

## **New Fisheries Management in the US Caribbean: A Comprehensive Sustainable Fisheries Act Amendment**

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### **ABSTRACT**

A Comprehensive Sustainable Fisheries Act amendment approved by the Caribbean Fishery Management Council to amend its Reef Fish, Spiny Lobster, Queen Conch, and Coral Fishery Management Plans (FMPs) has been implemented and is in effect. The comprehensive amendment is designed to ensure the FMPs are fully compliant with the provisions of the Magnuson-Stevens Fishery Conservation and Management Act. The proposed rule would redefine the fishery management units for the FMPs; establish seasonal closures; impose gear restrictions and requirements; revise requirements for marking pots and traps; and prohibit the filleting of fish at sea. In addition, the comprehensive amendment would establish biological reference points and stock status criteria; establish rebuilding schedules and strategies to end overfishing and rebuild overfished stocks; provide for standardized collection of bycatch data; minimize bycatch and bycatch mortality to the extent practicable; designate essential fish habitat (EFH) and EFH habitat areas of particular concern (HAPCs); and minimize adverse impacts on such habitat to the extent practicable. The intended effect of this proposed rule is to achieve optimum yield in the fisheries and provide social and economic benefits associated with maintaining healthy stocks.

KEY WORDS: Fisheries management, sustainable fisheries, US Caribbean

## **Nueva Gerencia de las Industrias Pesqueras en los E.E.U.U. el Caribe: Una Enmienda Sostenible Comprensiva Del Acto De las Industrias Pesqueras**

Una enmienda sostenible comprensiva del acto de las industrias pesqueras aprobada por el consejo del Caribe de la gerencia de la industria pesquera para enmendar sus pescados del filón, langosta espinosa, conch de la reina, y planes coralinos de la gerencia de la industria pesquera (FMPs) se ha puesto en ejecución y está en efecto. La enmienda comprensiva se diseña para asegurar el FMPs es completamente obediente con las provisiones del acto de la conservación y de la gerencia de la industria pesquera de Magnuson-Stevens. La regla propuesta redefiniría las unidades de la gerencia de la industria pesquera para el FMPs; establezca los encierros estacionales; imponga las restricciones y los requisitos del engranaje; revise los requisitos para marcar los potes y las trampas; y prohíba cortar de pescados en el mar. Además, la enmienda comprensiva establecería puntos de referencia biológicos y los criterios comunes del estado; establezca la reconstrucción de horario y las estrategias para terminar overfishing y la reconstrucción overfished la acción; prevea la colección estandarizada de datos del bycatch; reduzca al mínimo el bycatch y la mortalidad del bycatch al grado practicable; señale las áreas esenciales del habitat de los pescados (EFH) y del habitat de EFH de la preocupación especial (HAPCs); y reduzca al mínimo los impactos adversos en tal habitat al grado practicable. El efecto previsto de esta regla propuesta es alcanzar la producción óptima en las industrias pesqueras y proporcionar las ventajas sociales y económicas asociadas a mantener la acción sana.

PALABRAS CLAVES: Gerencia de las industrias pesqueras, industrias pesqueras sostenibles, los E.E.U.U. el Caribe

### **INTRODUCTION**

The status of fish and invertebrate stocks in the United State Caribbean (i.e., the federal waters surrounding Puerto Rico and the U.S. Virgin Islands) has been a general concern for many years (Kawaguchi 1974, Stevenson 1978, Suarez-Caabro 1979, Boardman and Weiler 1980, Appledoorn and Lindeman 1985, Bohnsack *et al.* 1986, Kimmel and Appledoorn 1992, Garrison *et al.* 1998, National Marine Fisheries Service 1999, 2001, 2002, 2005). In an effort to organize fisheries management in the 200-mile Fishery Conservation Zone (a.k.a., Exclusive Economic Zone (EEZ)) of the U.S. Caribbean, the Caribbean Fishery Management Council (Council) was

established in 1976. The Caribbean Council consists of the Virgin Islands and the Commonwealth of Puerto Rico and has authority over the fisheries in the Caribbean Sea and Atlantic Ocean seaward of these U.S. possessions, except for highly migratory species that occur within the geographical area of authority of more than one of the Councils. The Caribbean Council has seven (7) voting members with at least one from each possession. The Council and NOAA's National Marine Fisheries Service (NMFS) using four fishery management plans (i.e., Reef Fish, Spiny Lobster, Queen Conch, and Coral Fishery Management Plans, FMPs) manage fisheries in the U.S. Caribbean. These fishery management plans and any

amendments are implemented under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA 1996). To be compliant with the MSFCMA FMPs must, among other things, end overfishing and rebuild depleted stocks. The Council submitted a Comprehensive Sustainable Fisheries Act Amendment (SFA Amendment) to all of its FMPs in June 16, 2005, which addressed all required mandates for compliance (CFMC 2005). The associated fishery regulations, implemented in November 2005, redefine the fishery management units for the FMPs:

- i) Establish seasonal closures;
- ii) Impose gear restrictions and requirements;
- iii) Revise requirements for marking pots and traps; and
- iv) Prohibit the filleting of fish at sea.

In addition, the comprehensive amendment establishes biological reference points and stock status criteria:

- i) Rebuilding schedules and strategies to end overfishing and rebuild depleted stocks;
- ii) Provides for standardized collection of bycatch data;
- iii) Minimizes bycatch and bycatch mortality to the extent practicable;
- iv) Designates essential fish habitat (EFH) and EFH habitat areas of particular concern (HAPCs); and
- v) Minimizes adverse impacts on such habitat to the extent practicable.

The intended effect of these regulations is to achieve optimum yield in the fisheries and provide social and economic benefits associated with maintaining healthy stocks. Within the amendment the impacts of amending the FMPs in the US Caribbean are described (CFMC 2005). The SFA Amendment also includes the description and identity of EFH for managed stocks, minimizes to the extent practicable adverse effects on such habitat caused by fishing, and identifies other actions to encourage the conservation and enhancement of such habitat.

## METHODS

### The Council Process

Using input from Caribbean resource stakeholders (i.e., Council members, Scientific and Statistical Committee, Advisory Panels, Sustainable Fisheries Act Working Group, Southeast Fishery Science Center, several non-governmental organizations, and many public hearings) the Council selected management measures from a reasonable range of alternatives. These measures were the basis for the SFA Amendment (CFMC 2005)

### Description of Chosen Alternatives

The alternatives, selected by the Council and approved by NMFS to address the MSFCMA requirements, are

summarized in Table 1. The alternatives in Table 1 are organized under seven general categories of actions:

- i) Defining fishery management units (FMUs) and sub-units,
- ii) Specifying biological reference points and stock status determination criteria,
- iii) Regulating fishing mortality,
- iv) Rebuilding overfished fisheries,
- v) Conserving and protecting yellowfin grouper,
- vi) Achieving the MSFCMA bycatch mandates, and
- vii) Achieving the MSFCMA EFH mandates.

A detailed description of the rationale behind the choice of each alternative, the methods used to determine stock status, and the needed reduction in fishing mortality can be found in CFMC, 2005. The following is a brief summary of the SFA Amendment.

Generally, FMU groupings are based on taxonomic families or subfamilies, modified by biological, geographic, economic, technical, social, and/or ecological criteria. In particular, effort was directed at grouping species caught in similar habitats with similar gear and whose ecologies and current status were thought to be similar. However, much remains to be learned about these various components of Caribbean fisheries. Scientific publications have provided insight into the biology and ecology of many managed species. Data on the depth distribution of species and the composition of landings by gear type were used to define complexes of food fish that are captured in similar depth ranges and with similar fishing gear. These types of information were considered in defining species that would best be managed together as sub-units.

The fisheries management unit measures re-define the FMUs and sub-units in the Queen Conch, Reef Fish, and Coral FMPs as detailed in Table 2. These measures include: Redefining select FMUs to represent only those species that are present in sufficient numbers in the U.S. EEZ to warrant inclusion in Council FMPs; retaining select species in FMUs for data collection only, based on a lack of need for conservation and management in federal waters; and defining or modifying FMU sub-units to include species that are best managed in coordination, for example, species that may be targeted collectively due to similar habitat and depth preference, or landed collectively due to gear type employed by the fishery.

The MSFCMA requires that each FMP define management reference points in the form of maximum sustainable yield (MSY) and optimum yield (OY). MSY is the greatest amount or yield of a species that can be sustainably harvested under prevailing environmental conditions, while OY is the amount or yield of a species that "will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems..."

**Table 1.** Management measures implemented by the Caribbean Sustainable Fisheries Act Amendment to achieve the defined purpose and need and compliance with the MSFCMA. The application of an alternative to an FMP is identified with an X. The acronym "AT" stands for aquarium trade species, "AO" stands for all other species in the FMU, and "QC" stands for queen conch.

MANAGEMENT ACTION	CORAL		QUEEN CONCH		REEF FISH		LOBSTER
	AT	AO	QC	AO	AT	AO	
<u>Management Measures (Alternatives)</u>							
<b>DEFINING FISHERY MANAGEMENT UNITS AND SUB-UNITS</b>							
<b>Defining FMUs and Sub-Units</b>							
Redefine the FMUs and FMU sub units in Council FMPs as detailed in Table 8. Delete from the Caribbean Conch Resource FMU the Caribbean helmet, <i>Cassia tuberosa</i> ; Caribbean vase, <i>Vasum muricatum</i> ; flame helmet, <i>Cassia flammea</i> ; and whelk (West Indian top shell), <i>Cittarium pica</i> , leaving nine other species detailed in Table 2.	X	X	X	X	X	X	X
<b>Additional Options for Aquarium Trade Species</b>							
Move aquarium trade species from a management to a data collection only category.	X				X		
Move all species in the Caribbean conch resource FMU, with the exception of queen conch, from a management to a data collection only category.				X			
<b>SPECIFYING BIOLOGICAL REFERENCE POINTS AND STOCK STATUS DETERMINATION CRITERIA</b>							
<b>Maximum Sustainable Yield (MSY)</b>							
In the absence of MSY estimates, the proxy for MSY will be derived from recent average catch (C), and from estimates of the current biomass ( $B_{CURR}/B_{MSY}$ ) and fishing mortality ( $F_{CURR}/F_{MSY}$ ) ratios as: $MSY = C / [(F_{CURR}/F_{MSY}) \times (B_{CURR}/B_{MSY})]$ ; 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.			X		X		X
Set MSY = 0.		X					
Set MSY equal to long term average catch based on commercial landings data from 1983–2001 and on recreational data provided by MRFSS for the years 2000–2001.							
<b>Fishing Mortality (F) and Biomass (B) Ratios</b>							
For each FMU sub-unit for which $B_{CURR}/B_{MSY}$ and $F_{CURR}/F_{MSY}$ have not been estimated through a stock assessment or other scientific exercise (i.e., stock status unknown), the following estimates will be used for the $B_{CURR}/B_{MSY}$ and $F_{CURR}/F_{MSY}$ proxies: 1) For species that are not believed to be at risk based on the best available information, the $F_{CURR}/F_{MSY}$ proxy is estimated as 0.75 and the $B_{CURR}/B_{MSY}$ proxy is estimated as 1.25; 2) For species for which no positive or negative determination can be made on the status of their condition, the default proxies for $F_{CURR}/F_{MSY}$ and $B_{CURR}/B_{MSY}$ are estimated as 1.00; and 3) For species that are believed to be at risk based on the best available information, the $F_{CURR}/F_{MSY}$ proxy is estimated as 1.50 and the $B_{CURR}/B_{MSY}$ proxy is estimated as 0.75.	X	X			X		X
<b>Optimum Yield (OY)</b>							
Set OY = 0.		X					
Set OY equal to the average yield associated with fishing on a continuing basis at $F_{OY}$ ; where $F_{OY} = 0.75F_{MSY}$ .			X		X		X

Table 1 continued.

MANAGEMENT ACTION	CORAL		QUEEN CONCH		REEF FISH		LOBSTER
<u>Management Measures (Alternatives)</u>							
<b>Minimum Stock Size Threshold (MSST)</b>	AT	AO	QC	AO	AT	AO	
Set MSST = $B_{MSY}(1 - c)$ ; where $c$ = the natural mortality rate ( $M$ ) or 0.50, whichever is smaller.		X	X			X	X
<b>Maximum fishing mortality threshold (MFMT), and limit and target control rules.</b>							
A) Specify an MSY control rule to define MFMT and ABC as 0; and		X					
B) Specify an OY control rule to define target catch levels as 0.							
A) Specify an MSY control rule to define $ABC = F_{MSY}(B)$ . When the data needed to determine $F_{MSY}$ are not available, use natural mortality ( $M$ ) as a proxy for $F_{MSY}$ ; and			X			X	X
B) Specify an OY control rule to define target catch limits such that they equal $F_{OY}(B)$ . If $F_{OY}$ can not be determined, use $0.5(M)$ as a proxy.							
<b>REGULATING FISHING MORTALITY</b>							
<b>Short term management alternatives</b>							
Establish seasonal closures.						X	
Eliminate the use of gill and trammel nets in the U.S. EEZ.						X	
Develop a memorandum of understanding (MOU) between NMFS and the state governments to develop compatible regulations to achieve the management objectives set forth in all Council FMPs in state and federal waters of the U.S. Caribbean							
<b>REBUILDING OVERFISHED FISHERIES</b>							
<b>Nassau Grouper (Rebuilding Schedule)</b>							
Rebuild Nassau grouper to $B_{MSY}$ in 25 years, using the formula $T_{min}$ (10 years) + one generation (15 years) = 25 years.						X	
<b>Nassau Grouper (Rebuilding Strategy)</b>							
Prohibit the filleting of fish in federal waters of the U.S. Caribbean. Require that fish captured or possessed in federal waters be landed with heads and fins intact.						X	
Alternative 4: Develop a memorandum of understanding (MOU) between NMFS and the USVI government to develop compatible regulations to achieve the objectives for Nassau grouper set forth in the Caribbean Fishery Management Council's Reef Fish FMP in USVI and federal waters of the U.S. Caribbean.						X	

Table 1 continued.

MANAGEMENT ACTION	CORAL		QUEEN CONCH		REEF FISH		LOBSTER
	AT	AO	QC	AO	AT	AO	
<b>Goliath Grouper (Rebuilding Schedule)</b>							
<b>Management Measures (Alternatives)</b>							
Rebuild Goliath grouper to $B_{MSY}$ in 30 years, using the formula $T_{min}$ (10 years) + one generation (20 years) = 30 years.							X
Prohibit the filleting of fish in federal waters of the U.S. Caribbean. Require that fish captured or possessed in federal waters be landed with heads and fins intact.							X
<b>Queen Conch (Rebuilding Schedule)</b>							
Rebuild queen conch to $B_{MSY}$ in 15 years, using the formula $T_{min}$ (10 years) + one generation (5 years) = 15 years.			X				
<b>Queen Conch (Rebuilding Strategy)</b>							
Prohibit commercial and recreational catch, and possession of queen conch in federal waters of the U.S. Caribbean, with the exception of Lang Bank near St. Croix.			X				
<b>Grouper Unit 4 (Rebuilding Schedule)</b>							
Rebuild Grouper Unit 4 to $B_{MSY}$ in 10 years.							X
<b>CONSERVING AND PROTECTING YELLOWFIN GROUPE</b>							
<b>ACHIEVING THE MSFCMA BYCATCH MANDATES</b>							
<b>Bycatch Reporting</b>							
Utilize the MRFSS database to provide additional bycatch information on the recreational and subsistence sectors.	X		X	X	X	X	X
Modify the trip ticket system currently in place in the U.S. Caribbean to require the collection of information on bycatch.	X		X	X	X	X	X
<b>Minimizing Bycatch and Bycatch Mortality to the Extent Practicable</b>							
<b>ACHIEVING THE MSFCMA EFH MANDATES</b>							
<b>Describe and identify EFH</b>							
Implement the preferred alternative from the EFH EIS to describe and identify EFH according to functional relationships between life history stages of federally-managed species and Caribbean marine and estuarine habitats.		X	X			X	X
Implement the preferred alternative from the EFH EIS to designate HAPCs.		X	X			X	X
<b>Minimize adverse effects on EFH</b>							
Implement the preferred alternative from the EFH EIS to establish modifications to anchoring techniques; establish modifications to construction specifications for pots/traps; and close areas to certain recreational and commercial fishing gears (i.e., pots/traps, gill/trammel nets, and bottom longlines) to prevent, mitigate, or minimize adverse fishing impacts in the EEZ.		X	X			X	X

**Table 2.** Recent combined landing averages in pounds for the U.S. Caribbean. Commercial landings were averaged over 1997 - 2001 for Puerto Rico, and 1994 - 2002 for the USVI. Recreational landings were averaged from MRFSS over 2000 - 2001 for Puerto Rico, and extrapolated for the USVI from Mateo (2001).

<b>STOCK (Table 2)</b>	<b>Commercial Landings</b>	<b>Recreational Landings</b>	<b>Total</b>	<b>Commercial Allocation</b>	<b>Recreational Allocation</b>
<b>REEF FISH FMP</b>					
<b>SNAPPER</b>					
<b>Unit 1</b>	301,434	176,757	478,191	63%	37%
SNAPPER, BLACK					
SNAPPER, BLACKFIN					
SNAPPER, SILK					
SNAPPER, VERMILION					
SNAPPER, UNC					
<b>Unit 2</b>	81,533	69,898	151,431	54%	46%
SNAPPER, QUEEN					
WENCHMAN					
<b>Unit 3</b>	406,382	135,559	541,941	75%	25%
SNAPPER, GRAY					
SNAPPER, LANE					
SNAPPER, MUTTON					
SNAPPER, UNC					
SNAPPER, DOG					
SNAPPER, SCHOOLMASTER					
SNAPPER, MAHOGANY					
<b>Unit 4</b>	337,273	27,832	365,105	92%	8%
SNAPPER, YELLOWTAIL					
<b>GROUPE</b>					
<b>Unit 1</b>	20,314	4,349	24,663	82%	18%
GROUPE, NASSAU					
<b>Unit 2</b>	76	7,114	7,190	1%	99%
GROUPE, GOLIATH					
<b>Unit 3</b>	93,871	63,735	157,606	60%	40%
HIND, RED					
CONEY					
HIND, ROCK					
GRAYSBY					
CROLE FISH					
<b>Unit 4</b>	77,218	24,574	101,792	76%	24%
GROUPE, RED					
GROUPE, MISTY					
GROUPE, TIGER					
GROUPE, YELLOWFIN					
GROUPE, YELLOWEDGE					
GROUPE, UNC					

Table 2 continued.

STOCK (Table 2)	Commercial Landings	Recreational Landings	Total	Commercial Allocation	Recreational Allocation
<b>GRUNTS</b>	172,960	21,970	194,930	89%	11%
GRUNT, WHITE					
PORKFISH					
MARGATE					
GRUNT, BLUESTRIPED					
GRUNT, FRENCH					
GRUNT, TOMTATE					
GRUNTS, UNC					
<b>GOATFISH</b>	22,752	1,741	24,493	93%	7%
GOATFISH, SPOTTED					
GOATFISH, YELLOW					
GOATFISHES, UNC					
<b>PORGIES</b>	41,143	3,445	44,588	92%	8%
PORGIES, UNC					
PORGY, JOLTHEAD					
SEA BREAM					
PORGY, SHEEPSHEAD					
PORGY, PLUMA					
<b>SQUIRRELFISH</b>	19,104	7,603	26,707	72%	28%
BIGEYE					
SQUIRRELFISH, LONGSPINED					
SQUIRRELFISHES, UNC					
SOLDIERFISH, BLACKBAR					
SQUIRRELFISH					
<b>TILEFISH</b>	667	2,035	2,702	25%	75%
TILEFISH, UNC					
TILEFISH, BLACKLINE					
TILEFISH, SAND					
<b>JACKS</b>	117,226	192,749	309,976	38%	62%
BLUE RUNNER					
HORSE-EYE JACK					
BLACK JACK					
ALMACO JACK					
BAR JACK					
GREATER AMBERJACK					
JACK, YELLOW					
JACKS, UNC					
<b>PARROTFISHES</b>	278,244	33,690	311,934	89%	11%
PARROTFISH, BLUE					
PARROTFISH, MIDNIGHT					
PARROTFISH, PRINCESS					
PARROTFISH, QUEEN					

Table 2 continued.

STOCK (Table 2)	Commercial Landings	Recreational Landings	Total	Commercial Allocation	Recreational Allocation
PARROTFISH, RAINBOW					
PARROTFISH, REDFIN					
PARROTFISH, REDTAIL					
PARROTFISH, STOPLIGHT					
PARROTFISH, REDBAND					
PARROTFISH, STRIPED					
PARROTFISH, UNC					
<b>SURGEONFISH</b>	34,883	727	35,610	98%	2%
TANG, BLUE					
SURGEON, OCEAN					
DOCTORFISH					
SURGEONFISHES, UNC					
<b>TRIGGERFISH</b>	110,050	85,748	195,798	56%	44%
FILEFISH					
FILEFISH, SCRAWLED					
FILEFISH, WHITESPOTTED					
TRIGGERFISHES, UNC					
TRIGGERFISH, OCEAN					
DURGON, BLACK					
TRIGGERFISH, SARGASSUM					
TRIGGERFISH, QUEEN					
<b>BOXFISH</b>	108,428	4,910	113,338	96%	4%
BOXFISH, UNC					
COWFISH, HONEYCOMB					
COWFISH, SCRAWLED					
TRUNKFISH					
TRUNKFISH, SPOTTED					
TRUNKFISH, SMOOTH					
<b>WRASSES</b>	58,602	8,553	67,155	87%	13%
HOGFISH, SPANISH					
WRASSES, UNC					
PUDDINGWIFE					
HOGFISH					



Table 2 continued.

STOCK (Table 2)	Commercial Landings	Recreational Landings	Total	Commercial Allocation	Recreational Allocation
ANGELFISH	6,391	1,474	7,865	81%	19%
ANGELFISH, QUEEN					
ANGELFISH, GRAY					
ANGELFISH, FRENCH					
<b>Finfish Total =</b>	<b>2,288,550</b>	<b>874,466</b>	<b>3,163,015</b>	<b>72%</b>	<b>28%</b>
<b>SPINY LOBSTER FMP</b>					
LOBSTER, SPOTTED SPINY					
LOBSTER, SPINY	370,856	175,784	546,640	68%	32%
<b>QUEEN CONCH FMP</b>					
CONCH	287,364	151,584	438,948	65%	35%
OTHER CONCH	1,616	0	1,616	100%	0%
<b>GRAND TOTAL =</b>	<b>2,948,386</b>	<b>1,201,834</b>	<b>4,150,220</b>	<b>71%</b>	<b>29%</b>

While economic and social factors are to be considered in defining the OY for each fishery, OY may not be defined as an amount of fish that would compromise a stock's ability to produce MSY (i.e., OY can not be established in excess on MSY). OY must prevent overfishing, which occurs when fishing mortality exceeds the level at which fishing produces MSY. In the case of a depleted fishery, OY must provide for rebuilding to a stock biomass level that is consistent with that which would produce MSY.

The MSFCMA requires that each FMP specify objective and measurable criteria for identifying when a species is depleted. Status determination criteria must include a minimum stock size threshold (MSST) and a maximum fishing mortality threshold (MFMT). The MSST represents the biomass level below which a species or species complex would not be capable of producing MSY. A species or species complex with a biomass below the MSST is considered to be depleted. The MFMT represents the maximum level of fishing mortality that a species or species complex can withstand, while still producing MSY on a continuing basis. A fishery experiencing a fishing mortality rate that exceeds the MFMT is considered to be undergoing overfishing.

Together, these four parameters (i.e., MSY, OY, MSST, AND MFMT) are intended to provide fishery managers with the means to measure the status and performance of each species or sub-unit in the FMU. By evaluating annual catches, species biomass ( $B_{CURR}$ ), and fishing mortality rates ( $F_{CURR}$ ) in relation to MSY, OY, MSST, and MFMT, fishery managers can determine the status of a fishery at any given time and assess whether management measures are achieving established goals. The primary goal of federal fishery management, as described in National Standard 1 of the MSFCMA, is to conserve and manage U.S. fisheries to "...prevent overfishing while achieving, on a continuing basis, the optimum

yield from each fishery for the United States fishing industry".

The National Standard Guidelines contained in the MSFCMA (1996) direct regional fishery management councils to use reasonable proxies when data are insufficient to provide direct estimates of biological reference points and status determination criteria for species under their jurisdiction. Restrepo et al. (1998) provides guidance on various proxies that could be used for MSY, MSST, and MFMT in data-poor situations.

The overfishing alternatives define, or modify the existing definitions of stock status parameters necessary under the MSFCMA. Additionally, these alternatives provide quantitative definitions of stock status based on the best available scientific information on the condition of individual stocks and fisheries, and would establish control rules, or pre-agreed upon strategies for managing catches to achieve established goals and objectives. The parameters that would result for each stock or stock complex under each of these alternatives are detailed in Table 3.

In order to determine many of the stock status parameters for Caribbean FMU sub-units, most of which lack formal stock assessments and discrete data on current fishing mortality rates and biomass levels, assumptions on the perceived fishing mortality rates and relative biomass of managed species are required. These assumptions are not determinations on the official stock status (i.e., depleted, overfishing). For a species to be classified as depleted as outlined in the MSFCMA, a species biomass would have to fall below its MSST.

The F ratio, or fishing mortality rate ratio, is the current fishing mortality rate ( $F_{CURR}$ ) divided by the fishing mortality rate associated with MSY ( $F_{MSY}$ ). Likewise, the B ratio, or biomass ratio, is the current biomass ( $B_{CURR}$ ) divided by biomass at MSY ( $B_{MSY}$ ). In general and all things being equal, a healthy stock would have a low fishing mortality rate (F) and a high relative biomass (B).

Conversely, an unhealthy stock would have a high fishing mortality rate and a low biomass.

The fishing mortality and biomass status of each sub-unit (i.e., those that lack a stock assessment) was determined by the SFA Working Group, a Council-advisory group, which consisted of staff from the Council, the NMFS SERO and SEFSC, the USVI and Puerto Rico fisheries management agencies, and several environmental non-governmental organizations. As stated in Restrepo et al. (1998), "in cases of severe data limitations, qualitative approaches may be necessary, including expert opinion and consensus-building methods." Refinements to these determinations were made by the Council and were based largely on public comment and anecdotal information. The fishing mortality and biomass status determinations made by the SFA Working Group were based on best professional judgment, informed by available scientific and anecdotal information on a variety of factors (e.g., Appeldoorn et al. 1992), including the anecdotal observations of fishermen as reported by fishery managers, life history information, and the status of individual species as evaluated in other regions. For example, some snapper and grouper species are generally long-lived, are heavily targeted by fishermen, and are documented to spawn in aggregations that make them vulnerable to local overexploitation. This would likely translate to a high potential fishing mortality rate and a low potential relative biomass, possibly indicating an overfishing condition. Therefore, applying a precautionary approach, these species (i.e., FMU sub-units) would be candidates for being determined to be potentially "at risk" of overfishing or potentially being depleted by the SFA Working Group, see Table 3. Again, it should be pointed out that this is not an official determination that a depleted or overfishing condition exists per the MSFCMA, but simply an assumption on the current fishing mortality and relative biomass rates. A high fishing mortality rate and low relative biomass could lead to a depleted or overfishing condition if other factors (e.g., low natural mortality rate indicating a species is slow to recover to  $B_{MSY}$ ) existed. Conversely, if a species was felt to have a low fishing mortality rate and a high relative biomass, the SFA Working Group would determine that it was healthy and not to be "at risk" of overfishing or potentially being depleted. If there was insufficient information to make an informed judgement on the fishing mortality rate and/or relative biomass of a species or sub-unit, the default status of "unknown" was selected. Formal stock assessments do exist for queen conch, Nassau grouper, and goliath grouper, and they concluded that each of these species was depleted. Therefore, this official "depleted" status was utilized for these three species. The discussion resulting in these determinations took place at the October 23-24, 2002 meeting of the SFA Working Group in Carolina, Puerto Rico.

The resulting determinations made for each FMU sub-unit, following the methodology outlined above, are presented in Table 3 under the "Status" column. For the

Caribbean queen conch, spiny lobster, and all reef fish, excluding those species retained for data collection purposes:

- i) The proxy for MSY was derived from recent average catch (C), and from estimates of the current biomass ( $B_{CURR}/B_{MSY}$ ) and fishing mortality ( $F_{CURR}/F_{MSY}$ ) ratios as:  $MSY = C / [(F_{CURR}/F_{MSY}) \times (B_{CURR}/B_{MSY})]$ ; 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.
- ii) For each FMU sub-unit for which  $B_{CURR}/B_{MSY}$  and  $F_{CURR}/F_{MSY}$  have not been estimated through a stock assessment or other scientific exercise (i.e., stock status unknown), the following estimates were used for the  $B_{CURR}/B_{MSY}$  and  $F_{CURR}/F_{MSY}$  proxies:
  - a) For species that are not believed to be Aat risk@ based on the best available information, the  $F_{CURR}/F_{MSY}$  proxy is estimated as 0.75 and the  $B_{CURR}/B_{MSY}$  proxy is estimated as 1.25;
  - b) For species for which no positive or negative determination can be made on the status of their condition, the default proxies for  $F_{CURR}/F_{MSY}$  and  $B_{CURR}/B_{MSY}$  are estimated as 1.00; and
  - c) For species that are believed to be Aat risk@ based on the best available information, the  $F_{CURR}/F_{MSY}$  proxy is estimated as 1.50 and the  $B_{CURR}/B_{MSY}$  proxy is estimated as 0.75.
- iii) Optimal Yield (OY) was set equal to the average yield associated with fishing on a continuing basis at  $F_{OY}$ ; where  $F_{OY} = 0.75F_{MSY}$ .
- iv) Minimum Stock Size Threshold (MSST) was set equal to  $B_{MSY}(1-c)$ ; where c = the natural mortality rate (M) or 0.50, whichever is smaller.
- v) The limit and target catch levels were defined as the yield associated with fishing at  $F_{MSY}$  and  $F_{OY}$ , respectively, regardless of where stock biomass is in relation to  $B_{MSY}$  and to MSST. This rule uses M and  $0.75(F_{MSY})$  as proxies for  $F_{MSY}$  and  $F_{OY}$ , respectively. The constant F strategy employed by this rule allows catches to increase in response to an increase in stock biomass, but requires that catches be reduced as stock biomass decreases
  - a) Specify an MSY control rule to define  $ABC = F_{MSY}(B)$ . When the data needed to determine  $F_{MSY}$  are not available, use natural mortality (M) as a proxy for  $F_{MSY}$ ; and
  - b) Specify an OY control rule to define target catch limits such that they equal  $F_{OY}(B)$ .

For all species in the Coral Reef FMP, excluding those species retained for data collection purposes, MSY was established as 0. Therefore, fishing mortality (F) and biomass (B) ratios were not established for those species.

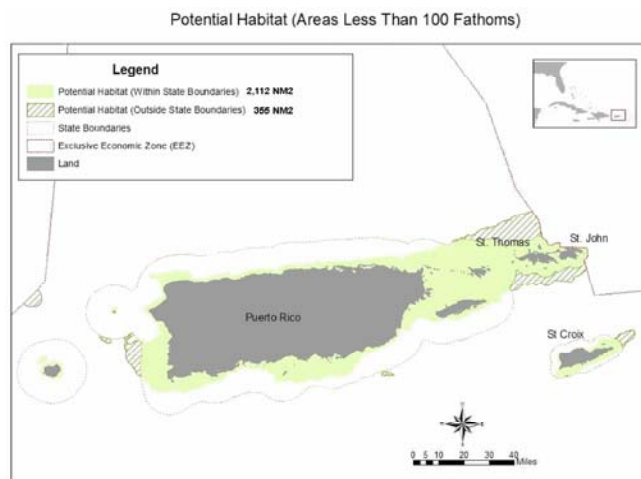
(3) Measures were implemented to keep catches in line with the preferred targets (i.e., optimal yield) and thresholds (i.e., minimum biomass limits) and regulate fishing effort. The alternatives are designed for select species (i.e., depleted or undergoing overfishing) to achieve immediate reductions in fishing mortality and include closed seasons and areas, gear restrictions, and administrative actions to foster the development of consistent regulations in state and federal waters. Grouper Unit 4 catches need to be reduced by 30%, parrotfish catches by 27%, and Snapper Unit 1 catches by 23). The management strategy is to require that catches of all species be reduced by 7%, on average, to achieve long-term average catches approximating OY.

It is important to note that the reductions in F reflect the amount that catches should be decreased in the entire U.S. Caribbean (e.g., in state and federal fisheries combined) to end overfishing and achieve OY. Consequently, assuming that catches are distributed evenly among fishable habitat, even a 100% reduction in fishing mortality rates in federal waters would not likely be sufficient to achieve the required reductions because only about 14% of the fishable habitat in the U.S. Caribbean occurs in federal waters (Figure 1). Recognizing this challenge, the local governments of Puerto Rico and the US Virgin Islands have been encouraged to promote the development of regulations in state waters compatible with the goals and objectives set forth in this amendment.

The following measures were adopted to collectively achieve needed reductions in fishing mortality in the EEZ:

- i) Prohibit fishing for or possession of queen conch in the EEZ, with the exception of Lang Bank east of St. Croix;
- ii) Close the EEZ to the possession of red, black, tiger, yellowfin, and yellowedge grouper from February 1 through April 30;
- iii) Close the EEZ off the west coast of Puerto Rico to the possession of red hind from December 1 through February 28;
- iv) Close the EEZ to the possession of black, blackfin, vermilion, and silk snapper from October 1 through December 31;
- v) Close the EEZ to the possession of mutton snapper and lane snapper from April 1 through June 30;
- vi) Implement an immediate prohibition against the use of gillnets and trammel nets to fish for Caribbean reef fish or Caribbean spiny lobster in the EEZ;
- vii) Require gillnets used to fish for bait in the EEZ to be tended at all times;

- viii) Prohibit the filleting of fish in the EEZ and require that fish captured or possessed in the EEZ be landed with heads and fins intact, with minor exceptions;
- ix) Close an area of the Grammanik Bank to fishing for or possessing any species of fish, except highly migratory species, from February 1 through April 30 of each year;



**Figure 1.** Map of the U.S. Caribbean and the 100-Fathom Contour.

Rebuilding schedules have been implemented for depleted species (i.e., queen conch, goliath grouper, and Nassau grouper; see below) and are consistent with the guidance provided in the National Standard Guidelines (found in MSFCMA, 1996). The shortest possible rebuilding period is defined as the length of time for a stock to rebuild in the absence of fishing mortality on that stock ( $T_{MIN}$ ). The longest recommended rebuilding period is defined as ten years if  $T_{MIN} < 10$ , or  $T_{MIN}$  plus one mean generation time if  $T_{MIN} > 10$ . Associated management measures used to aid rebuilding targets include seasonal and area closures, a prohibition on the filleting of fish at sea, catch restrictions, and administrative action to promote the development of compatible regulations in state waters.

- i) Rebuild queen conch to  $B_{MSY}$  in 15 years, using the formula  $T_{MIN}$  (10 years) + one generation (5 years) = 15 years.
- ii) Rebuild Goliath grouper to  $B_{MSY}$  in 30 years, using the formula  $T_{MIN}$  (10 years) + one generation (20 years) = 30 years.
- iii) Rebuild Nassau grouper to  $B_{MSY}$  in 25 years, using the formula  $T_{MIN}$  (10 years) + one generation (15 years) = 25 years.
- iv) Rebuild grouper unit 4 to  $B_{MSY}$  in 10 years. This rebuilding schedule for the Grouper Unit 4 Complex is consistent with the longest rebuilding period advised by the National Standard Guidelines (MSFCMA, 1996): 10 years, if  $T_{MIN}$  is less than 10 years.

Additional management actions the Council adopted were to increase protections for yellowfin grouper, one of the species included in the Council's proposed Grouper Unit 4. The measures include closed areas and seasons designed to protect an identified yellowfin grouper spawning aggregation on Grammanik Bank, south of St. Thomas.

- i) Close the Grammanik Bank to all fishing from February 1 to April 30 of each year. The proposed boundaries for the Grammanik Bank closed area are: 181 11.898' N, 641 56.328' W; 181 11.645' N, 641 56.225' W; 181 11.058' N, 641 57.810' W; and 181 11.311' N, 641 57.913' W.

This closure defines an area of approximately 3.0 km (1.62 nm) by 0.5 km (0.27 nm), resulting in a 1.50 km<sup>2</sup> (0.44 nm<sup>2</sup>) area in which fishing would be prohibited from February through April. The reported spawning aggregation would be centered within this closed area. Possession of species in Grouper Unit 4 is prohibited from February 1 - April 30, is expected to result in a 24% reduction in fishing mortality and protect spawning aggregations. Such a reduction in F should be sufficient to end overfishing and rebuild the slightly overfished ( $B_{CURR}$  is 91% of MSST) FMU sub-unit within the preferred rebuilding schedule.

Measures have been implemented to address bycatch in the fisheries: (A) Establish a standardized reporting methodology to assess the amount and type of bycatch occurring in federal fisheries and (B) minimize bycatch and bycatch mortality to the extent practicable. A bycatch reporting methodology using federal permits and a reporting system is recommended to the current state reporting systems. Other measures will aid to further reduce bycatch and include gear modifications, such as increasing the minimum allowable mesh size used in traps and nets.

Finally, Essential Fish Habitat (EFH) has been described and identified for managed stocks to minimize to the extent practicable adverse effects on such habitat caused by fishing, and to identify other actions to encourage the conservation and enhancement of such habitat. The implemented EFH measures describe and identify EFH according to functional relationships between life history stages of federally-managed species and Caribbean marine and estuarine habitats. Also identified are habitat areas of particular concern (HAPCs), based on confirmed spawning aggregations of managed species, or based on areas or sites identified as having particular ecological importance to Caribbean reef fish or coral species. Measures were adopted to minimize impacts on EFH and include requirement to use at least one buoy that floats on the surface on all individual traps/pots, or at each end of trap lines linking traps/pots for all fishing vessels that fish for or possess Caribbean spiny lobster or Caribbean reef fish species; the requirement of an anchor retrieval system for commercial and recreational fishing vessels that fish for or possess Caribbean reef species; and the prohibition of the

use of pots/traps, gill/trammel nets, and bottom longlines on coral or hard bottom habitat at documented reef fish spawning areas.

## RESULTS

The following is a list of regulatory measures resulting from the implementation of the SFA Amendment:

- i) Prohibit fishing for or possession of queen conch in the EEZ, with the exception of Lang Bank east of St. Croix;
- ii) Move aquarium trade species of Caribbean coral and reef fish from a management to a data collection only category, thereby removing existing fishery management restrictions on these species;
- iii) Move all species of Caribbean conch, with the exception of queen conch, to a data collection only category, thereby removing fishery management restrictions on these species;
- iv) Close the EEZ to the possession of red, black, tiger, yellowfin, and yellowedge grouper from February 1 through April 30;
- v) Close the EEZ off the west coast of Puerto Rico to the possession of red hind from December 1 through February 28;
- vi) Close the EEZ to the possession of black, blackfin, vermilion, and silk snapper from October 1 through December 31;
- vii) Close the EEZ to the possession of mutton snapper and lane snapper from April 1 through June 30;
- viii) Implement an immediate prohibition against the use of gillnets and trammel nets to fish for Caribbean reef fish or Caribbean spiny lobster in the EEZ;
- ix) Require gillnets used to fish for other species in the EEZ to be tended at all times;
- x) Prohibit the filleting of fish in the EEZ and require that fish captured or possessed in the EEZ be landed with heads and fins intact, with minor exceptions;
- xi) Close an area of the Grammanik Bank to fishing for or possessing any species of fish, except highly migratory species, from February 1 through April 30 of each year;
- xii) Amend current requirements for trap construction such that only one escape panel is required, which could be the door;
- xiii) Require at least one buoy that floats on the surface for all traps/pots fished individually for all fishing vessels that fish for or possess Caribbean spiny lobster or Caribbean reef fish species in or from the EEZ;
- xiv) Require at least one buoy at each end of trap lines linking traps/pots for all fishing vessels that fish

- for or possess Caribbean spiny lobster or Caribbean reef fish species in or from the EEZ;
- xv) Prohibit use of pots/traps, gill/trammel nets, and bottom longlines on coral or hard bottom year-round in the existing seasonally closed areas and Grammanik Bank in the EEZ; and
  - xvi) Require an anchor retrieval system for all vessels that fish for or possess Caribbean reef fish species in or from the EEZ.

## DISCUSSION – ANTICIPATED IMPACTS

### Availability and Completeness of the Utilized Information

To select the management measures in the SFA Amendment the Council and NMFS utilized the best available scientific information available through 2002 to evaluate the impacts on the human environment. However, the extent of that information limits the amount of detail that can be conducted during the various impact analyses, and requires that various reasonable assumptions and theoretical approaches be employed.

There is a general absence of any regional stock assessments for species managed by the Caribbean Council. Furthermore, restrictions on biological data (e.g., natural mortality rates) in the U.S. Caribbean imposes other obstacles to accurately evaluating the conditions of the fisheries. Landings data are fairly rudimentary, with very coarse spatial effort information. Generally, catch between state and federal waters cannot be determined in the US Caribbean, and species specific landings data remains problematic. This complicates the identification of catch trends for any particular species, which could mask reduced biomass or an overfishing/depleted condition.

There is trivial information on the U.S. Caribbean recreational fishery. While the Marine Recreational Fisheries Statistical Survey (MRFSS) has collected survey information from Puerto Rico since 2000, it does not gather recreational statistics from the USVI. Furthermore, as with the commercial landings data in Puerto Rico, MRFSS data do not differentiate between state and federal waters (<http://www.st.nmfs.gov/st1/recreational>). Therefore, the extent of the recreational fishery is largely unknown for the EEZ and the US territories. Also, there is a paucity of information pertaining to the fore-hire component of the recreational fishery.

In addition, there are significant socio-economic information gaps. Until 2004, fishermen in Puerto Rico were not required to possess a fishing permit. Therefore, it is likely that unreported fishing activity transpired off Puerto Rico; the portion of that unreported activity that occurred specifically in the EEZ is unknown. While fishermen in Puerto Rico generally sell their catch to fish houses or dealers, no such structure exists in the USVI. Fishermen in the USVI typically market their catch directly. Due to the lack of a centralized infrastructure, it is possible that a portion of the potentially available socio-

economic data (e.g., price per pound, revenue generated, etc.) is lost. While there have been some socio-economic studies performed in the U.S. Caribbean, due to the aforementioned issues with landings data, the utility of those studies is limited.

Several NMFS grant programs are in place to support various research and data collection efforts and to improve our knowledge base (<http://sero.nmfs.noaa.gov/grants>):

- i) *Cooperative Research Program (CRP)* — A competitive program that funds projects seeking to increase and improve the working relationship between researchers from the NMFS, state fishery agencies, universities, and fishermen.
- ii) *Cooperative Statistics Program (CSP)* — A cooperative agreement program between the States of the Southeastern region of the U.S. and the National Marine Fisheries Service providing funds for a continuing source of commercial and recreational fisheries statistics.
- iii) *Saltonstall-Kennedy (SK)* — A national competitive program providing funds in support of the seafood industry.
- iv) *Southeast Monitoring and Assessment Program (SEAMAP)* — A state/federal cooperative agreement program to provide fisheries-independent databases.

### Relevance of the Incomplete or Unavailable Information

The information currently not available is directly relevant to disseminating the status of managed marine resources (e.g., MSY, OY, etc.), as well as evaluating potential impacts resulting from the proposed management alternatives. Because of the lack of discrete biological data for the U.S. Caribbean, managers are handicapped and must rely on related studies conducted, and information gathered, in other geographic areas. Further, due to the caveats with the currently available landings data, assumptions were made to arrive at any conclusions on the status of the managed resources or on impacts to potentially affected users as it relates to the EEZ (i.e., Council jurisdiction).

### Biological/Ecological Environment

Impacts of management measures to the biological/ecological environment are expected to be largely positive. But, again, these impacts are not likely to be significant (i.e., without compatible state regulations), as the majority of affected species harvested in the U.S. Caribbean occur in state waters.

Given the suite of stock status parameters adopted, harvest needs to be reduced, which will benefit the stocks of reef fish that are over-exploited. The more significant impacts to the biological environment will result from gear restrictions or area/seasonal closures, which are expected to reduce fishery-related impacts on habitat, as well as reduce fishing mortality on numerous reef fish species.

Several management measures will have a species-specific effect, as rebuilding strategies are aimed at rebuilding those species determined to be depleted. However, some rebuilding strategies could indirectly impact other species. For example, a regulation prohibiting the filleting of fish at sea could improve species identification and data collection, while stemming the poaching of prohibited species and deterring the harvest of under-sized species. Furthermore, the administrative alternatives evaluated in this section could improve state management capacity and benefit numerous species by providing fishery managers a vehicle for enhancing federal-state cooperation.

Other alternatives, which are designed to conserve and protect yellowfin grouper, also could benefit numerous other species. The closed area options are intended to result in the protection of yellowfin grouper spawning aggregations on Grammanik Bank. Since the alternatives would prohibit all fishing within the specified coordinates, other species, including those species in the Coral FMP that are considered EFH (i.e., corals), would benefit from the closure as well. However, as with any closed area or season, there could be negative effects associated with these alternatives. Intensified fishing before and after a closed season could reduce or negate benefits accrued during the closure. Likewise, displaced fishing activities could increase pressure on juveniles in state waters, or impair EFH through intensified fishing activities in waters outside the closed area. The bycatch are expected to provide more and better data on bycatch in U.S. Caribbean fisheries, as well as reduce the amount of bycatch in federal waters. The gear prohibitions or modifications should benefit finfish species by reducing the number of juvenile or prohibited species harvested. Additionally, the prohibition of a specific gear type should benefit the environment where the gear adversely impacts EFH. However, any such benefits will be reduced or negated if fishermen adapt existing or develop new gear types that have greater impacts, or if they intensify their fishing effort in response to new regulations.

It is imperative to point out that the biological and ecological benefits are likely to be reduced or entirely negated if consistent action is not pursued in state waters.

### **Social/Economic Environment**

Impacts to the social and economic environment associated of management measures are generally expected to be negative in the short term, and positive in the long term. The majority of measures taken (i.e., definition of FMUs, establishment of MSY,OY,status determination criteria, and more) will not have a direct economic effect to fishermen. However, they could lead to indirect effects due to required reductions in fishing mortality associated with the selection of a particular control rule. This could restrict the number of fish available to fishermen in the short term, which could negatively impact fishermen's income. Regardless, any potential negative indirect effects

are expected to be overshadowed by long-term benefits resulting from the rebuilding of depleted stocks, the prevention of overfishing, and the establishment of sustainable fisheries.

Several measures could have a significant direct economic impact on fishermen in the short term. Due to the lack of information on the amount of fishing in federal waters, it is not possible to quantify the precise economic impact to fishermen. While the closed area measures, in particular, may reduce fishermen's income, they are unlikely to result in fishermen going out of business due to the fact that the majority of habitat and harvest occurs in state waters. Gear modifications and/or prohibitions will force fishermen either to displace their activities to state waters, or to modify/change their gear. This could present significant short-term social and economic impacts depending on the amount of gear employed by affected fishermen, and the extent to which those user groups fish in the EEZ. However, as mentioned earlier, any potential negative effects in the short term are expected to be overshadowed by long-term benefits resulting from the rebuilding of depleted stocks, the prevention of overfishing, and the establishment of sustainable fisheries.

The complete prohibition on queen conch harvest in the EEZ, excepting the Lang Bank area of St. Croix, is the most restrictive management action available to the Council to end overfishing of that species. Because the extent of queen conch harvest in federal waters appears to be very limited (particularly in Puerto Rico due to the extent of their territorial waters, i.e., 9 nm), the direct short-term adverse socioeconomic impacts associated with the fishery closure are likely to be relatively small. To the extent that the closure of the federal waters will allow for recovery of the stock, any adverse impacts would likely be outweighed by long-term benefits. Furthermore, if the harvest of queen conch is not prohibited in federal waters, it is likely that landings will continue to decline, and the fishery will approach or reach commercial extinction as has happened in other Caribbean and U.S. waters.

The closure of Grammanik Bank may result in decreased revenue for fishermen during the closed season. The actual size and length of the closure determines the extent of any socio-economic impact. However, based on available landings information, the total prohibition on yellowfin grouper harvest and possession during the spawning period will likely not result in a significant economic impact.

The bycatch measures could potentially result in social and economic impacts, more so in the USVI than Puerto Rico due to greater USVI fishermen utilization and dependence on the EEZ. Due to the current lack of a mandatory permit and reporting system in the EEZ, establishing a new federal permit system could result in confusion among fishing communities. Furthermore, there may be a resistance to purchase a federal permit, especially considering the limited harvest originating from the EEZ,

the existence of mandatory state permitting requirements (i.e., paying for yet another permit), and the level of active enforcement in the area. Any gear prohibition or modification alternatives may result in economic impacts to fishermen who would be forced to modify their gear or switch to a new gear type, as well as social impacts stemming from confusion among fishing communities.

### Administrative Environment

Impacts associated with many of the management measures are expected to impose additional burdens on the administrative environment, but to result in a more manageable and responsive management system. Establishing biological reference points and stock status determination criteria should directly benefit (rather than burden) the administrative environment by providing fishery scientists and managers specific objective and measurable criteria to use in assessing the status and performance of Caribbean fisheries. The Council and regional fishermen have expressed a desire for improved enforcement in the region. In order to assure compliance with many of the alternatives proposed in this amendment, increased funding to improve the effectiveness of enforcement would be required. This would be especially important with regards to the closed area and gear prohibition alternatives. Additional personnel and boats would be required to properly monitor the closed areas to prevent poaching, and to inspect gear and fishermen's catch offshore. Due to the potential for inconsistent regulations between state and federal waters, an enhanced enforcement presence would be critical to ensure compliance with some of the proposed fishery regulations (e.g., seasonal yellowfin grouper harvest prohibition) unless local governments adopt complimentary regulations. Only under certain situations (e.g., preemption) would the federal government be able to control fisheries in state waters.

### Major Conclusions and Areas of Controversy

Consistent management in state waters is essential in order for most, if not all, of the management actions to achieve the desired goals in federal waters. The majority of habitat, especially juvenile habitat, occurs in state waters (State waters in Puerto Rico and in the USVI extend from the shoreline out to 9 and 3 nm, respectively). While available landings data do not differentiate between state and federal waters, it is generally understood that the vast majority of total landings in the U.S. Caribbean originate from state waters due to the disparity of fishable habitat between state and federal waters. Therefore, state cooperation and establishment of consistent fishery regulations will be crucial if fisheries are to be managed effectively. This is especially important with regards to rebuilding depleted species such as Nassau grouper and queen conch, where continued harvest in state waters jeopardizes federal rebuilding programs.

For example, while current regulations prohibit the

harvest of queen conch, a depleted species, in federal waters, we only expect modest improvements in its condition without state action. This is validated by the fact that the status of Nassau grouper has yet to improve after almost a decade of prohibited catches in federal waters while the harvest of this species has been permitted in USVI waters. Puerto Rico had permitted the harvest of Nassau grouper and Goliath grouper; however, they implemented new regulations on March 12, 2004, to prohibit the possession or sale of these two species. The new (2004) Puerto Rican fishing regulations established closed areas; implemented minimum sizes for several managed species, quotas for aquarium trade species, license and reporting requirements; and prohibited the harvest of certain species and the use of certain gear types.

Consistent regulations in state waters would be desirable for any gear modifications or prohibitions, lest any regulatory or enforcement loopholes in state waters negate any benefits that might be achieved in federal waters. For example, a gear prohibition in federal waters might be ineffective if similar regulations are not implemented in state waters, since, in the absence of adequate at-sea enforcement in the EEZ, fishermen could simply state upon returning to the dock that their catch originated from state waters.

While there are likely to be negative social and economic impacts associated with some of the proposed alternatives, the social, economic, and biological consequences of not taking any action could be far more severe in the long-term. The federal management measures implemented in conjunction with consistent state regulations, are expected to improve the biological status of fishery resources in the U.S. Caribbean and to establish long-term benefits to fishing communities, the U.S. Caribbean islands, and the nation.

### LITERATURE CITED

- Appeldoorn, R., J. Beets, J. Bohnsack, S. Bolden, D. Matos, S. Meyers, A. Rosario, Y. Sadovy, and W. Tobias. 1992. Shallow Water Reef Fish Stock Assessment for the U.S. Caribbean. NOAA Technical Memorandum, NMFS-SEFSC-304. 70 pp.
- Appeldoorn, R.S., and K.C. Lindeman. 1985. Multispecies assessment in coral reef fisheries using higher taxonomic categories as unit stocks, with an analysis of an artisanal haemulid fishery. *Proceedings of the Fifth International Coral Reef Congress* 5:507-514.
- Boardman, C., and D. Weiler. 1980. Aspects of the life history of three deepwater snappers around Puerto Rico. *Proceedings of the Gulf and Caribbean Fisheries Institute* 32:158-172.
- Bohnsack, J. A., D.L. Sutherland, A. Brown, D.E. Harper, and D.B. McClellan. 1986. An analysis of the Caribbean biostatistical database for 1985. NOAA/NMFS/SEFSC Coastal Res. Div., Contr. No. 86/87-10.



- Caribbean Fishery Management Council. 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 FMP for the 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; Including Supplemental Environmental Impact Statement, Regulatory Impact Review, and Regulatory Flexibility Act Analysis. May, 24, 2005. Caribbean Fishery Management Council. 268 Munoz Rivera Avenue, Suite 1108. San Juan, Puerto Rico 00918-2577. pp. 673 + app.
- Caribbean Fishery Management Council. 2004. Generic Essential Fish Habitat Amendment for the U.S. Caribbean to the: Spiny Lobster Fishery Management Plan; Queen Conch Fishery Management Plan; Reef Fish Fishery Management Plan; Coral Fishery Management Plan; Including a Final Environmental Impact Statement. April 23, 2004. Caribbean Fishery Management Council. 268 Munoz Rivera Avenue, Suite 1108. San Juan, Puerto Rico 00918-2577, pp. 512 + app.
- Garrison, V.H., C.S. Rogers, and J. Beets. 1998. Of reef fishes, overfishing and in situ observations of fish traps in St. John, U.S. Virgin Islands. *Reviews in Tropical Biology* 5(46):41-59.
- Kawaguchi, K. 1974. Handline and longline fishing explorations for snapper and related species in the Caribbean and adjacent waters. *Marine Fisheries Review* 36(9):8-31.
- Kimmel, J.J., and R.S. Appeldoorn. 1992. A critical review of fisheries and fisheries management policy in Puerto Rico. *Proceedings of the Gulf and Caribbean Fisheries Institute* 41:349-360.
- National Marine Fisheries Service. 2005. Annual Report to Congress on the Status of U.S. Fisheries – 2004. U.S. Dep. Commerce, NOAA. National Marine Fisheries Service, Silver Spring, Maryland USA. 142 pp.
- 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 Tech. Memo, NMFS-F/SPO-31. 54 pp.
- Stevenson, D.K. 1978. Management of a tropical fish pot fishery for maximum sustainable yield. *Proceedings of the Gulf and Caribbean Fisheries Institute* 30:95-115.
- Suarez-Caabro, J. 1979. *El Mar de Puerto Rico. Una Introduccion a las Pesquerias de la Isla*. Editorial Universitaria, Universidad de Puerto Rico, Rio Piedras, Puerto Rico. 259 pp.
- U.S. Department of Commerce. 1996. Magnuson-Stevens Fishery Conservation and Management Act. NOAA Technical Memorandum NMFS-F/SPO-23. 121 pp.