaline Bank, 36, 37, 39, 311, 312, 313, 349
trammel nets, 39
Trap, 19, 20, 39, 129, 131, 137, 141, 156, 159, 173, 179, 182, 193, 296, 311, 315, 357, 358, 364, 371, 412, 414, 427, 431, 437, 438, 463
traps, 39
Trigger, 24, 25, 75, 76, 77, 88, 89, 100, 101, 102, 103, 104, 148, 278, 299, 300, 304, 336, 352
U.S. Caribbean, 8, 9, 10, 11, 12, 13, 20, 21, 22, 32, 33, 37, 40, 41, 43, 46, 49, 50, 51, 54, 57, 58, 59, 62, 65, 70, 72, 78, 81, 82, 84, 85, 86, 87, 88, 90, 91, 92, 93, 95, 97, 98, 102, 111, 112, 116, 118, 125, 128, 129, 130, 131, 132, 135, 136, 137, 139, 140, 141, 142, 143, 145, 146, 147, 160, 161, 170, 181, 186, 188, 190, 194, 196, 198, 214, 251, 254, 255, 256, 257, 258, 259, 260, 262, 263, 264, 266, 267, 268, 270, 271, 272, 276, 277, 279, 280, 281, 282, 286, 290, 292, 293, 296, 300, 302, 303, 308, 310, 311, 313, 321, 322, 324, 325, 326, 327, 328, 335, 336, 368, 371, 373, 374, 377, 378, 379, 380, 384, 390, 391, 412, 413, 414, 415, 422, 432, 433, 434, 448, 449, 453, 463, 464
Unclassified, 12, 42, 45, 51, 52, 70, 79, 80, 81, 83, 87, 234, 281, 288, 289, 290, 291, 348, 349

DRAFT

Unit, 2, 6, 12, 15, 16, 18, 19, 35, 40, 44, 51, 52, 55, 57, 58, 61, 77, 78, 80, 81, 82, 83, 87, 89, 90, 91, 118, 127, 128, 129, 130, 131, 169, 170, 171, 172, 175, 176, 177, 178, 183, 185, 194, 196, 198, 258, 262, 276, 279, 280, 281, 282, 283, 284, 287, 288, 291, 309, 310, 312, 325, 326, 327, 328, 330, 331, 332, 336, 337, 339, 340, 341, 342, 343, 344, 346, 347, 348, 352, 361, 363, 407, 420, 421, 424, 426, 430, 431, 432, 446, 448, 449, 450, 451, 454
United States Virgin Islands, 8, 10, 11, 12, 16, 18, 19, 21, 22, 23, 34, 35, 36, 38, 40, 41, 42, 43, 46, 48, 49, 56, 59, 61, 63, 64, 65, 69, 71, 77, 78, 79, 80, 81, 82, 84, 87, 88, 89, 90, 91, 94, 98, 99, 100, 101, 105, 111, 113, 114, 115, 116, 117, 120, 121, 122, 123, 124, 125, 132,뱀137, 138, 139, 140, 141, 142, 143, 145, 146, 147, 168, 202, 203, 204, 205, 206, 207, 209, 210, 211, 212, 213, 214, 215, 216, 218, 219, 220, 221, 236, 237, 238, 239, 240, 241, 248, 249, 250, 251, 252, 258, 262, 263, 267, 270, 271, 276, 278, 279, 280, 281, 282, 283, 284, 285, 287, 288, 289, 290, 295, 296, 297, 298, 302, 303, 304, 308, 309, 310, 311, 312, 314, 315, 316, 318, 321, 322, 326, 327, 328, 329, 331, 332, 334, 335, 336, 352, 356, 359, 363, 373, 374, 378, 380, 381, 394, 412, 413, 415, 420, 421, 434, 435, 441, 442, 444, 446, 454, 455, 463
Urchin, 93, 144, 375
Valued Ecosystem Component, 8, 93
Vermilion Snapper, 33, 118, 130, 131, 169, 171, 173, 174, 181, 182, 196, 245, 248, 279, 315, 364, 407
Vessel, 13, 22, 23, 35, 36, 46, 47, 48, 49, 50, 90, 91, 94, 97, 99, 100, 137, 138, 143, 146, 147, 150, 154, 158, 159, 164, 165, 170, 171, 172, 177, 178, 179, 180, 181, 182, 184, 185, 186, 187, 188, 190, 191, 193, 196, 202, 207, 209, 213, 214, 215, 216, 218, 220,뱀229, 230, 231, 232, 235, 274, 285, 286, 293, 296, 297, 298, 299, 311, 313, 314, 315, 316, 318, 319, 330, 331, 335, 337, 352, 359, 360, 361, 362, 363, 364, 365, 366, 367, 414
Virgin Islands Department of Planning and Natural Resources, 8, 35, 101, 116, 203, 210, 218, 220, 221, 252, 321, 332, 352, 353, 364
Wenchman, 11, 15, 32, 52, 53, 130, 190, 201, 253, 255, 308, 325, 355, 407, 431
Yellowedge Grouper, 10, 33, 51, 118, 119, 176, 311, 361, 367, 373, 377, 380, 381, 407, 420
Yellowfin Grouper, 44, 70, 118, 124, 125, 176, 177, 179, 181, 182, 198, 213, 220, 244, 245, 262, 315, 382, 408

DRAFT

APPENDICES

Appendix 1 – SSC data evaluation scenarios
Appendix 2 – Reef fish FMU
Appendix 3 – Bycatch practicability analysis
Appendix 4 – Locations and outcomes of scoping hearings
    Appendix S-1 – Minutes of April/May public hearings
    Appendix S-2 – Minutes of August public hearings
Appendix 5 – Alternatives considered and rejected
Appendix 6 – Other applicable laws
Appendix 7 – Research needs
Appendix 8 – Response to comments on DEIS

DRAFT

Appendix 1. Scenarios from the Scientific and Statistical Committee

Scenario:	1	2	3	4	5	6	7	8
Life History Demographics	Yes	Yes	Not useful	Yes/No	Yes	Yes	Yes/No	Fishery Determined to be Underutilized
Representative Lengths	Yes	Yes	Yes	No	Yes	Yes	No	
-single time period (recent only)	Yes	Yes	Yes	No	Yes	Yes	No	
-multiple time period	Yes	No	Yes	No	Yes	Yes	No	
Catch	Yes	Yes	Yes	Yes	No	Yes	No	
No recruitment anomaly	Yes	Yes	Yes	NA	Yes	No	NA	
Can trend in stock be determined?	Yes	No	Yes	No	Yes	No	No	
Can stock status be determined?	Yes	Yes (with lag)	No	No	Yes	No	No	
Can OFL be determined?	Yes	No	No	No	No	No	No	
Can ABC be determined?	Yes	No	No	No	No	No	No	
Can ACL be determined?	Yes	No	No	No	No	No	No	
Management Advice	OFL would be >, =, or < recent catch based on ratio of F_{MSY}/F	Catch level should not exceed recent catch. If $F/F_{MSY}>1$ then reduce catch based on this ratio	If trend in F is increasing, catch level should be reduced from recent levels. If not, catch level should not exceed recent catch	Catch level should not exceed average catch in recent years (determined on a case-by-case basis	Can give management advice (e.g., effort), but not catch advice	The result is the same as Scenario 4. If it's possible to correct for the anomaly, it become the same as Scenario 1	Taking into account fishery independent research, control a fishery with the purpose of collecting needed data. Catch and/or effort is limited to what is required to collect sufficient data	Taking into account fishery independent research, control a fishery with the purpose of collecting needed data. Catch and/or effort is limited to control the rate of development of the fishery to avoid overshooting OFL
Notes	Decrease if Council wants to be precautionary. May take into account vulnerability using scalars	Decrease if Council wants to be precautionary. May take into account vulnerability using scalars. Catch would need to be set lower than in Scenario 1 because of single point estimate and possible lag time due to non-equilibrium status.*	Decrease if Council wants to be precautionary. May take into account vulnerability using scalars. Catch should not be increased if overfishing may be taking place	Decrease if Council wants to be precautionary. May take into account vulnerability using scalars	Council may place additional limits if it wants to be precautionary. May take into account vulnerability using scalars		Participation in the fishery is dependent on following all data collection protocols	

* SEDAR recommended treating this situation as having no length data (Scenario 4)

DRAFT

Appendix 2. Reef Fish FMU

Lutjanidae--Snapper
Unit 1
Silk snapper, *Lutjanus vivanus*
Blackfin snapper, *Lutjanus buccanella*
Black snapper, *Apsilus dentatus*
Vermilion snapper, *Rhomboplites aurorubens*
Unit 2
Queen snapper, *Etelis oculatus*
Wenchman, *Pristipomoides aquilonaris*
Unit 3
Gray snapper, *Lutjanus griseus*
Lane snapper, *Lutjanus synagris*
Mutton snapper, *Lutjanus analis*
Dog snapper, *Lutjanus jocu*
Schoolmaster, *Lutjanus apodus*
Mahogany snapper, *Lutjanus mahogani*
Unit 4
Yellowtail snapper, *Ocyurus chrysurus*
Serranidae--Sea basses and Grouper
Unit 1
Nassau Grouper, *Epinephelus striatus*
Unit 2
Goliath grouper, *Epinephelus itajara*
Unit 3
Red hind, *Epinephelus guttatus*
Coney, *Epinephelus fulvus*
Rock hind, *Epinephelus adscensionis*
Graysby, *Epinephelus cruentatus*
Creole-fish, *Paranthias furcifer*
Unit 4
Red grouper, *Epinephelus morio*
Yellowedge grouper, *Epinephelus flavolimbatus*
Misty grouper, *Epinephelus mystacinus*
Tiger grouper, *Mycteroperca tigris*
Yellowfin grouper, *Mycteroperca venenosa*
Haemulidae--Grunts
White grunt, *Haemulon plumieri*
Margate, *Haemulon album*
Tomtate, *Haemulon aurolineatum*
Bluestriped grunt, *Haemulon sciurus*

DRAFT

French grunt, *Haemulon flavolineatum*
Porkfish, *Anisotremus virginicus*
Mullidae--Goatfishes
Spotted goatfish, *Pseudupeneus maculatus*
Yellow goatfish, *Mulloidichthys martinicus*
Sparidae--Porgies
Jolthead porgy, *Calamus bajonado*
Sea bream, *Archosargus rhomboidalis*
Sheepshead porgy, *Calamus penna*
Pluma, *Calamus pennatula*
Holocentridae--Squirrelfishes
Blackbar soldierfish, *Myripristis jacobus*
Bigeye, *Priacanthus arenatus*
Longspine squirrelfish, *Holocentrus rufus*
Squirrelfish, *Holocentrus adscensionis*
Malacanthidae--Tilefishes
Blackline tilefish, *Caulolatilus cyanops*
Sand tilefish, *Malacanthus plumieri*
Carangidae--Jacks
Blue runner, *Caranx crysos*
Horse-eye jack, *Caranx latus*
Black jack, *Caranx lugubris*
Almaco jack, *Seriola rivoliana*
Bar jack, *Caranx ruber*
Greater amberjack, *Seriola dumerili*
Yellow jack, *Caranx bartholomaei*
Scaridae--Parrotfish
Blue parrotfish, *Scarus coeruleus*
Midnight parrotfish, *Scarus coelestinus*
Princess parrotfish, *Scarus taeniopterus*
Queen parrotfish, *Scarus vetula*
Rainbow parrotfish, *Scarus guacamaia*
Redfin parrotfish, *Sparisoma rubripinne*
Redtail parrotfish, *Sparisoma chrysopterum*
Stoplight parrotfish, *Sparisoma viride*
Redband parrotfish, *Sparisoma aurofrenatum*
Striped parrotfish, *Scarus croicensis*
Acanthuridae--Surgeonfishes
Blue tang, *Acanthurus coeruleus*
Ocean surgeonfish, *Acanthurus bahianus*
Doctorfish, *Acanthurus chirurgus*
Balistidae–-Triggerfishes
Ocean triggerfish, *Canthidermis sufflamen*
Queen triggerfish, *Balistes vetula*
Sargassum triggerfish, *Xanthichthys rigens*
Monacanthidae–-Filefishes

DRAFT

Scrawled filefish, *Aluterus scriptus*
Whitespotted filefish, *Cantherhines macrocerus*
Black durgon, *Melichthys niger*
Ostraciidae--Boxfishes
Honeycomb cowfish, *Lactophrys polygonia*
Scrawled cowfish, *Lactophrys quadricornis*
Trunkfish, *Lactophrys trigonus*
Spotted trunkfish, *Lactophrys bicaudalis*
Smooth trunkfish, *Lactophrys triqueter*
Labridae--Wrasses
Hogfish, *Lachnolaimus maximus*
Puddingwife, *Halichoeres radiatus*
Spanish hogfish, *Bodianus rufus*
Pomacanthidae--Angelfishes
Queen angelfish, *Holacanthus ciliaris*
Gray angelfish, *Pomacanthus arcuatus*
French angelfish, *Pomacanthus paru*
Aquarium Trade-data collection only
Frogfish, *Antennarius* spp.
Flamefish, *Apogon maculatus*
Conchfish, *Astrapogen stellatus*
Redlip blenny, *Ophioblennius atlanticus*
Peacock flounder, *Bothus lunatus*
Longsnout butterflyfish, *Chaetodon aculeatus*
Foureye butterflyfish, *Chaetodon capistratus*
Spotfin butterflyfish, *Chaetodon ocellatus*
Banded butterflyfish, *Chaetodon striatus*
Redspotted hawkfish, *Amblycirrhitus pinos*
Flying gurnard, *Dactylopterus volitans*
Atlantic spadefish, *Chaetodipterus faber*
Neon goby, *Gobiosoma oceanops*
Rusty goby, *Priolepis hipoliti*
Royal gramma, *Gramma loreto*
Creole wrasse, *Clepticus parrae*
Yellowcheek wrasse, *Halichoeres cyanocephalus*
Yellowhead wrasse, *Halichoeres garnoti*
Clown wrasse, *Halichoeres maculipinna*
Pearly razorfish, *Hemipteronotus novacula*
Green razorfish, *Hemipteronotus splendens*
Bluehead wrasse, *Thalassoma bifasciatum*
Chain moray, *Echidna catenata*
Green moray, *Gymnothorax funebris*
Goldentail moray, *Gymnothorax miliaris*
Trumpetfish, *Aulostomus maculatus*
Cardinal soldierfish, *Plectrypops retrospinus*
Batfish, *Ogcocephalus* spp.

DRAFT

Goldspotted eel, *Myrichthys ocellatus*
Yellowhead jawfish, *Opistognathus aurifrons*
Dusky jawfish, *Opistognathus whitehursti*
Cherubfish, *Centropyge argi*
Rock beauty, *Holacanthus tricolor*
Sargeant major, *Abudefduf saxatilis*
Blue chromis, *Chromis cyanea*
Sunshinefish, *Chromis insolata*
Yellowtail damselfish, *Microspathodon chrysurus*
Dusky damselfish, *Pomacentrus fuscus*
Beaugregory, *Pomacentrus leucostictus*
Bicolor damselfish, *Pomacentrus partitus*
Threespot damselfish, *Pomacentrus planifrons*
Glasseye snapper, *Priacanthus cruentatus*
High-hat, *Equetus acuminatus*
Jackknife-fish, *Equetus lanceolatus*
Spotted drum, *Equetus punctatus*
Scorpaenidae-scorpionfishes
Butter hamlet, *Hypoplectrus unicolor*
Swissguard basslet, *Liopropoma rubre*
Great soapfish, *Rypticus saponaceus*
Orangeback bass, *Serranus annularis*
Lantern bass, *Serranus baldwini*
Tobaccofish, *Serranus tabacarius*
Harlequin bass, *Serranus tigrinus*
Chalk bass, *Serranus tortugarum*
Caribbean tonguefish, *Symphurus arawak*
Seahorses, *Hippocampus* spp.
Pipefishes, *Syngnathus* spp.
Sand diver, *Synodus intermedius*
Sharpnose puffer, *Canthigaster rostrata*
Porcupinefish, *Diodon hystrix*

DRAFT

Appendix 3. Bycatch Practicability Analysis

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

A) Population effects for the bycatch species;
B) Ecological effects due to changes in the bycatch of that species (effects on other species in the ecosystem);
C) Changes in the bycatch of other species of fish and the resulting population and ecosystem effects;
D) Effects on marine mammals and birds;
E) Changes in fishing, processing, disposal, and marketing costs;
F) Changes in fishing practices and behavior of fishermen;
G) Changes in research, administration, and enforcement costs and management effectiveness;
H) Changes in the economic, social, or cultural value of fishing activities and nonconsumptive uses of fishery resources;
I) Changes in the distribution of benefits and costs; and,
J) 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.

Background

Bycatch practicability was first addressed in the Comprehensive SFA Amendment/Final EIS, which was approved by the agency on September 13, 2005 and the final rule published in the *Federal Register* on October 28, 2005, effective November 28, 2005 (70 FR 62073). The Comprehensive SFA Amendment contained a bycatch practicability analysis and evaluated the biological, ecological, social, economic, and administrative impacts associated with a wide range of alternatives including those required for achieving the bycatch mandates of the Magnuson-Stevens Fishery Conservation and Management Act. In summary, 4 alternatives including a "No Action" alternative were presented and impacts were described regarding bycatch reporting and are included herein by reference. Those alternatives in addition to no action proposed to: Develop a federal permit system for commercial and charter boat fishermen participating in Council-managed fisheries, with an associated mandatory monthly reporting requirement; utilize the MRFSS database to provide additional bycatch information on the recreational and subsistence sectors; and consult with Puerto Rico and the USVI in an effort to modify the trip ticket system currently in place in the U.S. Caribbean to require standardized collection of bycatch data.

Also, measures were included in the Comprehensive SFA Amendment to minimizing bycatch and bycatch mortality to the extent practicable. The analysis of the practicability of these measures is provided in Section 6.6.2 of that amendment and is herein included by reference.

To summarize, 4 alternatives including a "No Action" alternative were presented and impacts were described regarding minimizing bycatch and bycatch mortality and are included herein by reference. Those alternatives in addition to no action proposed to: Increase the minimum allowable mesh size for fish traps; establish a minimum mesh size of two inches and a maximum mesh size of six inches, stretched mesh, for gill and trammel nets. Additionally, gill and trammel nets must be tended at all times; and amend current requirements for trap construction such that only one escape panel be required, which could be the door.

Puerto Rico

There are scant data on commercial and recreational bycatch in the U.S. Caribbean region. Rosario (1993) estimated, based on fishery-independent data from the SEAMAP-Caribbean program collected off the west coast of Puerto Rico, that about 14% by number and 17% by weight of the fish caught in the commercial hook and line fishery are species with low market value, including squirrel fishes, butterfly fishes, doctorfishes, puffers, filefish, and scorpion fish. Matos-Caraballo (2007) surveyed a limited number of fishers from the west coast of Puerto Rico in 2004-2005 and a limited number of gears (traps, beach seine and trammel nets). Beach seines, the gear with the highest rate of discard mortality, are not used in the EEZ. Trammel nets were ban from the EEZ in 2005 (CFMC 2005) but were reported to produce little by-catch. Unfortunately, the information

provided is very limited. However, anecdotal information suggests that the vast majority of fish harvested in the U.S. Caribbean are retained for the market or for personal use – including species with low market value. With the exception of species that are commonly believed to be ciguatoxic, economic discards in this region appear to be minimal. Regulatory discards may potentially include the following species:

- Nassau grouper. Federal, state, and territorial laws require that Nassau grouper landed in the U.S. Caribbean be returned to the water;
- Goliath grouper. Federal, state, and territorial laws require that Goliath grouper landed in the U.S. Caribbean be returned to the water;
- Butterfly fish. The harvest of some species of butterfly fish (*Chaetodon spp.*) is not prohibited in federal waters (CFMC 2005) but it is prohibited in the state waters of Puerto Rico. The USVI has permitted the catch of a small number of these species for scientific research/educational purposes;
- Sub-adult yellowtail snapper. Federal law requires that catches of yellowtail snapper under 12 inches in fork length be returned to the water (yellowtail snapper are not regulated in the state waters of the USVI, and the minimum size in Puerto Rico waters is 10.5 inches) SL, about the same as in federal waters;
- Sub-adult and berried spiny lobster. Federal, state, and territorial laws prohibit the harvest of spiny lobster under 3.5 inches in carapace length and berried spiny lobsters (this size limit also applies to Panulirus argus imports into the U.S. Caribbean (CFMC 2008); and,
- GU3, GU4, SU1. Federal law prohibits fishing for and possession of fish within these FMUs during the closed seasons. State and territorial laws also prohibit fishing for and possession of species within these FMUs during the closed seasons to varying degrees. Depending on the species and depth of the fishing activity, there might be high mortality.

USVI

In 2006, a pilot research study to deploy observers in St. Thomas (USVI) fisheries was conducted and also examined bycatch composition of several fishing gears (Trumble et al. 2006). The primary purpose of this project was to assess the potential for obtaining information on bycatch, discards, and biological data from commercial fisheries in the USVI. The project focused on gears typically used on the continental shelf platform of St. Thomas: fish traps, lobster traps, seine nets, and hook and line. One of the findings of this study was problems of data bias occur when placement of observers on vessels is voluntary because fishers may operate differently when observers are on board.

Summary results of the bycatch portion of the study, all gears combined, indicated 78% of the fish discarded as bycatch were smaller than the marketable size. Of these discards 56% were either small box fish (Ostraciidae) or surgeon fish (Acanthuridae). These discards have been reported as being due to market preferences and are released alive. Also, fishers affirm that the risk of ciguatera fish poisoning negates the marketability for some species, accounting for nearly 14% of the discarded finfish. Virgin Islands

consumers eat a wide variety of species so that species discarded in other regions are often marketed and consumed in this area. A total of 89 species were found in the landed catch. Thus, it not unexpected that only 9% of the by catch was made up of unacceptable species. Finally, fishermen had said that when the market was filled with a particular species, they discarded those fish at sea. Use of bycatch for bait is an insignificant element of the by catch.

Summary

The extent of these regulatory discards has not been quantified. In the past, the regulatory requirements forcing fishermen to discard these species were difficult to enforce because regulations were generally less restrictive in state waters. So, for example, the captain/crew of a boat boarded in the U.S. EEZ could claim that any prohibited and/or undersized species onboard were captured in state waters. The mortality rates associated with commercial and recreational bycatch also have not been quantified, but generally increase with depth (e.g., finfish taken from deeper water generally have a lower survival rate when returned to the water).

Due to the nature of Caribbean fisheries, it is unlikely that any of the alternatives in the Comprehensive SFA Amendment would significantly reduce bycatch. Most Caribbean fishermen utilize all they catch, and those fisheries that are noted for producing large amounts of bycatch (e.g., trawling) are essentially absent from the U.S. Caribbean. Thus, bycatch is not as significant an issue in the U.S. Caribbean compared to other regions. What little bycatch occurs is generally confined to regulatory discards, which would be minimally affected by the gear restriction alternatives evaluated here. Such discards will likely be further reduced if preferred alternatives identified in other sections of this amendment are retained and implemented (e.g., prohibition on filleting fish at sea). In summary, the direct effects to the biological environment from any of these alternatives would be minimal. The effects of the management regime implemented in 2005 have not been fully assessed to determine the impact of bycatch.

One or more alternatives may result in a direct, but relatively minor, effect to the socioeconomic and administrative environment, due to the required modifications of fishing gear. In contrast, anecdotal information suggests that the only reason for large-mesh net fisheries is to illegally fish for turtles. Similarly, most trap fishermen already only employ one escape panel door. Regardless, the Council also opted to prohibit the use of gill and trammel nets in the EEZ (excluding some bait and species not managed by the FMP), primarily to reduce fishing mortality, though it will also have ancillary benefits in the reduction of bycatch.

The alternatives implemented for the EEZ in 2005 were to varying degrees also implemented in state and territorial waters in the U.S. Caribbean. Additionally, Puerto Rico has implemented additional regulations for the commercial and recreational harvest. Both Puerto Rico and the USVI governments, in cooperation with the fishers, SEFSC, SERO, and the CFMC, are actively involved in the development of new data gathering forms and improving the quality of the catch reports and trip interview programs.

In the current amendment bycatch in commercial and/or recreational fisheries may be affected through alternatives presented and described to revise/establish management reference points (MSY, OY, OFL, and ACL), allocate resources (based on species/species group, recreational and commercial sectors, and geographic criteria), and establish parrotfish management measures and establish recreational bag limits. The 10 factors, listed below (A-J) should be considered in determining whether a management measure minimizes bycatch or bycatch mortality to the extent practicable.

A) Population effects for the bycatch species: Management measures presented in this amendment may have an indirect but slight impact on minimizing bycatch. If measures redefining management reference points result in more conservative estimates of MSY and OY, conservative establishment of OFLs and ACLs, and with these measures there is a high compliance to regulations, fishing effort would be expected to be reduced in proportion to the more conservative catch allowances resulting in a reduction in bycatch and bycatch mortality.

B) Ecological effects due to changes in the bycatch of that species (effects on other species in the ecosystem): If management develops conservative measures as cited in (A) above, slightly less bycatch and bycatch mortality would be expected, although natural variation may mask such a result. Theoretically, in response to such conservative management, the coral reef ecosystem would become better balanced as a result of more intact trophic and predatory interactions due fewer non-target individuals being extracted or dying from the impacts of capture and release to the natural system.

C) Changes in the bycatch of other species of fish and the resulting population and ecosystem effects: Same as (C) above.

D) Effects on marine mammals and birds: Because fishers in this area traditionally utilize most resources harvested, the amounts of bycatch resulting from proposals in this amendment are not expected to change, so little to no affect to mammals or birds is expected.

E) Changes in fishing, processing, disposal, and marketing costs: If management chooses the most conservative and restrictive proposals in this amendment one might expect changes to fishing in that more fishing effort might take place after implementation of the amendment to hedge against closure once limits are reached. Such a change may result in a proportionate change in bycatch or bycatch mortaility. If this occurs, AMs would be triggered to reduce the length of the fishing season in subsequent fishing yeatrs, thereby minimizing bycatch.

F) Changes in fishing practices and behavior of fishermen: Regardless of the conservative degree management takes in responding to the proposals of this

amendment, changes to fishing practices are not expected to result in higher or lesser degrees of bycatch. Fish traps, hook-and-line, and spearfishing have been the most successful fishing practices and these practices are not expected to change without further regulations. Bycatch is not expected to change from its current level.

G) Changes in research, administration, and enforcement costs and management effectiveness: Research and monitoring is needed to understand the effectiveness of proposed management measure in reducing bycatch. Additional work is needed to determine the effectiveness of measures being developed in this amendment and by future actions being considered by the Council to reduce bycatch. A Data Collection Improvement Program is being developed in the region in cooperation with local governments and NMFS, which if funded should begin accumulation of information needed to assess bycatch questions. Additional administrative and enforcement efforts will be needed to implement and enforce these regulations.

H) Changes in the economic, social, or cultural value of fishing activities and nonconsumptive uses of fishery resources: Proposed management measures, including those that are likely to increase or decrease discards could result in social and/or economic impacts as discussed in Section 4.

I) Changes in the distribution of benefits and costs: Attempts were made to ensure reductions provided by proposed management measures are equal in the commercial and recreational sectors. The extent to which these management measures will increase or decrease the magnitudes of discards is not clear. Potential increases in dead discards are taken into consideration in bag and size limits, setting commercial quotas, and determining the effectiveness of a seasonal closure. It is unlikely that the magnitude of discards will be the same in the commercial and recreational sectors. Commercial fishermen generally catch fewer small fish than recreational fishermen with the possible exception of spear gear where the size distribution of the catch is similar.

J) Social effects: The social effects of all the management measure, including those most likely to reduce bycatch, are described in Section 4.

Conclusion

This section evaluates the practicability of taking additional action to minimize bycatch and bycatch mortality in the Caribbean reef fish and queen conch fisheries using the ten factors provided at 50 CFR 600.350(d)(3)(i). In summary, the proposal of closing a fishery when an ACL is met could help to reduce bycatch. It is likely that some management measures such as reduced or new quotas, bag limits, and increased size limits could increase the number of discards. However, this depends on if fishermen shift effort to other species, seasons, or fisheries and if effort decreases in response to more restrictive

management measures as well as changes in community structure and age/size structures that could result from ending overfishing. Potential increases in dead discards are taken into consideration in bag and size limits, setting commercial quotas, and determining the effectiveness of a seasonal closure. Furthermore, overall fishing effort could decrease in the commercial and recreational sectors in response to more restrictive management measures, thereby reducing the potential for bycatch.

Overlapping seasonal closures could be expected to reduce bycatch and fishing mortality of many co-occurring species. The relative abundance, size structure, and age structure of other species in reef communities could be expected to change in response to reduced fishing pressure on species as a result of this amendment as well as potential shifts in effort. Thus, ecological changes could occur in the community structure of reef ecosystems through actions that would end overfishing. These ecological changes could affect the nature and magnitude of bycatch over time. Additional measures to reduce bycatch are being developed. The Comprehensive 2011 ACL Amendment could propose additional measures to reduce bycatch in the reef fish fishery. For example, species grouping based on biological, geographic, economic, taxonomic, technical, social, and ecological factors will be proposed in that amendment.

DRAFT

Appendix 4. Scoping Locations and Outcomes

RESPONSE TO PUBLIC COMMENTS

Public Hearings will be conducted after the Draft Public Hearing Document on ACLs and AMs is presented at the 134th CFMC Meeting.

Summary Scoping Meetings

This section summarizes testimony on earlier drafts of the scoping and options documents presented at ten public meetings or submitted in writing to the Caribbean Fishery Management Council and/or the NOAA-Fisheries during the public scoping period. The scoping documents are included in Appendices S-1 and S-2 as well as the summary minutes of the oral testimony received. Written comments received during each of the meetings are available from the Caribbean Fishery Management Council.

The first draft of the scoping document for Amendments to the Queen Conch and Reef Fish FMPs included 13 Actions, 51 Alternatives, and 69 sub-alternatives (See Appendix S-1). These draft scoping documents are prepared in both English and Spanish and mailed to individual fishers (both commercial and recreational), divers, charters, interested parties (scientists, academics, news media, general public), fishing associations, clubs, and marinas. Announcements for the meetings are published in the CFMC web site (http://www.caribbeanfmc.com), in the local newspapers, both in English and Spanish and in the Federal Register (FR Volume 74, No. 69: 16846-16850, Monday, April 13, 2009; FR Volume 74, No. 145: 37981-37986, Thursday, July 30 2009). The second draft scoping document contained 13 actions, 52 Alternatives, and 78 sub-alternatives responding to the comments received at the public meetings (See Appendix S-2). The comments from the public meetings were presented at the CFMC Regular Meetings number 131 (June 2009) and 132 (September 2009).

The Draft Scoping Document on Annual Catch Limits and Accountability Measures to amend the Queen Conch and Reef Fish FMPs (dated March 25, 2009) was taken to public meetings first during the period April 27 to May 7, 2009 and then (Scoping Document dated July 14 2009) in August 18-19, 2009. The following table summarizes the locations, dates, and public attendance as well as number of comments received at these meetings. Each scoping document included alternatives suggested at the public meeting and approved by the CFMC. The CFMC discussed the results of the scoping meetings during its 131st and 132nd meetings.

All comments received were addressed by the CFMC at the 131st and 132nd meetings. Although well attended, the results from the public meetings in the U.S. Virgin Islands yielded a No Action for every one of the alternatives presented in the scoping documents.

However, the written comments received from the St. Thomas Fishermen's Association included additional alternatives to determine ACLs. These were reviewed by the SEFSC and the SSC and addressed during the 132nd CFMC meeting.

Scoping Meetings ACLs and AMs

Place	Date	Attendance	Deponents
San Juan	April 27 2009	22	1** (representing 21)
San Juan	August 19 2009	0	0
Ponce	April 28 2009	2	0
Fajardo	April 29 2009	0	0
Mayaguez	May 4 2009	10	2
Mayaguez	August 18 2009	7	6
St. Thomas	May 6 2009	47	5
St. Thomas	August 18 2009	40*	10
St. Croix	May 7 2009	48	4
St. Croix	August 19 2009	17	7

*St. Thomas Fisherman Association presented 33 signatures
** Representing the Free Divers Association

The most relevant issues discussed during the scoping meetings were the need to (1) consider the landings by area for each separate Island and not in combined form, (2) account for the changes in the fishery after the SFA management measure went into effect in 2005, (3) account for the lack of enforcement, (4) account for the lack of information on the recreational sector, and (5) account for the lack of monitoring and data.

The Options Paper was presented at the CFMC 133rd meeting and additional alternatives were discussed and approved by the CFMC to be included in the public hearing draft. The Options paper was dated December 2, 2009. The CFMC reviewed the first draft of the Public Hearing Document at its 134th meeting (April 2010) and approved the document to be taken to public hearings.

The Public Hearing Draft (this document) includes many changes and a reorganization of the scoping and options paper. The original actions are discussed below and are referenced to the decisions of the CFMC and the new sections of the Public Hearing Draft (this document). The two scoping documents included the following actions differing in the alternatives and sub-alternatives as modified by the ACLG and SSC recommendations, CFMC and public comment (See Appendices S-1 and S-2). The

comments received are summarized under each Action. (Refer to Appendix 5 for the alternatives presented under each Action).

Action 1: Amending the Stock Complexes in the Reef Fish Fishery Management Unit

Parrtofish: Most comments agreed with separating the blue, rainbow, and midnight parrotfish and limiting their harvest; SSC and ACLG also recommended separating these species.

Grouper Unit 4: Misty and yellowedge grouper are harvested from deeper waters than the other species in the unit. There was one comment on the need to evaluate red grouper since it has disappeared from shallow waters.

Snapper: concurrence with the changes proposed.

This Action remains the same in the Public Hearing Draft (this document), as Action 1, except for the parrotfish being considered one unit (rather than 2) due to the lack of species specific data.

Action 2: Annual Catch Limits for Queen Conch (*Strombus gigas*) off St. Croix

Comments on determining ACLs for the USVI included (1) a need for enforcement of the regulations that are put in place (quota and bag limits), and (2) the need to monitor the resource and re-evaluate the overfished designation.

Comments received in Puerto Rico included the need to assess the conch population in the EEZ (now closed).

Action 3: Annual Catch Limits for Parrotfish Unit 1 and Parrotfish Unit 2

Some suggested that parrotfish be allocated to the recreational fishers and managed by bag limits.

Divers seek to harvest the largest individuals to set a record (as trophy fish).

Action 4: Annual Catch Limits for Grouper Unit 4

Commercial fishers suggested that the grouper in this unit be monitored before establishing an ACL.

St. Thomas fishers argued that with the establishment of the seasonal closure for GU4 and the seasonal area closure established in Grammanik Bank, there was no need to establish an ACL or to regulate these species further. USVI fishers also argued that some species within this unit are ciguatoxic and not harvested and therefore there is no need to establish an ACL or regulate these species further.

Action 5: Annual Catch Limits for Snapper Unit 1

USVI fishers argued that the species within the SU1 are not fished in St. Thomas and are not overfished but is a fishery that can expand. Puerto Rico fishers argue that based on information from the SEFSC there was room for expansion of this fishery.

All these Actions (2, 3, 4, and 5) from the scoping documents have been combined into Actions 2 and 3 of the Public Hearing Draft (this document). These are discussed under the re-definition of the management references points in pre- and post-SFA and the re-determination of these reference points in relation to ACLs for queen conch, SU1, GU4, and parrotfish.

Action 6: Annual Catch Limits for the Recreational Sector

Most recreational fishers supported an equal ACL for the recreational and commercial sectors based on the higher number of recreational fishers and the fact that both target the same species.

Most commercial fishers supported limits to the recreational harvest (10%, 25% of the commercial catch). Others suggested a 50:50 distribution between the commercial and recreational sectors for the ACL for all species.

Most comments received discussed the need for recreational fishing licenses and permits as well as the requirement to submit landings data after every trip as the commercial fishers are required to do. Comments also included the need to limit the recreational catch through quotas and bag limits.

Action 3 of the Public Hearing Draft includes the determination of ACLs allocation and management.

Action 7: Accounting for Uncertainty

Most comments received supported no scalar or the less restrictive reduction in harvest.

Action 2 of the Public Hearing Draft addresses uncertainty. All recommendations for scalars have been included.

Action 8: Alternative Methods for Reducing Fishing Mortality and Establishing ACL Proxies

This alternative originally included additional closures in the U.S. Caribbean EEZ and was rejected by the public and the CFMC. Among the issues raised by the public was (1) the lack of monitoring of the closed areas already in place, (2) the restrictive nature of the

closures, (3) the use of other management alternative such as bag limits, quotas, seasonal closures, and (4) the lack of information on the economic impact of the closures. Action 8 included, among the alternatives to reduce fishing mortality, a number of proposed area closures for the U.S. Caribbean EEZ. These alternatives were the most contentious and least accepted by the public and the Council. These alternatives were not considered in the July 15, 2009 draft of the scoping document and subsequent discussion at the Council.

Action 4 of the Public Hearing Draft addresses management measures including the recommendations of the public (bag limits for the recreational sector), among others, but no closed areas.

Action 9: Permits

The local governments have established or are establishing licenses and permits for the commercial and recreational fishers. Most commenters support the issuing of federal permits but reducing duplicaction.

This Action is not included in the Public Hearing Draft since the CFMC will develop a separate amendment for permits in the EEZ.

Action 10: Monitoring and Enforcement of Annual Catch Limits

This action received the most comments including: (1) the need to enforce the regulations in place (selling of the recreational catch, poaching of traps and during the seasonal closures, poaching in the closed areas) (2) monitor the closed areas specifically with the help of the commercial fishers, (3) the need to carry outreach and educate fishers on the regulations and data collection.

The CFMC discussed the need for monitoring and enforcement not only of the ACLs but of the management measures in place. The necessary steps to monitor the ACLs are already underway including improvements to the data collection programs and additional efforts to collect fisheries data, among others.

Action 11: Accountability Measures

The triggering of the accountability measures was of great concern to the fishers because of the time it takes to analyze the data and the lack of data from the recreational sector.

Action 5 in the Public Hearing Draft was expanded to accommodate the changes suggested to the now Action 2 in the Public Hearing Draft regarding management reference points and ACLs. All recommendations on the use of scalars to deal with uncertainty have been included.

Action 12: Allowable Gear for Reef Fish

The comments received included (1) allow use of spear by commercial fishers, (2) do not allow the use of powereheads by either commercial or recreational fishers, (3) nets are already prohibited in the EEZ and (4) do not allow trawling in the area.

This action was removed from the Options Paper and Public Hearing Draft because the necessary changes to the allowable gears in the US Caribbean EEZ can be achieved through technical amendments.

Action 13: Establish Framework Measures for ACLs and AMs in the Reef Fish FMP

This is Action 6 in the Public Hearing Draft.

All the issues addressed by the public have been discussed at each CFMC meeting following public meetings, subsequently revised, and the new document presented (Public Hearing Draft) is much less complex than the scoping documents. However, the determination of ACLs and AMs is the core of the document to be considered by the Council. The CFMC meeting at which results from the scoping meetings were discussed included meeting numbers 130th, 131st, 132nd and 133rd. Verbatim transcriptions of the Council meetings are all available at the Council Office.

DRAFT

Appendix S-1

CARIBBEAN FISHERY MANAGEMENT COUNCIL
268 MUNOZ RIVERA AVE. SUITE 1108
SAN JUAN, P. R. 00918-1920
ACLs SCOPING MEETINGS
SAN JUAN,PR
APRIL 27, 2009
SUMMARY MINUTES

The meeting was called to order at 7:25 pm. Mr. Eugenio Pineiro welcomed the attendees. A brief explanation of the ACLs and alternatives was presented by Graciela Garcia-Moliner.

A total of 22 participants were present. Council and staff members present were Gracie1a GarciaMoliner, Iris Oliveras, and Eugenio Pineiro.

Comments:
1. Roberto Reyes - Puerto Rico Freedivers, and member of the Council's AP. (Mr. Reyes a viva vocce requested and was granted support for his comments on the ACL alternatives as presented below. Free divers or apnea divers are recreational fishers harvesting fish with spears.)
Action 1 - Amend the Stock Complexes in the Reef Fish Fishery Management Unit
• Suggests that the midnight and rainbow parrotfish species be separated from the rest of the parrotfishes.
• Requested that a quota be established for recreational fishers (free divers). Free divers are interested in record fish by spear fishing and he stated that the divers can select the largest fish.
• Limit of 1 of the 3 parrotfish per person per day; the records are from Puerto Rico (largest individuals) for midnight and rainbow.
• They had no comments in the SUI (too deep for apnea or free diving)
Action 2 - ACLs for Queen Conch in St. Croix (Does not apply to PR)
Action 3 - ACLs for Parrotfish Unit 1 and Parrotfish Unit 2
• Proposes to establish an ACL for parrotfish units and divide it on a 50/50 between the commercial and recreational fishers. For example, multiply the average amounts calculated from the commercial catch by 2 and then divide it by 2. (e.g., 80,000 x 2 = 160 -;. 2= 80,000 pounds for each sector).
• The commercial and recreational fishers fish the same kind of fish and in the same areas.
• Tbere are many more recreational fisbers than commercial fishers.
• Need data from the recreational fisbing activity.
Action 4 - Annual Catch Limits for Grouper Unit 4

• Red grouper is rarely seen in the free diving depth range, suggested it be treated as the Nassau grouper, as threaten.
Action 5 -ACLs for Snapper Unit 1
• Suggests that equal amounts be established for commercial and recreational fishers of 374,000 pounds for each sector.
Action 6 - Annual Catch Limits for Recreational Fishing
• As in Alternative 3, use recreational fishing average landings in Puerto Rico, and if no data is available, establish a 50% for recreational and 50% commercial. (The ACL calculated for the commercial sector is used to establish the ACL for the recreational sector. See Action 5 above.)
• Suggest that Charters be included in the commercial sector. Numbers reported to MRFSS, be reported as commercial.
Action 7 - Accounting for Uncertainty
• No comments.
Action 8 - Alternative Methods for Reducing Fishing Mortality and Establishing ACL Proxies
• No closed areas (No to Alternatives 2, 3, and 4.) because these are too restrictive.
• Alternative 5 - Instead of closing areas (a) establish daily quotas for charters and recreational fishers, (b) catch and release for charters, (c) establish bag limits of 1 fish per day for recreational fishers, (d) use the recreational limits and regulations established by the PR-DNER (e.g. no SCUBA and spear for harvesting fish), (e) selectivity by gear (e.g., spears) also reduce by catch.
Action 9 - Permits
• Need to establish a recreational license, once established by the local government do not duplicate in the federal government. If there is a fee for the license/permit the money should go to the government of Puerto Rico. Only if moneys go to PR would they agree with the federal permits, otherwise, No Action.
Action 10 - Monitoring and Enforcement
• Alternative 4 is the preferred.
Action 11 - Accountability Measures
• Alternative 2, Sub-alternative A (one year) and Alternative 6.
Action 12 - Allowable Gear for Reef Fish
• Spear fishing is allowed.
• Do not allow powerhead in either the commercial and recreational sectors.
Action 13
• Alternative 2.

2. Rodolfo Abrams Palomares - Commercial Fisher - Toa Baja, PR
Action 1 - Amend the Stock Complexes in the Reef Fish Fishery Management Unit
• Suggests that the midnight and rainbow parrotfish species be separated from the rest of the parrotfishes; these are deep water species.
• Allow only recreational harvest.
• No changes suggested for the other fish units.
Action 2 - ACLs for Queen Conch in St. Croix (Does not apply to PR)
Action 3 - ACLs for Parrotfish Unit 1 and Parrotfish Unit 2
• Many commercial fishers do not have a commercial fishing license, many pass as

recreational fishers
• No changes noticed in the amount of fish being harvested.
Action 4 - Annual Catch Limits for Grouper Unit 4
• Red grouper is a small grouper that has been fished and there is a need to evaluate the species and treat it as a separate unit.
Action 5 -ACLs for Snapper Unit 1
• Keep the ACLs separate for Puerto Rico.
Action 6 - Annual Catch Limits for Recreational Fishing
• As in Alternative 3, use recreational fishing average landings in Puerto Rico, and if no data is available, establish a 50% for recreational and 50% commercial. [The ACL calculated for the commercial sector is used to establish the ACL for the recreational sector. See Action 5 above.]
• There are no real data from the recreational sector.
Action 7 - Accounting for Uncertainty
• No Action
Action 8 - Alternative Methods for Reducing Fishing Mortality and Establishing ACL Proxies
• No closed areas (No to Alternatives 2, 3, and 4.
• PR-DNER needs to focus more on outreach and education rather than enforcement. Need to work more with the commercial and recreational fishers.
Action 9 - Permits
• Need to establish permits as long as the moneys collected from these stays in Puerto Rico, otherwise, No Action.
Action 10 - Monitoring and Enforcement
• Alternative 4 is the preferred.
Action 11 - Accountability Measures
• Alternative 2, Sub-alternative A (one year) and Alternative 6.
Action 12 - Allowable Gear for Reef Fish
• Spear fishing is allowed for commercial and recreational fishing.
Action 13
• Alternative 2.

General Comments:
• Concerns about the reporting by recreational fishers, how the reporting is done and what is reported.
• Request from the PR DNER educate recreational fishers I
• PR-DNER should assign additional funds for education.
• Assign funds for outreach on the use of anchoring buoys.
• There is an urgent need for timeliness on the use of data.
• Enforcement Agents should be more courteous.

The meeting was adjourned at 10: I0 pm.

DRAFT

CARIBBEAN FISHERY MANAGEMENT COUNCIL
268 MUNOZ RIVERA AVENUE, SUITE 1108
SAN JUAN, PUERTO RICO 00918
SCOPING MEETING
ANNUAL CATCH LIMITS (ACLs) AND
ACCOUNTABILITY MEASURES (AMs)
PONCE,PR
APRIL 28, 2009
SUMMARY MINUTES

Council's Chainnan, Mr. Eugenio Pineiro opened the meeting at 7:55pm. A brief description of the ACLs background and the different alternatives for the ACLs were presented by Graciela GarciaMoliner.

A total of 2 participants were present. Council staff members attending this meeting were Graciela Garcia-Moliner, Iris Oliveras, and Eugenio Pifieiro, Council Chair, Mr. Miguel A. Rolon, Executive Director.

General Comments:

1. Maria Roman - Peseaderia City Island - Juana Diaz, and Julio Reyes, President of the "Asociacion de Pescadores Paseo Costero del Sur de Juana Diaz (previously Pastillo).
• They are worried about not having recreational statistics.
• There are no fishing regulations for recreational fishers and there are many of them
• Recreational fishing could be controlled using catch and release and bag limits.
• Regarding the charters, if customers are paying $500 for the trip, they should be allowed to keep the fish. There should also be catch and release for fish that the customer is not keeping.
• Have noticed a large decrease in the use of traps because of poaching and theft. This problem requires the presence of DNER Rangers or police. The trap fishers in the area use no GPS, no winch but still the cost oftrap construction has increased significantly.
• There are lots of restrictions on commercial fishing, but no effort to attract new, young fishers.
• Is very hard these days to make a living from fishing due to increased costs of materials.

Meeting adjourned at 9:00 pm.

CARIBBEAN FISHERY MANAGEMENT COUNCIL
268 MuNoz RIVERA AVE. SUITE 1108
SAN JUAN, P. R. 00918-1920
ACLs SCOPING MEETINGS
APRIL 29, 2009
FAJARDO,PR
SUMMARY MINUTES

There were no participants at this meting. Council staff members present were Graciela Garcia-Moliner and Iris Oliveras. Marcos Hanke acted as chairman.

Meeting adjourned at 9:30pm.

DRAFT

CARIBBEAN FISHERY MANAGEMENT COUNCIL
268 MUNOZ RIVERA AVENUE, SUITE 1108
SAN JUAN, PUERTO RICO 00918
SCOPING MEETING
ANNUAL CATCH LIMITS (ACLs) AND
ACCOUNTABILITY MEASURES (AMs)
MAYAGUEZ, PUERTO RICO
MAY 4,2009
SUMMARY MINUTES

The scoping meeting was held at the Mayagiiez Resort and Casino, in Mayagiiez, Puerto Rico, and was chaired by Mr. Marcos Hanke, CFMC Member.

Mr. Miguel Rolon gave a PowerPoint presentation (attached) on the proposed management measures for *ACLs/AMs,* and explaining the new requirements of the Magnuson Stevens Act.

A total of 10 people attended the meeting:
Following are the comments offered by the attendees:

1. Nelson Crespo - Commercial Fisherman
• A written statement was provided and read for the record. (Attached as part of the minutes.)

2. Fred Lentz - Commercial Fisherman
• A written statement was provided and read for the record. (Attached as part of the minutes.)

3. Jasmin Seda - Commercial Fisher
• Recommends to divide ACLs by Islands (Puerto Rico, St. Thomas, St. Croix, St. John)
• Monitoring is very important. How will it be done?
• The port agents should be the ones collecting the statistics from the fishermen as they used to
do before. It is more effective if it is done this way.

4. Alexander Hermindez Rodriguez - Commercial Fisherman
• The problem is that there is not good enforcement of the existing regulations.
• The recreational fishers are selling their catch to the local restaurants, and this is an illegal
practice since recreationals cannot sell their eatches. This hurts the commercial fishermen

who depend on selling the catch to support their families.
• The recreational fishermen should also report their catches.

The meeting was adjourned at 9:30 p.m.

Appendix S-2

CARIBBEAN FISHERY MANAGEMENT COUNCIL 268 MUÑOZ RIVERA AVE.
SUITE 1108 SAN JUAN, P. R. 00918-1920
ACLs SECOND SCOPING MEETING MAYAGÜEZ RESORT & CASINO HOTEL
AUGUST 18, 2009
SUMMARY MINUTES

The meeting was opened at 8:05 pm. The Council's Chairman, Mr. Eugenio Piñeiro read the Protocol for this meeting. The different alternatives for the ACL's were presented by Graciela García-Moliner.

A total of 7 people present, 6 were commercial fishers. Council and staff members present were Graciela García-Moliner, Iris Oliveras, and Eugenio Piñeiro.

Comments:

4.1 Action 1: Amending the Stock Complexes in the Reef Fish Fishery Management Unit

Alternative 2. Modify the FMU by:

Sub alternative A. Separating the Parrotfish Unit into 2 complexes. Parrotfish Unit 1 would include princess, queen, redfin, redtail, stoplight, redband, and striped parrotfishes and Parrotfish Unit 2 would include blue, midnight, and rainbow parrotfishes.

1. Victor Padilla – Commercial Fisher - El Seco, Mayagüez

Separate parrotfishes in two groups; the large ones and small ones.

2. General comment

Not much of a parrotfish fishery in the west coast of Puerto Rico; those present were mostly deep water snapper fishers and divers; one trap fisherman.

Sub alternative B. Separate Grouper Unit 4 into Grouper Unit 4 (yellowfin, red, tiger, and black grouper) and Grouper Unit 5 (yellowedge and misty grouper). Add black grouper to Grouper Unit 4.

1. Victor Padilla – Commercial Fisher - El Seco, Mayagüez

Separate them in two units. Deep water groupers and shallow water groupers. Concurred

that the yellowedge and misty should be a separate unit.

Sub alternative C. Add cardinal snapper (Pristipomoides macrophthalmus) to Snapper Unit 2 and move wenchman (Pristopomoides aquilonaris) into Snapper Unit 1.

1. General comment
Concurred that the cardinal snapper should be with the queen snapper. The wenchman is caught with the silk snapper and not much of a fishery. Whatever is reported in Puerto Rico as wenchman is really cardinal snapper.

4.2 Action 2: Annual Catch Limits for queen conch (Strombus gigas) off St. Croix

1. General comments

There were questions about the re-opening of the queen conch fishery in the EEZ off the west coast of Puerto Rico. Also, the fishers present voiced complaints about those fishers not abiding by the law (size and seasonal closure) and the indiscriminate harvest by recreational fishers of juvenile conch.

The fishers voiced a general concern about the lack of enforcement of the fishing regulations on the recreational sector.

The fishers voiced a general concern about the lack of recreational fishing license, fishing regulations, fishery statistics and interventions by the rangers and the USCG. Also, there are concerns about the recreational or non-licensed fishers selling the catch to restaurants and other dealers.

There is a need to reach out to the restaurants and fish buyers regarding the need to buy their fish from licensed commercial fishers.

4.3 Action 3: Annual Catch Limits for Parrotfish Unit 1 and Parrotfish Unit 2

Alternative 3. Set the ACL for Parrotfish Unit 1 off Puerto Rico equal to:

Sub alternative B. Establish an ACL of 80,000 pounds based on the average landings during 1999-2006. (ACLG February 2009 recommendation)

1. General comment

Although the fishers present are not harvesters of parrotfish, their main concerns were with the recreational harvest: (1) there should be a limit to the recreational landings of 25% or less of the total commercial catch; (2) there should be no selling of the catch by recreational fishers or non-licensed commercial fishers; (3) need the landings statistics from the recreational fishing sector.

2. Pedro Silva – Commercial Fisher - Mayagüez

Establish a limit for recreational of only 25% of the 80,000 pounds= 20,000 pounds or less

Alternative 6. Set the ACL for Parrotfish Unit 1 in the U.S. Caribbean equal to:

Sub alternative A. Zero for the EEZ and do not establish an ACL for state waters, but rely on the data collection program (described in Action 10) and revisit ACL for parrotfish five years after implementation of data collection program.

Sub alternative B. 380,000 pounds based on the average landings during 1999-2006.

Sub alternative C. The average landings during 1994-2006 multiplied by an uncertainty scalar (see Action 7 for uncertainty scalar).

1. General comment

The general consensus was that there should be ACLs separate for each Island; not to go back to having one fishery for the US Caribbean.

4.4 Action 4: Annual Catch Limits for Grouper Unit 4

Sub alternative C. 15,000 pounds, based on the average corrected landings for identified Grouper Unit 4 species during 1994-2006 plus the average proportional corrected landings estimate for Grouper Unit 4 species landed in the generic "Sea Basses" category during 1994-2006.

1. Victor Padilla - Commercial Fisher - El Seco, Mayagüez

Stated that groupers are harvested by commercial and recreational fishers and suggests first that recreational fishers be allowed to harvest 25% of the commercial catch. The rationale he offered was that of the total number of fishers in Puerto Rico, 95% are recreational and 5% are commercial. He asked if the ACLs in these alternatives included the recreational harvest and stated that the implementation of these should consider both the commercial and recreational harvest. He expressed concern about the lack of enforcement of fishing regulations on the recreational sector, including the lack enforcement on the selling of the catch by the recreational fishers.

2. Pedro Silva - Commercial Fisher - Mayagüez

Suggested that the level should be higher than 15,000 pounds to account for those years when fishing is better that correspond to years of good reproduction. Recreational fishers should be allowed to harvest less than the commercial fishers, about 10% of the commercial catch. The recreational fishers have other jobs and do not make a living from fishing and the amount allowed for harvest should be less than that of the commercial fishers.

Alternative 5. Set the ACL for Grouper in the U.S. Caribbean equal to:

1. General comment

Fishers consensus not to consider this alternative.

4.5 Action 5: Annual Catch Limits for Snapper Unit 1

Alternative 2. Set the ACL for Snapper Unit 1 off Puerto Rico equal to:

Sub alternative H. 500,000 pounds ACL in the EEZ and do not establish an ACL for state waters, but rely on the data collection program (described in Action 10) and revisit ACL for Snapper Unit 1 five years after implementation of the data collection program.

1. Gerardo Colón -Commercial Fisher - Mayagüez

Suggests DNER give a brochure to recreationals with species they can fish and quotas allowed when renewing their boats registration.

2. Carlos Nieves: Commercial Fisher –El Seco, Mayagüez

Recreationals be allowed only 10% of the commercial quota. Sub alternative J. 374,000 pounds each for both the commercial and recreational sectors.

1. Carlos Nieves - Commercial Fisher – El Seco, Mayagüez

Recreational fishers take 80% more snappers than commercials. He does not agree with the 374,000 pounds for recreational fishers considered in this alternative. Snappers should not be fished recreationally with cala (bottom line, deep water snapper reel: the way commercial fishers harvest deep water snappers). Recreational fishers should be allowed 10% of the commercial harvest.

2. Pedro Silva - Commercial Fisher - Mayagüez

Recreational fishers should only be allowed 10% of the harvest for snappers. Snappers are caught in federal waters – if closing fishing they won't fish

3. Julio Morales - Commercial Fisher – El Seco, Mayagüez

Recreational fishers should be sport fishers and have harvest limits. He was concerned about the managers taking into consideration the comments from the commercial fishers.

4. Victor Padilla - Commercial Fisher - El Seco, Mayagüez

Limit the recreational harvest of chillo (snappers).

DRAFT

5. Gerardo Colón - Commercial Fisher -Mayagüez

Suggested that the DNER educate the recreational fishers about the fishing regulations and that there should be a quota (by pounds) for the recreational fishers.

Alternative 5. Set the ACL for Snapper in the U.S. Caribbean equal to:
Sub alternative A. Zero for the EEZ off the U.S. Caribbean and do not establish an ACL for state waters, but rely on the data collection program (described in Action 10) and revisit ACL for Snapper Unit 1 five years after implementation of the data collection program.

Sub alternative B. 1,529,000 pounds, based on the average landings during 1994 - 2006 for all Snapper species.

Sub alternative C. The average landings during 1994 - 2006 for all Snapper species multiplied by an uncertainty scalar (see Action 7 for uncertainty scalar).

1. Pedro Silva - Commercial Fisher - Mayagüez

Separate each island because of the kind of fish harvested and the way fishing is done is different among the Islands. Also, the preference for fish is different among the Islands.

2. Daniel Matos – Director, Fishery Statistics Program, Fisheries Research Lab -DNER

The islands should be separated because each has different fisheries and the type of statistics that are collected are different and collected in a different manner. Puerto Rico has more species specific data.

4.6 Action 6: Annual Catch Limits for the Recreational Sector

Alternative 5. Set the recreational ACL in the USVI equal to 10% of each islands commercial ACL.

1. Pedro Silva - Commercial Fisher - Mayagüez

This should also be the alternative for Puerto Rico. (Concerns with the recreational fishing activity were raised by the commercial fishers on most of the alternatives for setting ACLs. The rational includes: (1) the high number of recreational fishers; (2) the lack of regulations, licenses and enforcement; (3) fishing gear used by the recreational fishers that should only be used by commercial fishers; (4) selling of the recreationally caught fish.)

Alternative 6. Establish a separate charter boat sector ACL based on MRFSS data for Puerto Rico.

1. General comment

Consensus on the separate ACL for charters.

Alternative 7. Establish recreational ACL equal to half of the commercial ACL in Puerto Rico

Sub alternative A. Allow recreational fishers to harvest all species managed by the Council in the EEZ and state waters.

Sub alternative B. Allow recreational fishers to harvest only fish species managed by the Council that are not listed as overfished or undergoing overfishing in the EEZ and state waters.

1. Victor Padilla - Commercial Fisher - El Seco, Mayagüez

The recreational harvest allowed should be lower than the commercial catch. Recreational fishers go out on the weekends and catch more than commercials that go out every day. Recreational fishers sell the catch at a lower price per pound (lower than the market value) than the commercial fishers and flood the market; commercial fishers then cannot sell the catch. Commercials have a lot more expenses than the recreationals. The cost of gas, gear, boat maintenance, etc. has increased greatly and these expenses cannot be overcome when the recreational fishers sell fish below market price.

2. Carlos Nieves - Commercial Fisher - El Seco, Mayagüez

The quotas for the recreational fishers should be set like they are in the fishing regulations on Puerto Rico for dorado (mahi), wahoo and mackerels. There are restrictions on the fishing gear; recreational fishers should not use malacate (hauler reel). This gear should only be used by licensed commercial fishers. There have to be fines for breaking the law.

3. Pedro Silva - Commercial Fisher - Mayagüez

Suggested that recreational fishers be allowed only 10% of the harvest (like in the USVI). There should be restrictions in the number of fish harvested during recreational fishing tournaments, large boats take much more than the quotas for fish such as dorado. These fish caught at tournaments are being sold. There should be no selling of the catch by recreational fishers.

4. Julio Morales - Commercial Fisher - El Seco, Mayagüez

Agreed with the 10% of the commercial catch for the recreational sector.
(Note: They referred to 10% of the commercial catch such that the total ACL would be the sum of the commercial plus this 10% of the recreational.)

5. Victor Padilla - Commercial Fisher - El Seco, Mayagüez

Requested clarification on the seasonal closures in the federal waters and on the

seasonally closed areas; these seasonally closed areas are pushing fishers to smaller and smaller fishing grounds. He suggested outreach and education to inform the fishers about the seasonal closures and other regulations. Fishers agreed that the seasonal closures are working and cited as examples the red hind and the mutton snapper with increased landings over the years.

6. Pedro Silva - Commercial Fisher - Mayagüez

Agreed with Victor Padilla and explained that the West coast was the most impacted by the closed areas in the EEZ.

4.7 Action 7: Accounting for Uncertainty

Alternative 2. In setting ACLs based on average catch, use:

Sub alternative A. 75% of the specified level in the previous actions to adjust for uncertainty

Sub alternative B. 50% of the specified level in the previous actions to adjust for uncertainty

Sub alternative C. 25% of the specified level in the previous actions to adjust for uncertainty.

1. Victor Padilla - Commercial Fisher - El Seco, Mayagüez

The problem is that they don't have real numbers from fishers; they don't know for sure how much has been reported or caught. It affects everybody. Work more with "bonafide" fishers.

2. Daniel Matos – Director, Fishery Statistics Program, Fisheries Research Lab - DNER

There is a study done every year to determine the correction factor. It will be done more frequently and in depth to have a better idea of the correction factor. There are many commercial fishers without commercial fishing license.

3. Victor Padilla - Commercial Fisher - El Seco, Mayagüez

Fishers do not report their real catches because then they will have to report a higher income (and will loose marginal benefits like food stamps, incentives for houses (Plan 8), etc.)

4. Daniel Matos – Director, Fishery Statistics Program, Fisheries Research Lab - DNER

Daniel explained to the fishers that because of the improvements on data reporting and the information collected by the Fisheries Research Lab, it is being shown that fish stocks are increasing, the size of the fish is increasing, and also landings are improving because of the closed seasons.

DRAFT

4.8 Action 8: Alternative Methods for Reducing Fishing Mortality and Establishing ACL Proxies

Alternative 2. Work with fishermen to develop measures to reduce fishing effort (i.e., permits, data collection).

Alternative 3. Establish ACL by sector for St. Thomas/St. John

Sub-alternative A. Establish ACL by net sector Sub-alternative B. Establish ACL by trap/pot sector Sub-alternative C. Establish ACL by hook-and-line sector

Alternative 4. Establish ACL by sector for St. Croix Sub-alternative A. Establish ACL by net sector Sub-alternative B. Establish ACL by trap/pot sector Sub-alternative C. Establish ACL by hook-and-line sector

Alternative 5. Establish ACL by sector for Puerto Rico Sub-alternative A. Establish ACL by net sector Sub-alternative B. Establish ACL by trap/pot sector Sub-alternative C. Establish ACL by hook-and-line sector

1. Pedro Silva - Commercial Fisher - Mayagüez

Keep the Islands separate and separated by fish stock not by gear.

4.9 Action 9: Permits

Alternative 2. Require a federal permit for fishing in the EEZ. Sub-alternative A. Require a federal permit for recreational fishing in the EEZ.

1. Carlos Nieves - Commercial Fisher - El Seco, Mayagüez

Consensus that there should be federal permits for recreational fishers. There should be quotas for the recreational fishers associated with these permits, quotas by species. Recreational fishers should be allowed 10 to 12 fish per fishing trip.

Sub-alternative B. Require a federal permit for commercial fishing in the EEZ.

1. General comment

Consensus among fishers present that there should be a federal permit for commercial fishers but the cost of the permit should be zero or very limited.

2. Carlos Nieves - Commercial Fisher - El Seco, Mayagüez

Establish a limited access to the fisheries and a permit which should be free or about $100 dollars.

DRAFT

Sub-alternative C. Require the use of trap tags for all (lobster and fish) trap fisheries in the EEZ.

1. Victor Padilla - Commercial Fisher - El Seco, Mayagüez

The trap fishers already have a color code in Puerto Rico assigned to the fisher. These color codes are supposed to be on the boat and the buoys. He did not think there was a registration number associated with the color codes. There should be no limit on the number of traps.

Sub-alternative D. Require a federal permit for charter boats fishing in the EEZ.

Alternative 3. Require a federal permit to sell Council managed species.

Alternative 4. Require a federal permit to purchase Council managed species.

1. Pedro Silva - Commercial Fisher - Mayagüez

Suggested a generic commercial license; that the Puerto Rico commercial fishing license be valid for federal waters too. There should be fee for the federal permit.

2. Gerardo Colón - Commercial Fisher -Mayagüez

Fishing licenses should not limit the type of fishing done by commercial fishers or the gears used by the commercial fishers. The commercial permit should be a general one that allows for all types of fishing and to harvest all species.

3. General comment

Fishers agreed that the federal permit would be better for enforcement.

4.10 Action 10: Monitoring and Enforcement of Annual Catch Limits

Alternative 1. No Action. Set the ACL at the level specified in the previous actions.

Alternative 2. Require any person landing Council managed species to submit an appropriate data collection form, as developed by the SEFSC or the Council's SSC, after every trip with enough detail such that CPUE per species can be calculated for each gear.

Alternative 3. Require any federal permit holder to submit an appropriate data collection form, as developed by the SEFSC or the Council's SSC, after every trip with enough detail such that CPUE per species can be calculated for each gear.

Alternative 4. Develop an updated catch report form in coordination with the SEFSC, local and territorial governments, fishermen, and the Council's SSC with enough detail such that CPUE per species can be calculated for each gear.

1. Daniel Matos – Director, Fishery Statistics Program, Fisheries Research Lab - DNER

Explained the development of the new data form and invited the fishers to the up-coming meetings in Rincón, Ponce and Cabo Rojo to discuss the form and to test it among the fishers. The more specific the data are and the more detail and real information, the better for everyone.

4.11 Action 11: Accountability Measures Alternative 1. No Action. Do not establish Accountability Measures. Alternative 2. Implement accountability measures for exceeding an ACL based on:

Sub alternative A. A single year of landings/catch. Sub alternative B. A 2-year average of landings/catch. Sub alternative C. A 3-year average of landings/catch.

Alternative 3. Reduce the fishing season in the following year by a length determined to be appropriate to account for exceeding the ACL.

Alternative 4. For queen conch exceedences in St Croix, close the EEZ to queen conch harvest.

Alternative 5. Reduce the ACL in the subsequent fishing year by an amount equal to an overage in the previous year.

1. Victor Padilla - Commercial Fisher - El Seco, Mayagüez

Expressed concern about the future of fishing and the lack of young people entering the commercial fishing. Commented on the numerous laws regulating commercial fishing and the need to monitor what is in place already.

2. Pedro Silva - Commercial Fisher - Mayagüez

There is great need to monitor all species and the regulations that are in place. The fishers agreed that the seasonal closures are working and that mutton snapper are more abundant now and larger.

4.12Action 12: Allowable Gear for Reef Fish

Alternative 2. Review the list of allowable gear under 50 CFR 600.725

1. General Comment

Agreed that commercial fishers using SCUBA should be allowed to use spear. Also, that the recreational fishers should not be allowed to use SCUBA and spear fish (this would be compatible with the Puerto Rico regulations). Recreational divers should not be allowed to use powerheads.

DRAFT

In the discussion on ACLs for snappers, the fishers suggested that the recreational fishers not be allowed the use of the bottom line (deepwater snapper reel) and hauler that the commercial fishers use.

4.13 Action 13: Establish Framework Measures for ACLs and AMs in the Reef Fish FMP.

Alternative 1. No Action. Do not establish a framework for ACLs and AMs
Alternative 2. Establish a framework procedure for setting and adjusting ACLs and AMs

1. Other General Comments:

Enforcement: There should be more enforcement interventions with the recreational fishers.

Recreational Fishing: There should be a recreational fishing license and quotas on recreational fishing. There should be data collection from the recreational fishers, same as it is done with the commercial fishers.

Studies should be carried out before implementing laws and regulations not the other way around.
Outreach and education: the DNER should inform the recreational fishers of the fishing regulations in place.

The meeting was adjourned at 10:10 pm.

DRAFT

CARIBBEAN FISHERY MANAGEMENT COUNCIL 268 MUÑOZ RIVERA AVENUE, SUITE 1108 SAN JUAN, PUERTO RICO 00918

SCOPING MEETING ANNUAL CATCH LIMITS (ACLs) AND ACCOUNTABILITY MEASURES (AMs)
ST. THOMAS, USVI AUGUST 18, 2009
SUMMARY MINUTES

The scoping meeting was held at Holiday Inn Windward Passage Hotel, in St. Thomas U.S.V.I., and was chaired by Mr. Winston Ledee, CFMC Member.

Mr. Miguel Rolón gave a PowerPoint presentation (attached) on the proposed management measures for ACLs/AMs, and explained the new requirements of the Magnuson Stevens Act.
Following are the comments offered by the attendees:

1. Julian Magras – Chairman of the Board, St. Thomas Fishermen's Association

A written statement was provided and is included with the minutes.

2. Makeda M. Okolo – Office of the VI Delegate to Congress Donna Christiansen

Ms. Makeda represented Congresswoman Donna Christensen who said she was behind the fishermen to back them up, and that fishermen alone should not be held accountable, she also invited everyone to "think outside the box" to make the best for the resources as well as for the fishermen.

A written statement will be provided by mail.

3. David Berry – Commercial Fisherman

Disagrees with the ACLs document. No action to all alternatives.

4. Jason Budsan – East Environmental Association St. Thomas/St. John

Support some limits to overfishing to a degree, but data collection is vital.
See the need for better land use planning and erosion control methods.
The VI needs a waste and land use plan to protect the reefs and mangroves. Without a

plan we will see a continuing decline in our fishery stocks.

5. Alberto Tapia – St. Thomas resident

There is a need to use the data that is collected in the USVI

6. Kevin Campbell – Commercial fisherman

Has a study been done on the hind bank to see how the closure is doing?
There is a need for more education on both sides.

The meeting was adjourned at 9:30 p.m.

DRAFT

CARIBBEAN FISHERY MANAGEMENT COUNCIL
268 MUÑOZ RIVERA AVE. SUITE 1108
SAN JUAN, P. R. 00918-1920
ACLs SECOND SCOPING MEETING
DOUBLE TREE BY HILTON HOTEL
SAN JUAN, PUERTO RICO
AUGUST 19, 2009
Summary Minutes

The meeting was opened at 7:30 pm. There were no participants at this meeting. Council staff Graciela

García-Moliner and Iris Oliveras were present, and the Chairman, Eugenio Piñeiro.
The staff and Mr. Piñeiro officially closed the meeting at 8:40 pm.

DRAFT

CARIBBEAN FISHERY MANAGEMENT COUNCIL
268 MUÑOZ RIVERA AVENUE, SUITE 1108
SAN JUAN, PUERTO RICO 00918
SCOPING MEETING
ANNUAL CATCH LIMITS (ACLs) AND
ACCOUNTABILITY MEASURES (AMs)
ST. CROIX, USVI
AUGUST 19, 2009
SUMMARY MINUTES

The scoping meeting was held at The Buccaneer Hotel, in St. Croix, U.S.V.I., and was chaired by Mr. Joseph Kimmel, CFMC Member.
Mr. Miguel Rolón gave a PowerPoint presentation on the proposed management measures for ACLs/AMs, and explained the new requirements of the Magnuson Stevens Act.
Following are the comments offered by the attendees:

1. Makeda M. Okolo – Office of the VI Delegate to Congress Donna Christiansen
Ms. Makeda represented Congresswoman Donna Christensen who said she was behind the fishermen to back them up, and that fishermen alone should not be held accountable, she also invited everyone to "think outside the box" to make the best for the resources as well as for the fishermen.

A written statement will be provided by mail.

2. Gerson Martinez – Commercial Fisherman

Disagrees with the ACLs document.
The only thing that the Council has to do is to work with the fishermen.
Feels that the Council is forcing something against the fishermen of St. Croix. It is not fair.
"The Fishermen are going to be hurt about these regulations. We are single individuals with twenty five foot boats that go every day out and come back with a hundred or a hundred of fifty pounds of fish, ten to fifteen pounds of lobster. We sell our catch, and tomorrow we go out and do the same thing. We are not exporting. We are just trying to catch enough to survive day by day."
"Regarding action 3, sub alternative F; the way that we intended that alternative was for you guys to set an ACL for federal waters and leave the state waters open. I don't know when the Council got a restriction over state waters, but from since the snapper extension

from shoreline to two hundred miles, you guys have been doing damage to the fishing industry here in St. Croix."
"I don't know how more we can reduce fishing effort. We have banned gillnets, we have 50 thousand pounds quota on conch…"

3. Edward Schuster – Commercial Fisherman – President St. Croix Commercial Fishermen Association.

"Numerous sub alternatives of actions have been added, and a lot of it has been twisted from what had been recommended from its original state."
"Alternative 5, sub alternative G, in action 3, you are going back to a timeframe where the fishing effort wasn't as mandatory as it is right now. There is more of a demand on seafood, there is conservation to bear in mind, but there is people that are tending more to eat a fresh produce."
"Alternative 2, what I understood it to be was that you would allow us to fish for the five years, collecting the data. Since the data which has been collected for about 40 years could not be used into any of the models that have been created by the Council, and rely on the data collected in those five years from port sampling. Now is turned around that is as long as the ACLs are set to 0 you cannot fish for the species that you are trying to obtain the information for to set an ACL. For this is action 3, alternative 2, sub alternative A. Regarding the conch, there needs to be a fair playing field here, because we came up with our own regulatory in our state waters on an action taken, which there was an issue where no matter how many commercial fishermen you had on board, it did not limit you to the amount of conch. We sat down in a group, we reduced that by having our catch to reduce from 150 per license, to 200 per boat. Now, when we did this it was not compatible in the EEZ, and we brought it up to your attention at the Carambola meeting. Now, on behalf of this conch issue, you are going back and setting an ACL where in a sense you are creating overfishing. Those resources are going to be impacted so hard in the timeframe where it is open, that I can almost tell you that the people who are not given or not had their fair share last year, you are going to actually get under reporting. So this thing about going back to the original state of setting an ACL, I think it should be higher to that 90 thousand pounds, which is more of a fair share of the pie, meaning that to this day a conch study has not been done to do a total analysis of the shelf, of what you have on St. Croix; meaning adults and juveniles."
"A final comment, I think the ACL should be set in the jurisdiction where the federal government has authorization to do so, or jurisdiction, and not be set in the state waters."

4. Michelle Pugh – St. Croix Resident – Diver

Written comment provided is attached with the minutes.

5. Tomas Daley – Commercial Fisherman – Vice chair of St. Croix Fishermen's Advisory Committee

What is now here is not what was promised.
There are already enough measures in place.

DRAFT

If the fishery collapses in St. Croix the CFMC will be held responsible.
There is a need to map the hind area and open the fishery.

The meeting was adjourned at 9:30 p.m.

Appendix 5. Alternatives the Council considered but eliminated from detailed study, and a brief discussion of the reasons for their elimination.

This section describes alternatives to the proposed actions that the Council considered in developing this document, but decided not to pursue. The description of each alternative is followed by a summary statement of why it was eliminated from more detailed summary. Alternatives are numbered as they were in the December 2, 2009 version of the options paper titles 'Options paper for Amendment 2 to the fishery management plan for the queen conch fishery of Puerto Rico and the USVI and Amendment 5 to the reef fish fishery management plan of Puerto Rico and the USVI.'

4.0 MANAGEMENT ALTERNATIVES

4.1 Action 1: Amending the Stock Complexes in the Reef Fish Fishery Management Unit

Action 1a. Amend the stocks that comprise the parrotfish FMU.
Alternative 1. No action. Do not change the stocks that comprise the parrotfish FMU.
Alternative 2. Separate the parrotfish FMU into 2 complexes. Parrotfish Unit 1 would include princess, queen, redfin, redtail, stoplight, redband, and striped parrotfish and Parrotfish Unit 2 would include blue, midnight, and rainbow parrotfish.

Landings data are not available with which to address the allocation of parrotfish among FMUs. In the USVI, parrotfish landings data are only available at the family level, inadequate for addressing species-level issues. Puerto Rico does capture parrotfish landings data at the species level, but >99% of all parrotfish landings from Puerto Rico waters are reported to the generic category 'parrotfishes'.

Action 1d. Create a 'data collection only' category for various species of Caribbean reef fish.
Alternative 1. No action. Do not create a 'data collection only' category for various species of Caribbean reef fish.
Alternative 2. Create a 'data collection only' category for various species of Caribbean reef fish and move creole fish from the grouper FMU into the 'data collection only' category.

It was determined by the Caribbean Fisheries Management Council at their 133rd meeting in December 2009 to focus the present amendment on setting ACLs for species undergoing overfishing. Other actions were removed from this amendment and will be

considered for inclusion in a future amendment that focuses on those Caribbean species that are not undergoing overfishing. This will include species relegated to the 'data collection only' category.

Action 2c: Annual Catch Limits for commercial harvest of queen conch off Puerto Rico

Alternative 2. Set an ACL for queen conch off Puerto Rico equal to:

Sub alternative B. The pounds of meats from combined commonwealth and Puerto Rico EEZ landings, based on the average commonwealth and federal landings from 1999-2007.

Sub sub alternative i. 205,812 pounds of meats, the average reported commonwealth and Puerto Rico EEZ landings during 1999-2007.

Sub alternative C. The pounds of meats from combined commonwealth and Puerto Rico EEZ landings, based on the average commonwealth and federal landings reported for the most recent five years (2003-2007).

Sub sub alternative i. 175,438 pounds of meats, the average reported commonwealth and Puerto Rico EEZ landings during 2003-2007.

The sub sub alternatives that considered reported rather than adjusted landings from Puerto Rico were rejected. Puerto Rico adjusts reported commercial catch data to account for failure of fishermen to report and for underreporting and misreporting. Expansion factors developed cooperatively between Puerto Rico DNER and NOAA's SEFSC are applied to the reported landings to adjust for such reporting discrepancies. It was decided by the Council at their 133rd meeting to only use the adjusted landings.

Action 3c: Annual Catch Limits for commercial harvest of parrotfish off Puerto Rico

Alternative 2. Set the ACL for parrotfish off Puerto Rico equal to**:**

Sub alternative B. The pounds of combined commonwealth and Puerto Rico EEZ landings, based on the average commonwealth and EEZ landings during 1999-2007.

Sub sub alternative i. 213 pounds, the average reported commonwealth and Puerto Rico EEZ landings during 1999-2007.

Sub sub alternative iii. 63,780 pounds, the average reported (with redistribution) commonwealth and Puerto Rico EEZ landings during 1999-2007.

Sub alternative C. The pounds of combined commonwealth and Puerto Rico EEZ landings, based on the average commonwealth and EEZ landings reported for the most recent five years (2003-2007).

Sub sub alternative i. 303 pounds, the average reported commonwealth and Puerto Rico EEZ landings during 2003-2007.

Sub sub alternative iii. 43,176 pounds, the average reported (with redistribution) commonwealth and Puerto Rico EEZ landings during 2003-2007.

As explained above, the CFMC at their 133rd meeting chose to not include reference to reported landings but to instead focus on adjusted landings.

Action 3d: Annual Catch Limits for commercial harvest of parrotfish unit 1 off Puerto Rico

Alternative 1. No action. Do not set an ACL for parrotfish unit 1 in the EEZ off Puerto Rico.
Alternative 2. Set the ACL for parrotfish unit 1 off Puerto Rico equal to**:**
Sub alternative A. Zero in the EEZ.
Sub alternative B. The pounds of combined commonwealth and Puerto Rico EEZ landings, based on the average commonwealth and EEZ landings during 1999-2007.
Sub sub alternative i. 19 pounds, the average reported commonwealth and Puerto Rico EEZ landings during 1999-2007.
Sub sub alternative ii. 25 pounds, the average adjusted commonwealth and Puerto Rico EEZ landings during 1999-2007.
Sub sub alternative iii. 5,783 pounds, the average reported (with redistribution) commonwealth and Puerto Rico EEZ landings during 1999-2007.
Sub sub alternative iv. 4,760 pounds, the average adjusted (with redistribution) commonwealth and Puerto Rico EEZ landings during 1999-2007.
Sub alternative C. The pounds of combined commonwealth and Puerto Rico EEZ landings, based on the average commonwealth and EEZ landings reported for the most recent five years (2003-2007).
Sub sub alternative i. 0 pounds, the average reported commonwealth and Puerto Rico EEZ landings during 2003-2007.
Sub sub alternative ii. 0 pounds, the average adjusted commonwealth and Puerto Rico EEZ landings during 2003-2007.
Sub sub alternative iii. 0 pounds, the average reported (with redistribution) commonwealth and Puerto Rico EEZ landings during 2003-2007.
Sub sub alternative iv. 0 pounds, the average adjusted (with redistribution) commonwealth and Puerto Rico EEZ landings during 2003-2007.

Action 3e: Annual Catch Limits for commercial harvest of parrotfish unit 2 in the U.S. Caribbean EEZ
Alternative 1. No action. Do not set an ACL for parrotfish unit 2 in the U.S. Caribbean EEZ.
Alternative 2. Set the ACL for parrotfish unit 2 in the U.S. Caribbean EEZ equal to**:**
Sub alternative A. Zero.
Sub alternative B. The pounds of combined state and U.S. Caribbean EEZ landings, based on the average state and EEZ landings reported during 2000-2007.
Sub sub alternative i. 365,030 pounds, the average reported state and U.S. Caribbean EEZ landings during 2000-2007.
Sub sub alternative ii. 365,453 pounds, the average adjusted state and U.S. Caribbean EEZ landings during 2000-2007.
Sub sub alternative iii. 425,483 pounds, the average reported (with redistribution) state and U.S. Caribbean EEZ landings during 2000-2007.
Sub sub alternative iv. 476,525 pounds, the average adjusted (with redistribution) state and U.S. Caribbean EEZ landings during 2000-2007.
Sub alternative C. The pounds of combined state and U.S. Caribbean EEZ landings, based on the average state and EEZ landings reported for the most recent five years (2003-2007).

Sub sub alternative i. 385,770 pounds, the average reported state and U.S. Caribbean EEZ landings during 2003-2007.
Sub sub alternative ii. 386,436 pounds, the average adjusted state and U.S. Caribbean EEZ landings during 2003-2007.
Sub sub alternative iii. 428,643 pounds, the average reported (with redistribution) state and U.S. Caribbean EEZ landings during 2003-2007.
Sub sub alternative iv. 486,551 pounds, the average adjusted (with redistribution) state and U.S. Caribbean EEZ landings during 2003-2007.

All unit-specific references to parrotfish have been rejected because the distribution of parrotfish species between two FMUs has been rejected, thus any alternatives that reference the parrotfish units are similarly rejected.

Action 4: Annual Catch Limits for commercial harvest of grouper
Action 4b: Annual Catch Limits for commercial harvest of goliath grouper
Alternative 1. No action. Do not set an ACL for goliath grouper in the EEZ off St. Croix.
Alternative 2. Set the ACL for goliath grouper in the EEZ off St. Croix equal to zero.
Alternative 3. No action. Do not set an ACL for goliath grouper in the EEZ off St. Thomas/St. John.
Alternative 4. Set the ACL for goliath grouper in the EEZ off St. Thomas/St. John equal to zero.
Alternative 5. No action. Do not set an ACL for grouper unit 2 (goliath grouper) in the EEZ off Puerto Rico.
Alternative 6. Set the ACL for grouper unit 2 (goliath grouper) in the EEZ off Puerto Rico equal to zero.

Goliath grouper are considered to be overfished but are not presently undergoing overfishing due to a complete prohibition on harvest. Thus, they are no longer included in the present amendment that is focused on species undergoing overfishing.

Action 4e: Annual Catch Limits for commercial harvest of "current" grouper unit 4 off Puerto Rico
Alternative 2. Set the ACL for "current" grouper unit 4 off Puerto Rico equal to:
Sub alternative B. The pounds of combined commonwealth and Puerto Rico EEZ landings, based on the average commonwealth and Puerto Rico EEZ landings from 1999-2007.
Sub sub alternative i. 8,776 pounds, the average reported commonwealth and Puerto Rico EEZ landings during 1999-2007.
Sub sub alternative iii. 12,438 pounds, the average reported (with redistribution) commonwealth and Puerto Rico EEZ landings during 1999-2007.
Sub alternative C. The pounds of combined commonwealth and Puerto Rico EEZ landings, based on the average commonwealth and Puerto Rico EEZ landings reported for the most recent five years (2003-2007).
Sub sub alternative i. 7,785 pounds, the average reported commonwealth and Puerto Rico EEZ landings during 2003-2007.

Sub sub alternative iii. 10,866 pounds, the average reported (with redistribution) commonwealth and Puerto Rico EEZ landings during 2003-2007.

As discussed above, all alternatives that include reported rather than adjusted landings have been rejected.

Action 4f: Annual Catch Limits for commercial harvest of "proposed" grouper unit 4 off Puerto Rico
Alternative 2. Set the ACL for "proposed" grouper unit 4 off Puerto Rico equal to:
Sub alternative B. The pounds of combined commonwealth and Puerto Rico EEZ landings, based on the average commonwealth and Puerto Rico EEZ landings from 1999-2007.
Sub sub alternative i. 2,906 pounds, the average reported commonwealth and Puerto Rico EEZ landings during 1999-2007.
Sub sub alternative iii. 4,118 pounds, the average reported (with redistribution) commonwealth and Puerto Rico EEZ landings during 1999-2007.
Sub alternative C. The pounds of combined commonwealth and Puerto Rico EEZ landings, based on the average commonwealth and Puerto Rico EEZ landings reported for the most recent five years (2003-2007).
Sub sub alternative i. 1,983 pounds, the average reported commonwealth and Puerto Rico EEZ landings during 2003-2007.
Sub sub alternative iii. 2,768 pounds, the average reported (with redistribution) commonwealth and Puerto Rico EEZ landings during 2003-2007.

As discussed above, all alternatives that include reported rather than adjusted landings have been rejected.

Action 5: Annual Catch Limits for commercial harvest of snapper
Action 5c: Annual Catch Limit for commercial harvest of snapper unit 1 off Puerto Rico
Alternative 2. Set the ACL for snapper unit 1 off Puerto Rico equal to:
Sub alternative B. The pounds of combined commonwealth and Puerto Rico EEZ landings, based on the average commonwealth and EEZ landings during 1999-2007.
Sub sub alternative i. 179,492 pounds, the average reported commonwealth and Puerto Rico EEZ landings during 1999-2007.
Sub sub alternative iii. 189,518 pounds, the average reported (with redistribution) commonwealth and Puerto Rico EEZ landings during 1999-2007.
Sub alternative C. The pounds of combined commonwealth and Puerto Rico EEZ landings, based on the average commonwealth and EEZ landings reported for the most recent five years (2003-2007).
Sub sub alternative i. 119,124 pounds, the average reported commonwealth and Puerto Rico EEZ landings during 2003-2007.
Sub sub alternative iii. 125,162 pounds, the average reported (with redistribution) commonwealth and Puerto Rico EEZ landings during 2003-2007.

As discussed above, all alternatives that include reported rather than adjusted landings have been rejected.

Action 6: Annual Catch Limits for the Recreational Sector
Sub action 6c. Annual Catch Limits for recreational harvest of conch off Puerto Rico
Alternative 2. Set the recreational ACL for conch off Puerto Rico:
Sub alternative B. equal to the average conch landings from MRFSS during 2000.
Sub action 6d. Annual Catch Limits for recreational harvest of parrotfish unit 1 off Puerto Rico
Alternative 1. No Action. Do not set a recreational ACL for parrotfish unit 1 in the EEZ off Puerto Rico.
Alternative 2. Set the recreational ACL for parrotfish unit 1 off Puerto Rico:
Sub alternative A. equal to zero in the EEZ.
Sub alternative B. equal to the average parrotfish unit 1 landings (17,785 fish A + B1) from MRFSS during 2000-2007.
Sub alternative C. equal to the average parrotfish unit 1 landings (13,729 fish A + B1) from MRFSS during the most recent five years (2003-2007).
Sub alternative D. Do not set recreational ACLs for parrotfish unit 1 in the EEZ off Puerto Rico, but use commercial ACL monitoring as a mechanism for recreational accountability measures.

Subalternative B uses Puerto Rico MRFSS data from only 2000. MRFSS data have been collected for Puerto Rico from 2000-2007 (and later years as well) so those data are used in the present amendment in lieu of using only the year 2000 data.

4.8 Action 8: Permits and tags

Action 8a: Establish a commercial fishing permit system for St. Croix EEZ waters.
Alternative 1. No Action. Do not establish a permit system for commercial fishing in the EEZ around St. Croix.
Alternative 2. Require a federal permit for commercial fishing in the EEZ around St. Croix.
Sub alternative A. Require that each fisherman submit an application for a federal fishing permit.
Sub alternative B. Award a federal fishing permit to all extant St. Croix territorial fishing permit holders.
Action 8b: Establish a commercial fishing permit system for St. Thomas/St. John EEZ waters.
Alternative 1. No Action. Do not establish a permit system for commercial fishing in the EEZ around St. Thomas/St. John.
Alternative 2. Require a federal permit for commercial fishing in the EEZ around St. Thomas/St. John.
Sub alternative A. Require that each fisherman submit an application for a federal fishing permit.
Sub alternative B. Award a federal fishing permit to all extant St. Thomas/St. John territorial fishing permit holders.

Action 8c: Establish a commercial fishing permit system for Puerto Rico EEZ waters.

Alternative 1. No Action. Do not establish a permit system for commercial fishing in the EEZ around Puerto Rico.

Alternative 2. Require a federal permit for commercial fishing in the EEZ around Puerto Rico.

Sub alternative A. Require that each fisherman submit an application for a federal fishing permit.

Sub alternative B. Award a federal fishing permit to all extant Puerto Rico territorial fishing permit holders.

Action 8d: Establish a commercial sales permit system for St. Croix EEZ waters.

Alternative 1. No Action. Do not establish a permit system for selling catch harvested from EEZ waters around St. Croix.

Alternative 2. Require a federal permit for selling catch harvested from EEZ waters around St. Croix.

Sub alternative A. Require that each fisherman submit an application for a federal catch sell permit.

Sub alternative B. Award a federal catch sell permit to all extant St. Croix territorial commercial fishing permit holders.

Action 8e: Establish a commercial sales permit system for St. Thomas/St. John EEZ waters.

Alternative 1. No Action. Do not establish a permit system for selling catch harvested from EEZ waters around St. Thomas/St. John.

Alternative 2. Require a federal permit for selling catch harvested from EEZ waters around St. Thomas/St. John.

Sub alternative A. Require that each fisherman submit an application for a federal catch sell permit.

Sub alternative B. Award a federal catch sell permit to all extant St. Thomas/St. John territorial commercial fishing permit holders.

Action 8f: Establish a commercial sales permit system for Puerto Rico EEZ waters.

Alternative 1. No Action. Do not establish a permit system for selling catch harvested from EEZ waters around Puerto Rico.

Alternative 2. Require a federal permit for selling catch harvested from EEZ waters around Puerto Rico.

Sub alternative A. Require that each fisherman submit an application for a federal catch sell permit.

Sub alternative B. Award a federal catch sell permit to all extant Puerto Rico territorial commercial fishing permit holders.

Action 8g: Establish a permit system for purchasing catch harvested from St. Croix EEZ waters for subsequent resale.

Alternative 1. No Action. Do not establish a permit system for purchasing catch harvested from EEZ waters around St. Croix for subsequent resale.

Alternative 2. Require a federal permit for purchasing catch harvested from EEZ waters around St. Croix for subsequent resale.

Action 8h: Establish a permit system for purchasing catch harvested from St. Thomas/St. John EEZ waters for subsequent resale.

DRAFT

Alternative 1. No Action. Do not establish a permit system for purchasing catch harvested from EEZ waters around St. Thomas/St. John for subsequent resale.
Alternative 2. Require a federal permit for purchasing catch harvested from EEZ waters around St. Thomas/St. John for subsequent resale.
Action 8i: Establish a permit system for purchasing catch harvested from St. Croix EEZ waters for subsequent resale.
Alternative 1. No Action. Do not establish a permit system for purchasing catch harvested from EEZ waters around St. Croix for subsequent resale.
Alternative 2. Require a federal permit for purchasing catch harvested from EEZ waters around St. Croix for subsequent resale.
The permit action has been removed from the present amendment and will instead be included in a future amendment.

4.9 Action 9: Monitoring of Annual Catch Limits

Alternative 1. No Action. Maintain existing catch reporting protocols.
Alternative 2. Require any person landing Council managed species to complete and submit an appropriate data collection form, as developed by the SEFSC or the Council's SSC, after every trip.
Alternative 3. Require any federal permit holder to complete and submit an appropriate data collection form, as developed by the SEFSC or the Council's SSC, after every trip.
Alternative 4. Require any federal permit holder to complete and submit an appropriate updated catch report form as developed in coordination with the SEFSC, local and territorial governments, fishermen, and the Council's SSC with enough detail such that CPUE per species can be calculated for each gear.

The monitoring action has been removed from the present amendment and will instead be included in a future amendment. A modified commercial data collection program for the U.S. Caribbean is being developed.

4.11 Action 11: Allowable Gear for Reef Fish

Alternative 1. No Action. Do not alter allowable gear in the U.S. Caribbean.
Alternative 2. Review the list of allowable gear under 50 CFR 600.725 and revise as appropriate.
Sub alternative A. Remove trawl from the list of allowable gears. (Prohibit the use of trawls in the EEZ (both recreational and commercial use) for reef fish, spiny lobster, queen conch and coral and reef resources.
Sub alternative B. Remove gillnet and trammel net from the list of allowable gears.
Sub alternative C. Remove powerheads from the list of allowable gears (Prohibit the use of powerheads in the Reef Fish, Coral and Queen Conch fisheries.)
Sub alternative D. Allow the harvest of reef fish with spearguns in the commercial fishery for reef fish.
Sub alternative E. Allow the commercial harvest of reef fish with the following gears: handline, bandit gear.

The allowable gear action has been removed from the present amendment and will instead be included in a future amendment.

Action 6: ACL for Recreational Sector

Alternative 4. Do not establish a recreational ACL in the USVI EEZ and state waters, but use the Commercial ACL for each unit or family as a proxy for the ACL for all sectors in the fishery.

Alternative 5. Set the recreational ACL in the USVI equal to 10% of each islands commercial ACL.

The Council (132nd meeting) discussed the lack of data from recreational fishing in the USVI and decided to "not specify recreational ACLs for the USVI, until a recreational survey is implemented".

Alternative 6. Establish a separate charter boat sector ACL based on MRFSS data for Puerto Rico.

The Council (132nd) decided that the charter ACL would not be set because (1) the proportion of the recreational landings from the charter sector is minimal, (2) there are efforts underway to establish log reporting by charter operators, (3) charters in Puerto Rico have a commercial fishing licenses and are prohibited from selling the catch. (4) the charter operators are more catch and release.

DRAFT

Appendix 6. Other Applicable Laws

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

Administrative Procedures Act

All federal rulemaking is governed under the provisions of the Administrative Procedure Act (APA) (5 U.S.C. Subchapter II), which establishes a "notice and comment" procedure to enable public participation in the rulemaking process. Under the APA, 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.

Coastal Zone Management Act

The Coastal Zone Management Act (CZMA) of 1972 (16 U.S.C. 1451 et seq.) encourages state and federal cooperation in the development of plans that manage the use of natural coastal habitats, as well as the fish and wildlife those habitats support. When proposing an action determined to directly affect coastal resources managed under an approved coastal zone management program, NOAA Fisheries is required to provide the relevant state agency with a determination that the proposed action is consistent with the enforceable policies of the approved program to the maximum extent practicable at least 90 days before taking final action. The Council and NOAA Fisheries determined that this action is consistent to the maximum extent practicable with the enforcement policies of the approved coastal management programs of Puerto Rico and the USVI.

Data Quality Act

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

does not include clearly stated opinions). Specifically, the Act directs the Office of Management and Budget (OMB) to issue government wide guidelines that "provide policy and procedural guidance to federal agencies for ensuring and maximizing the quality, objectivity, utility, and integrity of information disseminated by federal agencies." Such guidelines have been issued, directing all federal agencies to create and issue agency-specific standards to 1) ensure Information Quality and develop a pre-dissemination review process; 2) establish administrative mechanisms allowing affected persons to seek and obtain correction of information; and 3) report periodically to OMB on the number and nature of complaints received.

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

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 endangered and threatened species, and that they ensure actions they authorize, fund, or carry out are not likely to harm the continued existence of those species or the habitat designated to be critical to their survival and recovery. The ESA requires NOAA Fisheries, when proposing a fishery action that “may affect” critical habitat or endangered or threatened species, to consult with the appropriate administrative agency (itself for most marine species, the U.S. Fish and Wildlife Service for all remaining species) to determine the potential impacts of the proposed action. Consultations are concluded informally when proposed actions “may affect but are not likely to adversely affect” endangered or threatened species or designated critical habitat. Formal consultations, resulting in a biological opinion, are required when proposed actions may affect and are “likely to adversely affect” endangered or threatened species or designated critical habitat. If jeopardy or adverse modification is found, the consulting agency is required to suggest reasonable and prudent alternatives.

As provided in 50 CFR 402.16, reinitiation of formal consultation is required when discretionary involvement or control over the action has been retained (or is authorized by law) and: (1) the amount or extent of the incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not previously considered; or (4) if a new species is listed or critical habitat designated that may be affected by the identified action.

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 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 Sanctuaries are administered by NOAA's National Ocean Service. NMSA provides authority for comprehensive and coordinated conservation and management of these marine areas. The National Marine Sanctuary System 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. A complete listing of the current sanctuaries and information about their location, size, characteristics, and affected fisheries can be found at:
http://www.sanctuaries.nos.noaa.gov/oms/oms.html.

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act protects the quality of the aquatic environment needed for fish and wildlife resources. The Act requires consultation with the Fish and Wildlife Service and the fish and wildlife agencies of States where the "waters of any stream or other body of water are proposed or authorized, permitted or licensed to be impounded, diverted . . . or otherwise controlled or modified" by any agency (except TVA) under a federal permit or license. NOAA Fisheries was brought into the process later, as these responsibilities were carried over, during the reorganization process that created NOAA. Consultation is to be undertaken for the purpose of "preventing loss of and damage to wildlife resources", and to ensure that the environmental value of a body of water or wetland is taken into account in the decision-making process during permit application reviews. Consultation is most often (but not exclusively) initiated when water resource agencies send the FWS or NOAA Fisheries a public notice of a Section 404 permit. FWS or NOAA Fisheries may file comments on the permit stating concerns about the negative impact the activity will have on the environment, and suggest measures to reduce the impact.

Executive Orders

E.O. 12114: Environmental Effects Abroad of Major Federal Actions

The purpose of this Executive Order is to enable responsible officials of federal agencies having ultimate responsibility for authorizing and approving actions encompassed by this Order to be informed of pertinent environmental considerations and to take such considerations into account, with other pertinent considerations of national policy, in making decisions regarding such actions. While based on independent authority, this Order furthers the purpose of the National Environmental Policy Act (NEPA) and the Marine Protection Research and Sanctuaries Act and the Deepwater Port Act consistent

with the foreign policy and national security policy of the United States, and represents the United States government's exclusive and complete determination of the procedural and other actions to be taken by federal agencies to further the purpose of the NEPA, with respect to the environment outside the United States, its territories and possessions.

Agencies in their procedures shall establish procedures by which their officers having ultimate responsibility for authority and approving actions in one of the following categories encompassed by this Order, take into consideration in making decisions concerning such actions, a document described in Section 2-4(a):

(1) major federal actions significantly affecting the environment of the global commons outside the jurisdiction of any nation (e.g., the oceans or Antarctica);
(2) major federal actions significantly affecting the environment of a foreign nation not participating with the United States and not otherwise involved in the action;
(3) major federal actions significantly affecting the environment of a foreign nation which provide to that nation:
    (a) a product, or physical project producing a principal product or an emission or effluent, which is prohibited or strictly regulated by federal law in the United States because its toxic effects on the environment create a serious public health risk; or
    (b) a physical project which in the United States is prohibited or strictly regulated by federal law to protect the environment against radioactive substances.
(4) major federal actions outside the United States, its territories and possessions which significantly affect natural or ecological resources of global importance designated for protection under this subsection by the President, or, in the case of such a resource protected by international agreement binding on the United States, by the Secretary of State. Recommendations to the President under this subsection shall be accompanied by the views of the Council on Environmental Quality and the Secretary of State.

E.O. 12866: Regulatory Planning and Review

Executive Order 12866: Regulatory Planning and Review, signed in 1993, requires federal agencies to assess the costs and benefits of their proposed regulations, including distributional impacts, and to select alternatives that maximize net benefits to society. To comply with E.O. 12866, NOAA Fisheries prepares a Regulatory Impact Review (RIR) for all fishery regulatory actions that either implement a new fishery management plan or significantly amend an existing plan. RIRs provide a comprehensive analysis of the costs and benefits to society associated with proposed regulatory actions, the problems and policy objectives prompting the regulatory proposals, and the major alternatives that could be used to solve the problems. The reviews also serve as the basis for the agency's determinations as to whether proposed regulations are a "significant regulatory action" under the criteria provided in E.O. 12866 and whether proposed regulations will have a significant economic impact on a substantial number of small entities in compliance with the Regulatory Flexibility Act (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 has other major economic effects.

E.O. 12630: Takings

The Executive Order on Government Actions and Interference with Constitutionally Protected Property Rights, which became effective March 18, 1988, requires that each federal agency prepare a Takings Implication Assessment for any of its administrative, regulatory, and legislative policies and actions that affect, or may affect, the use of any real or personal property. Clearance of a regulatory action must include a takings statement and, if appropriate, a Takings Implication Assessment.

E.O. 13089: Coral Reef Protection

The Executive Order on Coral Reef Protection (June 11, 1998) requires federal agencies whose actions may affect U.S. coral reef ecosystems to identify those actions, utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and, to the extent permitted by law, ensure that actions they authorize, fund or carry out not degrade the condition of that ecosystem. By definition, a U.S. coral reef ecosystem means those species, habitats, and other national resources associated with coral reefs in all maritime areas and zones subject to the jurisdiction or control of the United States (e.g., federal, state, territorial, or commonwealth waters).

E.O. 13112: Invasive Species

The Executive Order requires agencies to use authorities to prevent introduction of invasive species, respond to and control invasions in a cost effective and environmentally sound manner, and to provide for restoration of native species and habitat conditions in ecosystems that have been invaded. Further, agencies shall not authorize, fund, or carry out actions that are likely to cause or promote the introduction or spread of invasive species in the U.S. or elsewhere unless a determination is made that the benefits of such actions clearly outweigh the potential harm; and that all feasible and prudent measures to minimize the risk of harm will be taken in conjunction with the actions. The actions undertaken in this amendment will not introduce, authorize, fund, or carry out actions that are likely to cause or promote the introduction or spread of invasive species in the U.S. or elsewhere.

E.O. 13132: Federalism

The Executive Order on federalism requires agencies in formulating and implementing policies that have federalism implications, to be guided by the fundamental federalism principles. The Order serves to guarantee the division of governmental responsibilities between the national government and the states that was intended by the framers of the Constitution. Federalism is rooted in the belief that issues that are not national in scope or significance are most appropriately addressed by the level of government closest to the people. This Order is relevant to FMPs and amendment given the overlapping authorities of NOAA Fisheries, the states, and local authorities in managing coastal resources, including fisheries, an the need for a clear definition of responsibilities. It is important to recognize those components of the ecosystem over which fishery managers have no direct

control and to develop strategies to address them in conjunction with appropriate state, tribes and local entities.

E.O. 13158: Marine Protected Areas

Executive Order 13158 (May 26, 2000) requires federal agencies to consider whether their proposed action(s) will affect any area of the marine environment that has been reserved by federal, state, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural or cultural resource within the protected area.

E.O. 12898: Environmental Justice

This Executive Order mandates that each federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions. Federal agency responsibilities under this Executive Order include conducting their programs, policies, and activities that substantially affect human health or the environment, in a manner that ensures that such programs, policies, and activities do not have the effect of excluding persons from participation in, denying persons the benefit of, or subjecting persons to discrimination under, such, programs policies, and activities, because of their race, color, or national origin. Furthermore, each federal agency responsibility set forth under this Executive Order shall apply equally to Native American programs.

Specifically, federal agencies shall, to the maximum extent practicable; conduct human health and environmental research and analysis; collect human health and environmental data; collect, maintain and analyze information on the consumption patterns of those who principally rely on fish and/or wildlife for subsistence; allow for public participation and access to information relating to the incorporation of environmental justice principals in federal agency programs or policies; and share information and eliminate unnecessary duplication of efforts through the use of existing data systems and cooperative agreements among federal agencies and with State, local, and tribal governments.

Marine Mammal Protection Act (MMPA)

The MMPA established a moratorium, with certain exceptions, on the taking of marine mammals in U.S. waters and by U.S. citizens on the high seas. It also prohibits the importing of marine mammals and marine mammal products into the United States. Under the MMPA, the Secretary of Commerce (authority delegated to 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 otters, polar bears, manatees, and dugongs.

In 1994, Congress amended the MMPA, to govern the taking of marine mammals incidental to commercial fishing operations. 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; Category III designates fisheries with a remote likelihood or no known serious injuries or mortalities. To legally fish in a Category I and/or II fishery, a fisherman must obtain a marine mammal authorization certificate by registering with the Marine Mammal Authorization Program (50 CFR 229.4) and accommodate an observer if requested (50 CFR 229.7(c)) and they must comply with any applicable take reduction plans. According to the List of Fisheries for 2010 published by the National Marine Fisheries Service, the both the Reef Fish (all gear) and Caribbean conch fisheries are considered Category III (74 FR 58859).

Paperwork Reduction Act

The Paperwork Reduction Act (PRA) of 1995 (44 U.S.C. 3501 et seq.) regulates the collection of public information by federal agencies to ensure that the public is not overburdened with information requests, that the federal government's information collection procedures are efficient, and that federal agencies adhere to appropriate rules governing the confidentiality of such information. The PRA requires NOAA Fisheries to obtain approval from the Office of Management and Budget before requesting most types of fishery information from the public. This action contains no new collections of information.

Small Business Act

The Small Business Act of 1953, as amended, Section 8(a), 15 U.S.C. 634(b)(6), 636(j), 637(a) and (d); Public Laws 95-507 and 99-661, Section 1207; and Public Laws 100-656 and 101-37 are administered by the Small Business Administration (SBA). The objectives of the act are to foster business ownership by individuals who are both socially and economically disadvantaged; and to promote the competitive viability of such firms by providing business development assistance including, but not limited to, management and technical assistance, access to capital and other forms of financial assistance, business training and counseling, and access to sole source and limited competition federal contract opportunities, to help the firms to achieve competitive viability. Because most businesses associated with fishing are considered small businesses, NMFS, in implementing regulations, must make an assessment of how those regulations will affect small businesses.

Magnuson-Stevens Act Essential Fish Habitat (EFH) Provisions

The Magnuson-Stevens Act includes EFH requirements, and as such, each existing, and any new, FMPs must describe and identify EFH for the fishery, minimize to the extent practicable adverse effects on that EFH caused by fishing, and identify other actions to encourage the conservation and enhancement of that EFH. The Council and NMFS have determined there are no adverse effects to EFH in this amendment as discussed in the Environmental Consequences section (Section 5.0).

DRAFT

National Environmental Policy Act

The National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321 et seq.) requires federal agencies to consider the environmental and social consequences of proposed major actions, as well as alternatives to those actions, and to provide this information for public consideration and comment before selecting a final course of action. This document contains an Environmental Impact Statement to satisfy the NEPA requirements. The statement of need can be found in Section 2, Alternatives are found in Section 4, the environmental impacts are found in Section 5, and a list of agencies/people consulted is found in Section 10.

Regulatory Flexibility Act

The purpose of the RFA (1980, 5 U.S.C. 601 et seq.) is to ensure that federal agencies consider the economic impact of their regulatory proposals on small entities, analyze effective alternatives that minimize the economic impacts on small entities, and make their analyses available for public comment. The RFA does not seek preferential treatment for small entities, require agencies to adopt regulations that impose the least burden on small entities, or mandate exemptions for small entities. Rather, it requires agencies to examine public policy issues using an analytical process that identifies, among other things, barriers to small business competitiveness and seeks a level playing field for small entities, not an unfair advantage.

After an agency determines that the RFA applies, it must decide whether to conduct a full regulatory flexibility analysis (IRFA or Final Regulatory Flexibility Analysis) or to certify that the proposed rule will not "have a significant economic impact on a substantial number of small entities. In order to make this determination, the agency conducts a threshold analysis, which has the following 5 parts: 1) Description of small entities regulated by proposed action, which includes the SBA size standard(s), or those approved by the Office of Advocacy, for purposes of the analysis and size variations among these small entities; 2) Descriptions and estimates of the economic impacts of compliance requirements on the small entities, which include reporting and recordkeeping burdens and variations of impacts among size groupings of small entities; 3) Criteria used to determine if the economic impact is significant or not; 4) Criteria used to determine if the number of small entities that experience a significant economic impact is substantial or not; and 5) Descriptions of assumptions and uncertainties, including data used in the analysis. If the threshold analysis indicates that there will not be a significant economic impact on a substantial number of small entities, the agency can so certify. The IRFA for this action can be found in Section 7.0.

DRAFT

Appendix 7. Research Needs

An overarching consideration with regard to the following research needs is that they be well-designed and include statistically valid sample sizes and distribution and that they be conducted with a commitment to long-term data collection as appropriate (SEDAR 2009).

- Conduct age, growth, and reproduction studies for important fish groups in the U.S. Caribbean (those species or groups overfished or undergoing overfishing).
- Determine a more complete picture of the locations of spawning aggregation sites for snapper/grouper (idea is to determine the location of a greater number of spawning aggregation sites).
- Assess the temporal and spatial stability of spawning aggregrations.
- Elucidate source-sink dynamics and larval transport pathways, including stability of those pathways, for reef fish and queen conch metapopulations in the U.S. Caribbean.
- Determine fishery-independent CPUEs for principle gears in the U.S. Caribbean.
- Determine the adult standing crop of queen conch in Lang Bank USVI and compare to overall populations of the rest of STX.
- Develop techniques for aging queen conch.
- Determine the biological and economic effects of various escape vents on fish and lobster traps.
- Determine the effects of harvesting herbivorous fishes and invertebrates (queen conch) on the settlement of coral propagules.
- Quantify the size distribution and abundance of fishes in MPAs and compare to similar habitats outside of MPAs.
- Compare four treatments for macroalgal vs. coral cover, including:
    1. unfished/no point source pollution;
    2. fished/no point source pollution;
    3. unfished/point source pollution; and,
    4. fished/point source pollution.
- Continue the trap studies by Sheridan et al. from NMFS' SEFSC.
- Conduct reef fish surveys (focused on targeted species (grouper, snapper, triggerfish, parrotfish)) that can be used for density and abundance estimates.
- Conduct benthic habitat surveys that can be used for abundance and density estimates of benthic species (corals, algae, and sponges), rugosity, and temporal variation (i.e., long term studies).
- Conduct hydrographic studies to aid in determining larval flow/marine reserve areas.
- Obtain effort analysis for both the commercial and recreational fisheries.
- Effect comparative studies between reserve areas (that we think are actually enforced) and fished areas, focusing on assemblage density and for both fish and benthic communities.
- Evaluate and verify expansion factors used to estimate total catch from trip intercepts.

DRAFT

- Develop and implement effective sampling programs for recreational and commercial fisheries.
- Collate, computerize, and evaluate the quality of early biological and biostatistical data collected from U.S. Caribbean waters.

Appendix 8. Response to Comments on DEIS

CFMC, Amend 2 Queen Conch and Amend 5 Reef Fish
D. Keys DEIS comments
March 16, 2010
Refer to 40 CFR 1502.10 through 1502.18 for the format and contents of an EIS.
Refer to NEPAnet for policy and guidance: http://ceq.hss.doe.gov/nepa/nepanet.htm

- Strongly suggest adding the phrases "annual catch limits" and "accountability measures" to the title of this consolidated dual amendment/EIS.

  I am hesitant to unilaterally alter the title as it has been distributed to an extensive list of people and agencies as it is presently titled. However, I will discuss this with the team and if they are in accordance then the title will be changed.

- **Cover sheet**—Designate NMFS as the "Lead Agency" on page 8. Keep the cover page to one page. Include a one paragraph abstract of the statement.

  NMFS has been designated as the lead agency, the cover page is a single page, and a one-paragraph abstract has been added.

- **Summary**—not yet written, but keep it under 15 pages.

  An Executive Summary has been added. It is 21 pages in length, but most of that is a table describing the various alternatives that was requested by PPI in their initial review. Some of that length is derived from the need to coherently split the table between pages.

- **Table of Contents**—Ensure that the section numbers in the TOC match those in the document, e.g. see cumulative effects (6.9 v. 6.7). Top of page 2, change "FEIS" to "DEIS."

  - Add a separate page for the DEIS Table of Contents (NAO 216-6, Sec. 6.03a.2), which should have the same topic headings as the first level (solid black) bullets in this set of comments.

  TOC has been updated and should be correct. FEIS has been changed to DEIS. A separate TOC for the DEIS has not been addressed.

- **Purpose and need**—**A**dequate, but still too lengthy. In addition, section 2.3, Background, immediately precedes section 3.1, Background. Suggest putting all background material into the section 3.1 Background.

  Done.

- **Alternatives**—Delete "(status quo)" from all alternatives that have it and stick with the "No Action." We have far too much difficulty in this "status quo" matter. NEPA requires us to include the "No Action" alternative (40 CFR 1502.14(d)). When we call it the "status quo" we really mean *no change in the status quo*, which is actually the "No Action" alternative. Also see Question #3 in Forty Most Asked Questions Concerning CEQ's NEPA Regulations, 23 March 1981, in NEPAnet as at the beginning of these comments.

  Done.

  Several actions have only two alternatives, which violates the search for all reasonable alternatives required by NEPA and the CEQ NEPA Regulations, 40 CFR 1502.14, as well as the stated purpose and need on page 10 of the DEIS.

  The Alternatives in this document have been vetted through GC and no objections to their structure have been expressed. Those Actions or Sub-actions with only two alternatives are by their nature limited to two alternatives. For example, in Action 1the options are to either maintain the FMUs as they presently stand or to revise them as proposed. Note that, although many actions appear to have only two alternatives, there are many sub-actions and sub-alternatives so in reality there are more than two alternatives for almost every action with the exception of Action 3(b), and that too is a sub-action. This topic was discussed at length with David Keys and he concurred with this approach.

  There are no preferred alternatives designated in the DEIS.

  Preferred Alternatives for most but not all actions were chosen by the CFMC at their April 2010 meeting and have been designated throughout the document.

  There is no monitoring or mitigation analysis in the DEIS. That analysis must be included in the Environmental Consequences section, the Alternatives section, or in the Cumulative effects section, numbers 10 and 11.

  This has been added as Section 6.10.

- **Affected Environment**—this section is too long at over 100 pages out of 273 pages total. Shorten it up as much as possible. Refer to 40 CFR 1502.15.

This remains the longest section of the document, and the majority of the section addresses economic and social aspects of the U.S. Caribbean fisheries, both recreational and commercial. I defer to the contributing economist on modifications to the socioeconomic impacts sections. Socioeconomics impacts of the actions in this amendment have been very controversial and have included Congressional subcommittee meetings involving Puerto Rico and USVI commercial fishermen and their political representatives. Because of the complexity and controversy of these issues, it is felt that the extensive socioeconomic discussions included in the document are necessary and appropriate. David Keys concurred with this approach.

- **Environmental Consequences**—
    - **Cumulative effects analysis and climate change**—Finish the cumulative effects analysis, including climate change. While climate change is mentioned a few times, there is no analysis of its potential effects on the proposed actions.

      This section has been extensively revised.

    - **Socioeconomic and environmental justice—**on page 238, **s**pecify section 5.3 and various subsections in 6 that address the "Direct and Indirect Effects on the Economic and Social Environments." In addition, section 7.3, Summary of Social Impact Assessment, should provide a brief summary of those pertinent analyses in the aforementioned sections. Page 271, environmental justice, here we mostly describe the requirements of the EO except for the last three sentences. In those sentences we make the claim that there are no EJ issues without any supporting analysis. Suggest moving the EJ analysis, when completed, into the environmental consequences and/or cumulative effects section of the document.

    - **Adverse effects that cannot be avoided—**this part of the DEIS is limited to one sentence that states there are no adverse effects, which does not make sense given this is an DEIS. For only one example, see page 227 just under Figure 6.4.2.1 where it states that "The economic and social impacts of **Alternatives 2a, 2b, and 2c** are unknown; however, it is likely that St. Croix fishers, their families and families could experience larger adverse impacts than their counterparts in St. Thomas/St. John and possibly significantly larger adverse impacts than their counterparts in Puerto Rico." Suggest reviewing all of the direct and indirect analyses in section 6 for potential adverse impacts and summarizing them in section 6.8,

DRAFT

Unavoidable adverse effects, page 236. The TOC section number does not match the section number in the document here either (6.10 v. 6.8).

- **Relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity**—this analysis has not yet been started and/or included in the DEIS.

- **Irreversible and irretrievable commitment of resources—**this section is confusing because it starts off by stating there are no irretrievable commitments of resources, then states that there may be. Be clear on what we mean.

  The previous four comments have been addressed by extensively revising each sectioin in response to David Keys' comments, and he is satisfied that his concerns have been appropriately dealt with.

- **List of Preparers—**add a chart listing the name, title, agency, division, and location of all IPT members. See SAFMC Amendment 17A for an example.

  Done.

- **Distribution—**List the agencies, organizations, and persons to who we are sending copies of the DEIS. This part is adequate, but double check for inclusiveness and error on the side of inclusion.

  Done.

- **Index—**not yet compiled and/or included in the DEIS.

  Index has been added.

Appendices—there are three out of seven appendices in some form of completion in this document, see page 258. Appendix 7, Alternatives considered but rejected, is not among them but is crucial to the NEPA analysis. The DEIS must include scoping reports or scoping summaries and we often place them in an appendix.

Done.

Other applicable laws—page 268, change "E.O. 12114: Environmental Assessments of Actions Abroad" to "E.O. 12114: Environmental Effects Abroad of Major Federal Actions."

This has been changed in the most recent version.

Throughout sections 4, 5, and 6 we say that data or effects are "unknown." For only one example see page 11, Table 2.2.1. We must be as objective as possible about what we do know and what we do not know. The CEQ NEPA Regulations, 40 CFR 1502.22, Incomplete or unavailable information, anticipate this uncertainty of information in decision making and lay out a method for proceeding with the analysis. If the incomplete information is necessary for making an informed choice among alternatives, and the overall cost is not exorbitant, the information must be obtained and included in the analysis. If we cannot get the information, then we must clearly indicate that it cannot be obtained because either the overall cost is exorbitant, or the means of obtaining it are not known. There are four specific requirements of 40 CFR 1502.22 (b) (1)-(4):

1. A statement that such information is incomplete or unavailable;
2. A statement of the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment;
3. A summary of existing credible scientific evidence which is relevant to evaluating the reasonably foreseeable significant adverse impacts on the human environment, and
4. The agency's evaluation of such impacts based upon theoretical approaches or research methods generally accepted in the scientific community. For the purposes of this section, "reasonably foreseeable" includes impacts which have catastrophic consequences, even if their probability of occurrence is low, provided that the analysis of the impacts is supported by credible scientific evidence, is not based on pure conjecture, and is within the rule of reason.

See Hilborn, R. and R. M. Peterman, 1996, in the reference section of the DEIS, page 245: http://www.fao.org/docrep/003/W1238E/W1238E04.htm and also see Improving the Use of the "Best Scientific Information Available" Standard in Fisheries Management (2004), Ocean Studies Board (OSB**),** especially chapter 3, Characterizing "Best Scientific Information Available."

The IPT writing team has addressed this comment and David Keys concurs.

DRAFT