# Comprehensive Fishery Management Plan for the St. Croix Exclusive Economic Zone

**Including Draft Environmental Assessment**

**Caribbean Fishery Management Council**
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# Comprehensive Fishery Management Plan for the St. Croix Exclusive Economic Zone

**Proposed Action**: Establish a new St. Croix Fishery Management Plan (FMP) and repeal the existing species-based FMPs, modify the composition of the stocks to be managed under the St. Croix FMP, organize those stocks for effective management, modify and/or establish management reference points for managed stocks, establish accountability measures, identify essential fish habitat for stocks new to management, and establish framework measures.

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Note to readers: This document is an integrated Fishery Management Plan/Environmental Assessment. The DEA evaluates seven actions within the St. Croix FMP.


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# Abbreviations and Acronyms Used in this Document

| | |
|---|---|
| ABC | acceptable biological catch |
| ABC CR | acceptable biological catch control rule |
| ACL | annual catch limit |
| ACT | annual catch target |
| AM | accountability measure |
| AP | advisory panel |
| APA | Administrative Procedure Act |
| CCR | commercial catch report |
| CEA | cumulative effects assessment |
| CEQ | Council on Environmental Quality |
| CFMC | Caribbean Fishery Management Council |
| CFR | Code of Federal Regulations |
| CZMA | Coastal Zone Management Act |
| DAP | District Advisory Panel |
| DEIS | draft environmental impact statement |
| DPNR | Department of Planning and Natural Resources of the U.S. Virgin Islands |
| EA | environmental assessment |
| EEZ | exclusive economic zone |
| EFH | essential fish habitat |
| EIS | environmental impact statement |
| EPA | Environmental Protection Agency |
| ESA | Endangered Species Act |
| FAD | fish aggregation device |
| FAO | Food and Agriculture Organization (United Nations) |
| FEIS | final environmental impact statement |
| FMP | fishery management plan |
| $F_{MSY}$ | fishing mortality rate yielding MSY |
| FMC | fishery management council |
| FMU | fishery management unit |
| FONSI | finding of no significant impact |
| FR | federal regulations |
| GDP | gross domestic product |
| GNI | gross national income |
| GNP | gross national product |
| HAPC | habitat area of particular concern |
| HMS | highly migratory species |
| ITCZ | inter-tropical convergence zone |

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| | |
|---|---|
| MCD | marine conservation district |
| MFMT | maximum fishing mortality threshold |
| MMPA | Marine Mammal Protection Act |
| MPA | marine protected area |
| MSA | (Magnuson- Stevens Act); Magnuson-Stevens Fishery Conservation and Management Act |
| MSST | minimum stock size threshold |
| MSY | maximum sustainable yield |
| NEPA | National Environmental Policy Act |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic and Atmospheric Administration |
| NOI | notice of intent |
| NS | national standard |
| OFL | overfishing limit |
| OMB | Office of Management and Budget |
| OY | optimum yield |
| PDF | probability density function |
| PSA | productivity-susceptibility analysis |
| RA | Regional Administrator of NMFS |
| RFA | Regulatory Flexibility Act |
| RIR | Regulatory Impact Review |
| SBA | Small Business Administration |
| SD | standard deviation |
| SEAMAP | Southeast Area Monitoring and Assessment Program |
| SEDAR | Southeast data assessment review (stock assessment) |
| SEFSC | Southeast Fisheries Science Center |
| SERO | Southeast Regional Office |
| SFA | Sustainable Fisheries Act |
| SSC | Scientific and Statistical Committee |
| SYL | sustainable yield level |
| USVI | United States Virgin Islands |

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# Chapter 1. Introduction

## 1.1 What Action is Being Proposed?

The Caribbean Fishery Management Council (Council) is proposing to transition from a species[1]-based management approach to an approach that manages fisheries at the island level (*i.e.*, island-based management), applicable to three U.S. Caribbean management areas: (1) Puerto Rico; (2) St. Thomas/St. John, USVI, and; (3) St. Croix, USVI. Historically, the Council managed federal fisheries in the U.S. Caribbean exclusive economic zone (EEZ) under four species-based fishery management plans (FMP): FMP for the Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands (USVI) (Reef Fish FMP), FMP for the Spiny Lobster Fishery of Puerto Rico and the USVI (Spiny Lobster FMP), FMP for the Queen Conch Resources of Puerto Rico and the USVI (Queen Conch FMP), and the FMP for Corals and Reef Associated Plants and Invertebrates of Puerto Rico and the USVI (Coral FMP). Through the actions proposed in this integrated FMP/draft environmental assessment (EA), the Council is proposing to repeal the four existing Caribbean-wide species-based FMPs and manage fishery resources in the U.S. Caribbean under three new island-based FMPs: Comprehensive FMP for the Puerto Rico EEZ (Puerto Rico FMP), Comprehensive FMP for the St. Thomas/St. John EEZ (St. Thomas/St. John FMP), and Comprehensive FMP for the St. Croix EEZ (St. Croix FMP).

Implementing an island-based FMP for St. Croix would allow the Council to manage St. Croix EEZ fisheries based on the stocks[2] targeted in federal waters surrounding St. Croix, the available markets for the products harvested from U.S. EEZ waters off St. Croix, the economies of fishermen and the fishing communities they represent, and the social and cultural attributes unique to the island of St. Croix. To complete the transition from species-based FMPs to island-based FMPs the Council is considering seven actions to establish and revise the St. Croix FMP. These actions provide an opportunity for the Council to update management regulations that are outdated or do not reflect the current state of issues in the St. Croix EEZ.

- Action 1 reorganizes existing management measures such that they apply by island, rather than by species;
- Action 2 revises the list of species (*i.e.*, stocks) included for management, focusing on those applicable to the St. Croix EEZ;

[1] Species: Group of animals or plants having common characteristics, able to breed together to produce fertile (capable of reproducing) offspring, and maintaining their "separateness" from other groups.

[2] Stock: A part of a fish population usually with a particular migration pattern, specifi c spawning grounds, and subject to a distinct fi shery. A fish stock may be treated as a total or a spawning stock. Total stock refers to both juveniles and adults, either in numbers or by weight, while spawning stock refers to the numbers or weight of individuals that are old enough to reproduce.

- Action 3 establishes how the stocks are grouped into stock complexes based on current information including fishing practices, and identifies indicator stocks for those complexes where appropriate;
- Action 4 establishes maximum sustainable yield (MSY) or an MSY proxy, status determination criteria (SDC), and management reference points for the stocks, stock complexes, or indicator stocks included for management;
- Action 5 establishes accountability measures (AM) to be implemented when landings exceed the annual catch limits (ACL);
- Action 6 identifies and describes essential fish habitat (EFH) for species included in the FMP that have not been previously managed by the Council; and
- Action 7 establishes framework procedures that would allow the Council to adjust reference points and management measures more quickly.

With the exception of tilefish and aquarium trade species (discussed in Chapter 2), the Council already applies certain required management measures separately within the three island management areas (*i.e.*, Puerto Rico, St. Thomas/St. John, St. Croix). Through actions taken in the 2010 Caribbean Annual Catch Limit (ACL) Amendment (CFMC 2011a) and the 2011 Caribbean ACL Amendment (CFMC 2011b), the Council established boundaries (Figure 1.5.1) to define EEZ subdivisions for each island management area and established separate, island-specific acceptable biological catch (ABC), ACL, and accountability measures (AM) within each of, some management measures already apply the island level. However, other components of management, including a proxy for maximum sustainable yield (MSY) and an overfishing limit (OFL), were maintained at a U.S. Caribbean region-wide level. The seven actions included within this St. Croix FMP would fully transition to island-based management for the St. Croix EEZ, and all status determination criteria (SDC), management reference points, and other management regulations would be set for and applied to the of the St. Croix EEZ.

The proposed actions in this integrated FMP/EA are fully discussed in Chapter 2.

## 1.2 Why is the Action Being Proposed?

The fisheries and related coastal and marine environments of St. Croix are highly valued and remain an important part of the history, culture, and tradition of the island. Fishery resources contribute to the economy, livelihood, food, and recreational enjoyment of the citizens of St. Croix. These resources and the habitats upon which they depend are subject to the adverse effects of anthropogenic impacts and environmental degradation. Both federal and state governments work to conserve and manage the fisheries of St. Croix, and both entities recognize the role fishermen and others play in conserving, managing, and sustaining the island's fisheries.

Previous FMPs managed U.S. Caribbean fisheries by species, with no regard for differences among islands.

The fishermen, fishing community representatives, and the local governments of Puerto Rico and the USVI have frequently requested the Council consider differences among the islands or island groups when addressing fisheries management in the U.S. Caribbean to recognize the unique attributes of each U.S. Caribbean island. The Council responded to these requests by initiating an assessment of shifting from a species-based management approach to an island-based approach (NMFS 2014). The details of that assessment and process are described in Appendix A. By implementing island-based FMPs, the Council along with the National Marine Fisheries Service (NMFS) concluded they would be able to better account for differences among the U.S. Caribbean islands with respect to would be able to better account for differences among the U.S. Caribbean islands with respect to environment, culture, markets, gear, seafood preferences, and the ecological impacts that result from these differences.

Tailoring management measures to specific management areas could potentially make fisheries management more effective by ensuring to the greatest possible degree that optimum yield is achieved while minimizing adverse effects to the environment as discussed in the EA initiating this action (NMFS 2014; Appendix A). If approved, the St. Croix FMP, in conjunction with St. Thomas/St. John and Puerto Rico FMPs, would respond to the Council's decision in their 2014 EA to move forward with island-based management by replacing the existing species-based FMPs with island-based plans.

## 1.3 Who is Proposing the Action?

The Council proposes the action to establish a new St. Croix FMP, which would include repealing the existing species-based FMPs, modifing the composition of the stocks to be managed under the St. Croix FMP, organizing those stocks for effective management, establishing SDC, management reference points, and AMs for managed stocks, identify EFH for stocks new to management, and establishing framework measures. The Council develops the FMP and submits it to NMFS, who implements the actions in the FMP on behalf of the Secretary of Commerce.

The National Environmental Policy Act (NEPA) requires federal agencies to conduct an environmental review when proposing major federal actions. Appendix A describes the process that the Council and NMFS used leading up to the preparation of this integrated FMP/EA, which evaluates potential alternative approaches for implementing island-based fishery management in the St. Croix EEZ. Within the context of federal fisheries management in the U.S. Caribbean, the new St. Croix FMP would contain the Council's preferred approach, applying the best available scientific information regarding the management of fishery resources in St. Croix EEZ

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waters. Alternatives considered in the EA include a "no action" alternative, which essentially maintains provisions established in the species-based FMPs, as well as a range of viable alternative approaches for revising the management of U.S. Caribbean fisheries in the St. Croix management area. The outcomes of the Council's preferred alternatives and management measures that were migrated from the previous species-based FMPs are listed in Chapter 5: Conservation and Management Measures – Action Plan.

The Council and NMFS would consider public comments received on the St. Croix FMP and associated EA before voting to approve the St. Croix FMP. If the Council approves the FMP, it would submit it to NMFS for Secretarial review, approval, and implementation.

NMFS would announce all public comment periods on the St. Croix FMP and its proposed implementing regulations in the *Federal Register*. NMFS would consider all public comments received during the Secretarial review period, whether they are on the St. Croix FMP or the proposed regulations prior to final agency action.

With the exception of management revisions proposed in Actions 2-7 discussed in this document, shifting from species-based FMPs to island-based FMPs (proposed in Action 1) would simply repackage the existing management measures. The reorganization would be considered largely an administrative exercise.

## 1.4 Statement of Purpose and Need

The St. Croix FMP is one of three island-based FMPs being developed by the Council to update management of federal fishery resources in the U.S. Caribbean. The St. Croix FMP would incorporate and replace those components of the Caribbean-wide Reef Fish, Spiny Lobster, Queen Conch, and Corals FMPs that pertain to the EEZ surrounding the island of St. Croix (Figure 1.5.1).

The **purpose** of developing the St. Croix FMP/EA is to ensure the continued health of fishery resources occurring in the EEZ surrounding St. Croix within the context of the unique biological, ecological, economic, and cultural characteristics of those resources and the communities' dependent upon them by managing on an island basis. The St. Croix FMP is intended to ensure productive and sustainable fisheries for the long-term livelihood, enjoyment, economy, and environment of St. Croix and the U.S.; conserve and manage the fisheries of St. Croix within an integrative island-based approach; and, enhance stewardship among fishermen, residents, and others who value the fishery resources and the marine and coastal environments of St. Croix and the U.S.

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Shifting management from a species-based approach to an island-based approach was deemed necessary based on written and verbal comments received from constituents at multiple scoping hearings held on St. Croix and on written comments received in response to notices published in the *Federal Register*, as described in Appendix A. That input suggested that, while not all presently existing fishery management regulations applicable to St. Croix EEZ waters are in need of revision, some revisions are needed as the Council and NMFS move from a species-based to an island-based approach to managing resources. In particular, it was recognized that the present management plans target many species that occur infrequently, if at all, in federal waters surrounding the island, such that federal management actions have no impact because federal fishery management authority does not extend to state jurisdictional waters. In contrast, some of the species that are the most economically important inhabitants of federal waters are not included in those management plans.

## 1.5 Project Location

Fisheries governed by the St. Croix FMP are located primarily in the U.S. EEZ surrounding St. Croix (*i.e.*, the St. Croix EEZ), defined as the federal waters ranging from 3 to 200 nautical miles (nm) (6 – 370 kilometers [km]) from the nearest coastline point of territories of St. Croix (Figure 1.5.1). Fishery resources within 3 nm of the USVI coast are managed by the territorial government of the USVI.

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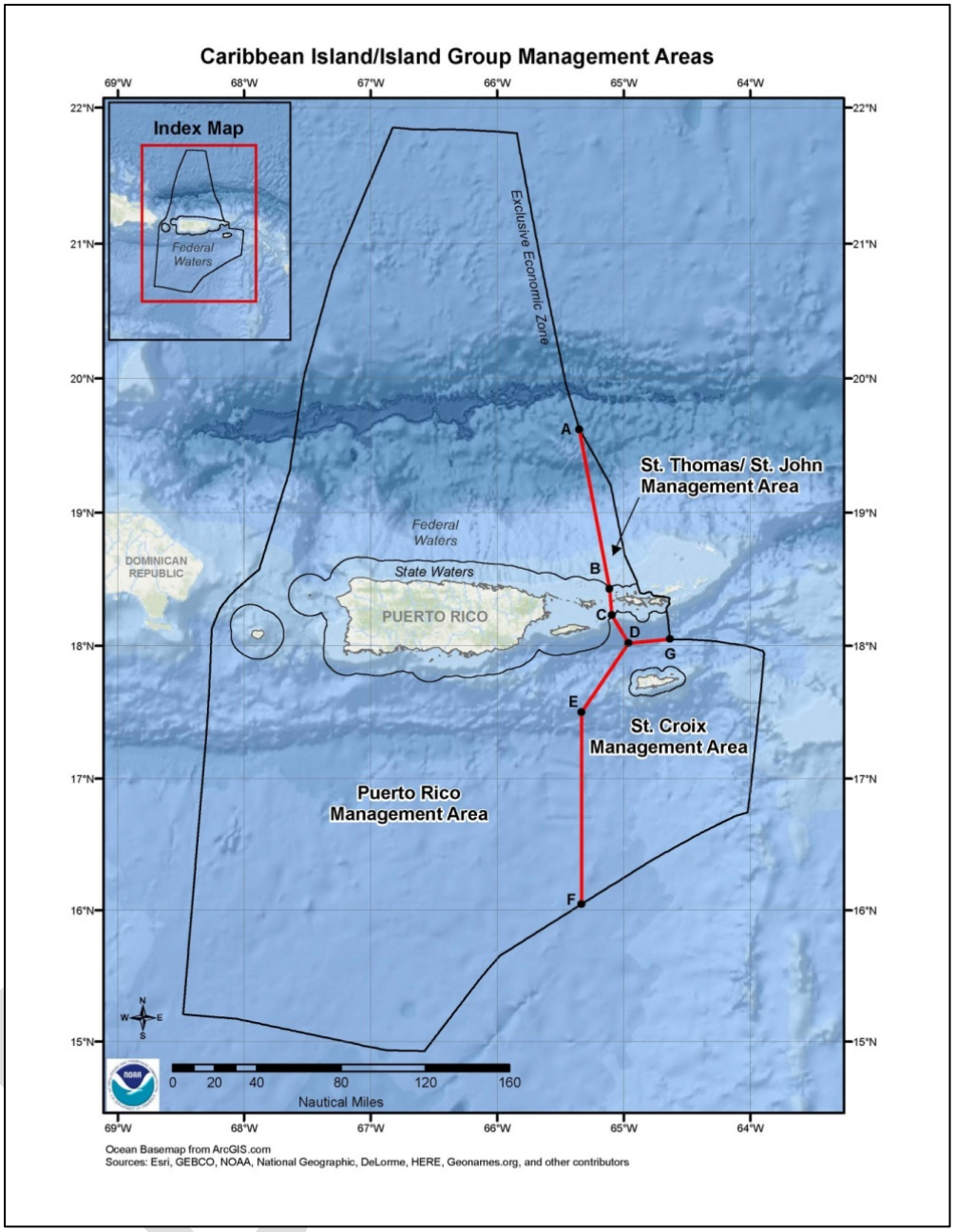


**Figure 1.5.1**. Jurisdictional boundaries of the Caribbean Fishery Management Council. Latitude and longitude coordinates for the boundary connecting points A-G are listed in Appendix E of the Code of Federal Regulations, part 622 (Fisheries of the Caribbean, Gulf of Mexico, and South Atlantic).

## 1.6 Regional Fisheries Management

In the U.S. Caribbean region, there are multiple levels of authority in the geo-political arena, making fisheries management in the region quite complex (Schärer-Umpierre et al. 2014). The U.S. federal government has jurisdiction within the USVI EEZ (*i.e.*, those waters from 3 - 200 nm (4.8 - 322 km) from the coast, as well as indirect participation elsewhere in agreements with the local USVI government (Schärer-Umpierre et al. 2014). The Council, NMFS, the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Department of Commerce are responsible for developing and implementing management measures for U.S. Caribbean federal fisheries. Other federal entities, such as the U.S. Department of Interior through the U.S. Fish and Wildlife Service (e.g., National Wildlife Refuges), possess other management responsibilities either solely or in cooperation with local entities. The U.S. Department of Defense, through the Air Force, Army, Navy, and Marine Corps, controls access and use of various marine waters throughout the U.S. Caribbean region. The U.S. Coast Guard, Sector San Juan, oversees all the vessels and facilities that operate in the region's 21 deep draft ports, including two of the busiest cruise ship ports in the world, and protect the marine environment in the over 450 miles of coastline encompassing the many islands of Puerto Rico and the USVI that are home to numerous endangered species[3]. NOAA Line Offices, such as the Coral Reef Conservation Program, support effective management and sound science to preserve, sustain, and restore valuable coral reef ecosystems for future generations.

The Territorial Government of the USVI governs those waters from the shore out to 3 nm and manages marine resources within that jurisdiction (*See Section 1.6.2 below for Territorial Fisheries Management*). At present, the USVI manages fisheries resources cooperatively with the Council, although not all regulations are consistent across the state-federal boundary. To conserve and sustain the USVI's fisheries and fishing communities, the federal and territorial governments have worked in consultation with fishermen and other constituents to develop strategies, rules, and laws to conserve and manage these valuable resources. A primary goal of these actions has been to ensure productive, healthy and sustainable ecosystems and fishery resources for the use and enjoyment of USVI fishermen, fishing communities, residents and visitors.

Regulations that implement the management measures contained within the FMPs are enforced through actions of NOAA's Office of Law Enforcement, the U.S. Coast Guard, and various USVI authorities. To better coordinate enforcement activities, federal and territorial enforcement agencies have developed cooperative agreements to enforce the Magnuson-Stevens Act. However, enforcement in the Caribbean region is severely underfunded. Because

[3] Source: http://www.atlanticarea.uscg.mil/Our-Organization/District-7/Units/Sector-San-Juan-PR/

personnel and equipment are limited, compliance with federal regulations depends largely on voluntary compliance (Heinz Center 2000).

### 1.6.1 Federal Fisheries 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 nm from shore, as well as authority over U.S. anadromous species and continental shelf resources that occur beyond the U.S. Caribbean EEZ.

Responsibility for federal fishery management decision-making is divided between the U.S. Secretary of Commerce (Secretary) and eight regional Fishery Management Councils (FMC) 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[4] within their jurisdiction. The Secretary is responsible for promulgating regulations to implement proposed plans and amendments after ensuring that management measures are consistent with the Magnuson-Stevens Act, and with other applicable laws summarized in Appendix B. In most cases, the Secretary has delegated this authority to NMFS.

Each FMC is responsible for the EEZ adjacent to its constituent states. The FMCs develop FMPs and management measures for the fisheries within their EEZ. Afterwards, and if approved by the Secretary, NMFS implements these plans and measures[5].

**Caribbean Fishery Management Council**

In order to conserve, maintain, and sustain the fisheries and related environment and habitats in the U.S. Caribbean, the goal of the Council is to develop and establish effective conservation and management measures that maintain a healthy fishery that meets the needs of fishermen and the general public. These conservation and management measures are based on (1) determining the status of the fisheries stocks and overall biological productivity and capacity to maintain vital fishery resources for the near- and long-term, (2) considering the economic, social and cultural aspects of the fisheries, and (3) determining effective fishing practices, rules, and regulations to ensure sustainable harvest of fishery resources within the context of optimum yield. For more information please visit the Council website.

The Council is responsible for the conservation and management of fishery stocks within federal waters surrounding Puerto Rico and the USVI, representing the majority of U.S. Caribbean

[4] §600.340 National Standard 7 – Costs and Benefits (2) Criteria.
[5] Source: http://www.nmfs.noaa.gov/sfa/reg_svcs/councils.htm

federal fishery resources (highly migratory species are managed directly by NMFS). The Council consists of seven voting members:

- Four public voting members appointed by the Secretary;
- The principal officials with marine fishery management responsibility and expertise for the Commonwealth of Puerto Rico and the Territory of the USVI, who are designated as such by the Governors of the territories;
- The Regional Administrator of NMFS for the Southeast Region.

Public interests are also involved in the fishery management process through participation on advisory panels and through Council meetings that, with few exceptions for discussing matters bearing on a national security classification, or matters pertaining to national security, personnel litigation in which the Council is interested, or other internal administrative matters, are open to the public. In addition, the regulatory process consider matters approved by the Council is conducted 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.

Council Committees and Panels

*Scientific and Statistical Committee (SSC)*

Each FMC establishes, maintains, and appoints members of an SSC to assist it in the development, collection and evaluation of statistical, biological, economic, social and other scientific information relevant to the Council's development of or amendment to any FMP. The SSC provides expert scientific and technical advice to the Council on the development of fishery management policy, on the preparation of FMPs, and on the effectiveness of such plans once in operation. The SSC also provides ongoing scientific advice for fishery management decisions. The SSC aids the Council in identifying scientific resources available for the development of plans, in establishing the objectives of plans, in establishing criteria for judging plan effectiveness and in the review of plans. Scientific and Statistical Committee members also play a key role in developing stock assessments for Council-managed resources through participation in SEDAR, the Southeast Data Assessment and Review program (SAFMC[6]). The SSC is composed of economists, biologists, sociologists and natural resource experts who are knowledgeable about the technical aspects of fisheries in the U.S. Caribbean.

*Advisory Panels (AP)*

Fishery management councils are authorized to establish APs as necessary or appropriate to assist in carrying out its functions in accordance with the Magnuson-Stevens Act. Advisory Panels obtain and transmit to the Council advice and information from the people most affected by and knowledgeable of fishery management actions and needs. The APs aid the Council in

[6] https://safmc.net/scientific-and-statistical-committee/

establishing the goals and objectives of plans and the criteria for judging plan effectiveness, while also providing a communication link with those who operate under the management regime. The size of each AP is discretionary within the resources available to each FMC, but each panel must be of sufficient size and number to permit a balanced representation of interests[7]. The Council's St. Croix District Advisory Panel (STX DAP) is composed of fifteen members either actually engaged in the harvest, processing or consumption of fishery resources, or are knowledgeable of the conservation and management of fishery resources and the ecosystem upon which they depend.

**Management of Highly Migratory Species (HMS)**

The Fishery Conservation Amendments of 1990 (P.L. 101-627) conferred management authority for Atlantic HMS, including some tunas, oceanic sharks, marlins, sailfishes, and swordfish, to the Secretary. At that time, the Secretary delegated authority to manage these species in the Atlantic Ocean, including the Gulf of Mexico and the U.S. Caribbean Sea, to NMFS. NMFS is responsible for preparing, monitoring, and revising management plans for HMS needing management, while the Secretary is responsible for promulgating regulations to implement proposed plans and amendments after ensuring that management measures are consistent with the Magnuson-Stevens Act, and with other applicable laws as summarized in Appendix B of this document. In 2013, Amendment 4 to the Consolidated Atlantic HMS FMP re-evaluated the management measures for commercial and recreational HMS fisheries operating in the U.S. Caribbean. This action had the purpose of improving permitting of and data collection from vessels operating in the U.S. Caribbean to better manage the traditional small-scale commercial HMS fishing fleet in the U.S. Caribbean region, enhance fishing opportunities, improve profits for the fleet, and provide improved capability to monitor and sustainably manage those fisheries (NMFS 2012).

### 1.6.2 Territorial Fisheries Management

The Territory of the USVI has the authority to manage its respective state fisheries in waters extending from shore to 3 nm. The Department of Planning and Natural Resources (DPNR) is responsible for the conservation and management of USVI fisheries and enforcement of boating and fishing regulations. The Division of Fish and Wildlife (DFW) is responsible for data collection pertaining to the fisheries of the USVI. The DFW monitors commercial and recreational fisheries and provides recommendations to the Commissioner of DPNR on matters relating to fisheries management. The Division of Environmental Enforcement is responsible for the explanation and enforcement of regulations in matters pertaining to boating, fishing, and the environment. Rules and regulations for the USVI fisheries are codified in the Virgin Islands Code, primarily within Title 48 Chapter 12.

[7] Source: Part 601—Regional Fishery Management Councils §601.22.

The USVI fishery management agency has a designated seat on the Council for state participation in federal fishery management decision-making. The USVI government has the authority to manage its respective territorial fisheries. The USVI exercises legislative and regulatory authority over its natural resources through discrete administrative units. Although each agency is the primary administrative body with respect to the territory's natural resources, the USVI cooperates with numerous territorial and federal regulatory agencies when managing marine resources. In addition, it promotes the development of compatible regulations between state and federal waters. However, while the USVI has adopted compatible regulations for several management issues, some fishery regulations remain inconsistent. For example, in the EEZ, any yellowtail snapper harvested needs to have a minimum total length of 12 inches, but no such regulation exists in territorial waters. The lack of compatible regulations in territorial waters makes federal regulations difficult to enforce and in some instances hinders the Council's ability to achieve federal management objectives. The Council is working with the USVI fishery managers to increase compatibility of fisheries regulations between federal and USVI waters.

Another aspect where federal and territorial jurisdiction share responsibilities has to do with federal consistency provisions of the Coastal Zone Management Act (CZMA), which requires NMFS to seek consistency to the maximum extent practicable with enforceable policies of the approved coastal management program of the USVI. Federal consistency[8] provides states with an important tool to manage coastal uses and resources and to facilitate cooperation and coordination with federal agencies. Under the CZMA, federal agency activities that have coastal effects are evaluated to ensure they are consistent to the maximum extent practicable with federally approved enforceable policies of a state's coastal management plan. In addition, the statute requires non-federal applicants for federal authorizations and funding to be consistent with enforceable policies of state coastal management plan.

Additional information regarding fishery management in USVI territorial waters can be found in Section 2.1 of the Caribbean Sustainable Fisheries Act (SFA) Amendment (CFMC 2005), and in the 2010 Caribbean ACL Amendment (CFMC 2011a). Additional information about fisheries in the USVI can be found in Chapter 3 of this document.

[8] Federal consistency is the CZMA provision that federal actions that have reasonably foreseeable effects on any land or water use or natural resource of the coastal zone (also referred to as coastal uses or resources, or coastal effects) should be consistent with the enforceable policies of a coastal state's federally approved coastal management plan (DOC 2009)

## 1.6.3 International Fisheries Management Pertaining to the U.S. Caribbean

### 1.6.3.1 U.S. Authority in International Waters

In certain cases, U.S. authority for fishery management extends beyond the boundaries of the U.S. EEZ. Federal regulations (50 CFR 600.310 (k)) address international overfishing in the following manner. If the Secretary determines that a fishery is overfished or approaching a condition of being overfished due to excessive international fishing pressure, and for which there are no management measures (or no effective measures) to end overfishing under an international agreement to which the United States is a party, then the Secretary and/or the appropriate Council shall take certain actions as provided under Magnuson-Stevens Act section 304(i). The Secretary, in cooperation with the Secretary of State, must immediately take appropriate action at the international level to end the overfishing. In addition, within one year after the determination, the Secretary and/or appropriate Council shall effect several actions, as follows. First, develop recommendations for domestic regulations to address the relative impact of U.S. fishing vessels on the stock. Council recommendations should be submitted to the Secretary. Second, develop and submit recommendations to the Secretary of State, and to the Congress, for international actions that would end overfishing in the fishery and rebuild the affected stocks, taking into account the relative impact of vessels of other nations and vessels of the United States on the relevant stock. Councils should, in consultation with the Secretary, develop recommendations that take into consideration relevant provisions of the Magnuson-Stevens Act and National Standard 1 guidelines, including section 304(e) of the Magnuson-Stevens Act and paragraph (j)(3)(iii) of this section (600.310), and other applicable laws. In assessing the relative impact of U.S. fishing vessels and vessels of other nations, as set forth above, the Secretary or appropriate Council may consider factors that include, but are not limited to domestic and international management measures already in place, management history of a given nation, estimates of a nation's landings or catch (including bycatch) in a given fishery, and estimates of a nation's mortality contributions in a given fishery. Information used to determine the relative impact must be based upon the best available scientific information.

### 1.6.3.2 International Authorities

The "Wider Caribbean" region, referred to as the Western Central Atlantic (Fishery Statistical Area 31) by the United Nations Food and Agriculture Organization (FAO), includes the northeast coast of South America, the Caribbean Sea, the Gulf of Mexico, and the southeastern Atlantic coast of North America. The region is geopolitically complex with the highest density of separate states per unit area in the world. The Caribbean Community[9] (CARICOM) countries

[9] The Caribbean Community (CARICOM) is an organization of 15 Caribbean nations and dependencies. CARICOM's main purposes are to promote economic integration and cooperation among its members, to ensure that the benefits of integration are equitably shared, and to coordinate foreign policy. Its major activities involve coordinating economic policies and development planning; devising and instituting special projects for the less-

are distributed throughout the region, and their EEZs form a mosaic, which includes most of the marine space in the region. The USVI is not included as a CARICOM entity.

The Western Central Atlantic Fishery Commission (WECAFC) is a regional fishery body (a group of states or organizations that are parties to an international fishery arrangement). The general objective of WECAFC is to "promote the effective conservation, management, and development of the living marine resources of the area of competence of the Commission, in accordance with the FAO Code of Conduct for Responsible Fisheries, and address common problems of fisheries management and development faced by members of the Commission". Membership is open to coastal States whose territories are situated wholly or partly within the area of the Commission or States whose vessels engage in fishing in the area of competence of the Commission that notify in writing to the Director-General of the organization of their desire to be considered as members of the Commission. The United States is a member country.

Activities of the WECAFC are arranged under the following four components:

- Promote the application of the FAO Code of Conduct on Responsible Fisheries and its related instruments;
- Support the development and management of responsible small-scale, artisanal and subsistence fisheries and aquaculture;
- Coordinate and cooperate with other relevant international organizations on matters of common interest;
- Manage the work programme and carry-out a strategic reorientation of the functions and mandate of the Commission.

These activities are conducted in addition to the advisory services (policy advice, provision of information, management advice, legal, etc.) that the Commission usually provides.

### 1.6.4 Ecosystem-based Fisheries Management

On May 23, 2016, NOAA's National Marine Fisheries Service (NMFS) rolled out their ecosystem-based fisheries management policy. The purpose of that policy is to define ecosystem-based fisheries management (EBFM), describe the benefits of EBFM, relate EBFM to management of living marine resources, establish the principles guiding the EBFM approach (Figure 1.6.1), and build on past progress with respect to management within an ecosystem context. The EBFM approach is being implemented nationwide by NMFS, with the intent of informing better decisions regarding trade-offs among and between fisheries, aquaculture, protected species, biodiversity, and habitats. Ultimately, an EBFM approach would help to build

developed countries within its jurisdiction; operating as a regional single market for many of its members (Caricom Single Market); and handling regional trade disputes.

and maintain resilient and productive ecosystems within the context of the human community dependent upon ecosystem services, while ensuring timely and effective response to a constantly changing environment.

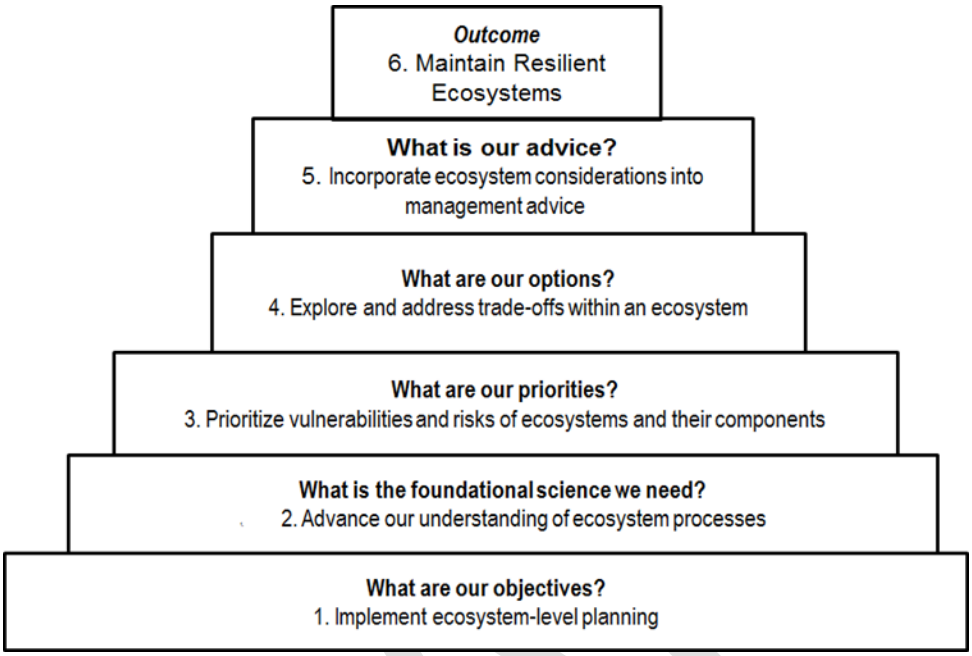


**Figure 1.6.1**. Hierarchical arrangement of NMFS' six guiding principles for implementation of ecosystem-based fisheries management.
(Source: http://www.nmfs.noaa.gov/op/pds/index.html)

Ecosystem-based fisheries management is defined by NMFS as "a systematic approach to fisheries management in a geographically specified area that contributes to the resilience[10] and sustainability of the ecosystem[11]; recognizes the physical, biological, economic, and social interactions among the affected fishery-related components of the ecosystem, including humans; and seeks to optimize benefits among a diverse set of societal goals." A central tenet of this definition, and of the NMFS approach to management within an ecosystem context, is recognition of the human community as a component of the ecosystem, thereby ensuring a full and equal treatment of economic needs and cultural values. Particularly in the U.S. Caribbean, a

[10]Resilience is defined as the capacity of an ecosystem to persist or maintain function in the face of exogenous disturbances. That is, the capacity of an ecosystem to tolerate disturbance without collapsing into a different state that is controlled by a different set of processes. This is primarily encapsulated by two elements, resistance to and recovery from pressure.
[11]In the NMFS context, the term "ecosystem" means a geographically specified system of fishery resources, the persons that participate in that system, the environment, and the environmental processes that control that ecosystem's dynamics (c.f. Murawski and Matlock, 2006, NMFS-F/SPO-74). To be clear, fishermen and fishing communities are understood to be included in the definition.

region characterized by cultural diversity and subtle economic interrelationships, consideration of the human community is essential.

In 2016, the Council initiated their process of evaluating the EBFM approach and implementing it in the region. Their approach to EBFM is hierarchical, considering the ecosystem at the local (e.g., among coasts within an island), island, U.S. Caribbean region, Caribbean basin, and global scales. This hierarchical approach allows a more intensive focus on fine-scale management needs while still allowing consideration of the larger-scale effects of management decisions. The Council intends the process to be open and inclusive. To that end, the Council would conduct frequent public meetings, provide educational opportunities via brochures and web-based information, directly involved the District Advisory Panels (DAP) representing each of the three island management areas (Puerto Rico, St. Thomas/St. John, St. Croix), and present progress reports to the public at every Council meeting. The first step in moving from the historic species-based management approach to an EBFM approach is the shift from species-based FMPs to island-based FMPs as described and proposed in this document and the companion documents regarding the St. Thomas/St. John and Puerto Rico FMPs.

## 1.7 History of Federal Fisheries Management

Prior to development of the St. Croix FMP described herein, stocks and stock complexes in the St. Croix EEZ (and throughout the U.S. Caribbean) were managed within the Spiny Lobster FMP (CFMC 1981), the Reef Fish FMP (CFMC 1985), the Coral FMP (CFMC 1994), and the Queen Conch FMP (CFMC 1996), as respectively amended.

The following amendments to the four previously operational species-based FMPs, are of particular relevance to the development of the new St. Croix FMP: (1) the Caribbean SFA Amendment (CFMC 2005), implemented in 2005, where the Council took several actions to address required provisions of the Magnuson-Stevens Act, as amended by the Sustainable Fisheries Act of 1996, many of which set the basis for the current management regime in the U.S. Caribbean; (2) the 2010 Caribbean ACL Amendment (CFMC 2011a) and 2011 Caribbean ACL Amendment (CFMC 2011b), both implemented in 2012, where the Council took several actions to comply with the 2007 revisions to the Magnuson-Stevens Act[12], specifically the implementation of ACLs and AMs; and (3) the EA for the Development of Island-Based FMPs in the U.S. Caribbean (NMFS 2014) and Finding of No Significant Impact (FONSI), which

[12] Magnuson-Stevens Fishery Conservation and Management Act – 2007 Reauthorization – In 2006, Congress passed a significant amendment, the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006, which was signed into law in January 2007. This law was groundbreaking in several respects as it featured a number of new requirements to: prevent overfishing by establishing ACLs and accountability measures; promote market-based management strategies, including limited access privilege programs, such as catch shares; strengthen the role of science through peer review, the Councils' Scientific and Statistical Committees, and the Marine Recreational Information Program; enhance international fisheries sustainability by addressing illegal, unregulated, and unreported fishing and bycatch (http://www.nmfs.noaa.gov/sfa/laws_policies/msa/msa_2007.html).

evaluated the effects of transitioning management of federal fisheries in the U.S. Caribbean from species-based FMPs to island-based FMPs and set the basis for the reorganization of management measures under the Reef Fish, Spiny Lobster, Queen Conch, and Coral FMPs into FMPs for each of the Puerto Rico, St. Thomas/St. John, and St. Croix management areas.

The amendments and documents mentioned above, as well as the history of management actions taken to date under all four of the species-based FMPs are summarized in Appendix C of this document.

## 1.8 Goals and Objectives of the St. Croix FMP

The overarching *goal* of St. Croix's FMP is to ensure the continued health of fishery resources occurring in the EEZ surrounding St. Croix, within the context of the unique biological, ecological, economic, and cultural characteristics of those resources and the communities that are dependent upon them. Specific fishery management goals for the St. Croix EEZ are:

G1. Prevent overfishing and achieve, on a continuing basis, the optimum yield from St. Croix's federally managed fishery resources, while ensuring the continued health of the fishery resource, providing for the sustained participation of fishermen and fishing communities, and minimizing to the extent practical adverse economic impacts on such communities.

G2. Manage the fisheries within the limits of local ecosystem production so as to not jeopardize the wide range of goods and services provided by a healthy ecosystem, including food, revenue, and recreation for humans.

G3. Ensure continued provision of ecosystems services derived from living marine resources, including adequate abundance of forage resources to ensure a healthy and diverse trophic web.

G4. Promote awareness of laws and regulations governing marine resource management and the science and social obligations that support that management, and to ensure informed public input into the management process.

G5. Foster collaboration between territorial and federal authorities to achieve compatible management of fisheries throughout the waters surrounding St. Croix.

To achieve the goals described above, the following *objectives* are defined:

O1. Provide for long-term sustainable use of fisheries resources within the limits of local ecosystem production using a precautionary, ecosystem-based approach to management that accounts for uncertainty and relevant biological, ecological, economic and social factors in the fishery, including the benefits of food production, recreational opportunities, and protection of marine ecosystems.

O2. Reduce bycatch and waste in the fishery through the use of measures such as gear restrictions, seasonal closures or marine protected areas that reduce or minimize regulatory and/or economic discards, including measures to minimize the mortality of discarded bycatch that cannot be avoided.

O3. Establish and maintain data collection and reporting programs necessary to support the conservation and management objectives of the FMP, including the biological, ecological, economic, and social data needed to assess the impacts of management measures.

O4. Collaborate with domestic and international regional fishery management bodies in managing pan-Caribbean stocks.

O5. Promote fair and equitable use of fishery resources, recognizing the importance of fishery resources to fishing communities as well as differences in local environment, culture, markets, user groups, gear types, and seafood preferences.

O6. Provide flexibility in the management process which minimizes regulatory delay and allows for rapid adaptation to changing resource abundance, availability, health or preference, using the best available scientific and socioeconomic information.

O7. Devise a regulatory framework that maximizes the efficiency and efficacy of enforcement efforts within and across jurisdictional boundaries while promoting the safe conduct of fishing operations.

O8. Promote awareness of laws and regulations governing marine resource management and the science and social obligations that support that management, and to ensure informed public input into the management process.

O9. Protect spawning aggregations and the habitats supporting those aggregations to ensure the future health of the resource.

O10. Map, define, and manage habitats upon which the resource depends, with particular emphasis on coral reef resources throughout the region.

O11. Account for ecological relationships and functional roles of species in the fishery that contribute to a healthy ecosystem, such as grazers, forage fish, habitat-builders and top predators.

O12. Require essential scientific data is gathered and analyzed in advance to guide the development of new fisheries to ensure they are sustainable from the start.

While most of these goals and objectives are being addressed throughout this plan, some may be addressed through future amendments to the St. Croix FMP, as requested by the Council to NMFS.

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# Chapter 2. Creating a St. Croix Fishery Management Plan (FMP) - Proposed Actions and Alternatives

This chapter discusses each proposed management action and the respective alternatives that were considered by the Caribbean Fishery Management Council (Council) in creating a St. Croix FMP. The presentation and evaluation of management actions included in this chapter are not mutually exclusive, in that some of the proposed management actions are directly related to the previous action(s) and thus "tier" from one another. As a first step, through Action 1 the Council would decide to either continue managing fisheries at the U.S. Caribbean level under the four species-based FMPs (by selecting the no action alternative), or switch to an island-based approach through the establishment of a St. Croix FMP (by selecting the action alternative). As noted elsewhere, to transition to island-based management, the action alternative must be selected in each of the three island-based FMPs under development. Action 1 thus describes no action at the highest level, which means not taking action to establish the St. Croix FMP.

Because the Council decided to establish the new St. Croix FMP by selecting the action alternative in Action 1, it developed and evaluated Actions 2-7, which provide the opportunity to modify that newly created FMP to best revise regulations for fisheries management in the St. Croix exclusive economic zone (EEZ). The order in which the actions are presented in this chapter reflects the tiered structure the Council used when developing the St. Croix FMP (Figure 2.1): Action 2 tiers directly from Action 1, Action 3 tiers directly from Action 2, and Action 4 tiers directly from Action 3. Action 5 follows Action 4, but tiers to both Action 3 and Action 4. Action 6 tiers from Action 2 and Action 7 tiers from Action 1. As a result, the no action alternative in each of Actions 2-7 tiers from the Council's preferred alternative in one or more prior actions, and reflects not taking further action to adjust the management plan.

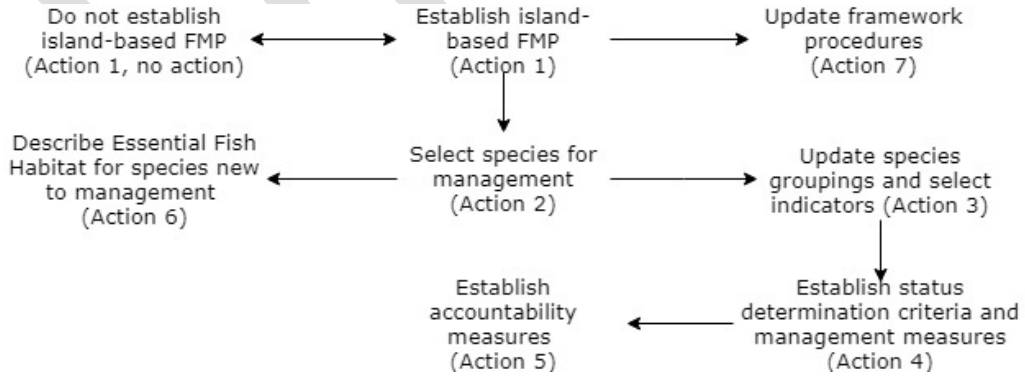


**Figure 2.1**. Structure of the management actions considered in Chapter 2.

## 2.1 Action 1: Transition Fisheries Management in the St. Croix EEZ from a Species-based Approach to an Island-based Approach

Action 1 provides the actual mechanism for transitioning from species-based to island-based management in St. Croix EEZ waters.

### 2.1.1 Proposed Alternatives for Action 1

**Alternative 1**. No action. The transition from a species-based to a fully island-based approach to management would not be implemented. Instead, the four presently existing U.S. Caribbean-region FMPs (Reef Fish FMP; Spiny Lobster FMP; Queen Conch FMP; and Coral FMP) would continue to guide federal fishery management in the St. Croix EEZ.

**Preferred Alternative 2**. Establish a new St. Croix FMP to manage fishery resources in the St. Croix EEZ and repeal the Caribbean Fishery Management Council's (Council) Reef Fish, Spiny Lobster, Queen Conch, and Coral FMPs and replace them with the new St. Croix FMP. The new St. Croix FMP would include all fishery management measures presently included in the Reef Fish, Spiny Lobster, Queen Conch, and Coral FMPs that are applicable to the St. Croix EEZ.

### 2.1.2 Discussion of Action 1 Alternatives

**Alternative 1** (no action) would maintain the existing species-based fisheries management approach. The Council would continue to manage federal fisheries in the U.S. Caribbean EEZ via amendments to each of the Reef Fish FMP, Spiny Lobster FMP, Queen Conch FMP, and Coral FMP, as appropriate. To initially evaluate the environmental effects of shifting from species-based to island-based management in the U.S. Caribbean, and to identify the most appropriate aggregation of islands for island-based management, the Council, in partnership with the NMFS, prepared an environmental assessment (EA) that concluded with a Finding of No Significant Impact (FONSI) regarding the management transition (NMFS 2014).

Additionally, if the current management regime is continued, as noted in the 2014 EA, under **Alternative 1**, the Council would have to develop a new Aquarium Trade Species FMP as recommended by the Council in the 2011 Caribbean Annual Catch Limit (ACL) Amendment (CFMC 2011b).

**Preferred Alternative 2** would complete the transition from species-based to island-based fishery management in the St. Croix EEZ as initiated and evaluated in the 2014 EA. The EA evaluated the impact of incorporating the most current regulations under the four species-based

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FMPs into the Puerto Rico, St. Thomas/St. John, and St. Croix FMPs. With the exception of the management revisions proposed in the subsequent six actions discussed in this DEIS, shifting from species-based FMPs to island-based FMPs would only reorganize the existing management measures and thus would be considered largely an administrative exercise. Moreover, tailoring management measures to specific islands, in this case St. Croix, could potentially make fisheries management more effective by ensuring to the greatest possible degree that optimum yield (OY) is achieved while minimizing adverse direct or indirect effects to the environment (NMFS 2014).

An implicit requirement of **Preferred Alternative 2** is that it be implemented for all three proposed island-based management areas: Puerto Rico, St. Thomas/St. John, and St. Croix. It would not be possible to partially transition from species-based management to island-based management, as the species-based FMPs are based on certain measures that were established across the entire U.S. Caribbean region. For example, in the 2010 and 2011 Caribbean ACL Amendments, maximum sustainable yield (MSY) and overfishing limit (OFL) were set on a Caribbean-wide basis for managed stocks and stock complexes, and two stock complexes (tilefish, aquarium trade) are presently managed Caribbean-wide. Removing some, but not all, of those management measures from the species-based plans would undermine the rationale behind the species-based FMPs. In addition, even if it was possible to partially transition to island-based management, specifically if island-based management was implemented for the St. Croix EEZ but the Caribbean-wide species-based regulations were maintained for either or both of the Puerto Rico and St. Thomas/St. John management areas, the outcome would be two sets of management measures applicable to the St. Croix EEZ. In at least some cases, those management measures would overlap and likely would be contradictory. The effects of such contradictory management would be generally negative, in many cases unenforceable, and would violate the mandates of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act).

As is noted above, the Caribbean-wide management measures established in the species-specific FMPs are not amenable to being transferred to the island-based FMPs. Thus, after choosing to transition to island-based management, the Caribbean-wide status determination criteria (SDC), such as MSY and OFL, must be updated. A complete transition to island-based management (for all three island management areas) would be needed, otherwise the Council would be required to reevaluate the proposed alternative approach.

**Comparison of Action 1 Alternatives and Summary of Effects**

As described in the 2014 EA, continuing the status quo in **Alternative 1** is an administrative action that would not result in changes to the management of federal fisheries in the U.S. Caribbean EEZ; therefore, would not have any direct effects on the physical or

biological/ecological environments. When compared to **Preferred Alternative 2** (establishing a new St. Croix FMP), taking no action in **Alternative 1** would benefit the administrative environment in the *short-term* because it would not require administrative adjustments. However, long-term effects would be negative as prior federal management addressed stocks over which the Council has little or no influence. Indirect effects to the biological/ecological and socioeconomic environments largely would be negative for those same reasons. Expending resources to manage stocks over which there is little federal control, for example, by expending resources to monitor ACLs and implement AMs, could prove costly in terms of the actual expense of implementing measures that would be difficult to enforce. In addition, this process could take away resources from developing and implementing management measures for stocks over which the Council has more influence. Taking away resources from developing and improving fisheries management could lead to short-term and long-term negative effects to the resources upon which fishermen and the communities supporting those fishermen depend, resulting in negative socioeconomic consequences.

**Alternative 1** would not change the management of federal fisheries in the U.S. Caribbean EEZ and would not have any direct effects on the physical or biological/ecological environments as current fishing practices would continue. **Alternative 1** might prove beneficial to the administrative environment in the short-term because managing federal fisheries under the four species-based FMPs would not require administrative adjustments. However, long-term indirect effects to the biological/ecological, social, economic, and administrative environments would be negative because the species-based FMPs include stocks for which the Council has little or no influence and management measures (e.g., ACLs) that may be outdated. As a result, accountability measures could be applied unnecessarily. Other indirect effects on the social and economic environments could be expected from **Alternative 1**, in the form of diminished compliance with fishery regulations and less participation in management activities.

**Preferred Alternative 2** would have *short-term* effects to the human environment (physical, biological/ecological, and socioeconomic) similar to those described for **Alternative 1** because, based solely on the outcome from Action 1, the applied regulatory environment would not change. An island-based approach proposed by **Preferred Alternative 2** could, in the long term, potentially minimize impacts to the physical, biological, economic, and social environments from fishing activities by enhancing fisheries management. However, some of the expected benefits are unknown at this time because future impacts to the human environment depend on the nature of the specific future management actions implemented under the new St. Croix FMP as proposed in Actions 2-7. However, the ultimate outcome from implementing **Preferred Alternative 2**, coupled with implementation of any combination of proposed management actions (except the no action alternatives) presented and discussed in Actions 2-7, likely would be positive.

With the exception of Actions 2-7, all present management measures applicable to the St. Croix EEZ would be included in (migrated to) the new plan, and their effect on the human environment would not be expected to differ from the status quo. The effects of those regulations have been analyzed and disclosed in previous Council National Environmental Policy Act (NEPA) documents (see Appendix B for the history of management).

## 2.2 Action 2: Identify Stocks in Need of Federal Conservation and Management

Action 2 follows from Action 1. If the "no action" alternative is selected in Action 1, then the current management regime remains in place and the Council would not transition to island-based fisheries management, and would not proceed to Action 2. If, however, the Council creates the St. Thomas/St. John FMP under Action 1, then it would proceed to Action 2 to reconsider the appropriate species to be managed under the new island-based plan.

Magnuson-Stevens Act guidelines for developing and reviewing FMPs state that "stocks that are predominantly caught in federal waters and are overfished or subject to overfishing, or likely to become overfished or subject to overfishing" require conservation and management (50 CFR 600.305(c)(1)). These stocks must be included in an FMP. In addition, the regulations provide the following non-exhaustive factors that may be considered when deciding whether additional stocks require conservation and management and should be included in the FMP (50 CFR 600.305(c)(1)(i)-(x)):

(i) The stock is an important component of the marine environment;

(ii) The stock is caught by the fishery;

(iii) Whether an FMP can improve or maintain the condition of the stock;

(iv) The stock is a target of a fishery;

(v) The stock is important to commercial, recreational, or subsistence users;

(vi) The fishery is important to the Nation or to the regional economy;

(vii) The need to resolve competing interests and conflicts among user groups and whether an FMP can further that resolution;

(viii) The economic condition of a fishery and whether an FMP can produce more efficient utilization;

(ix) The needs of a developing fishery, and whether an FMP can foster orderly growth;

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(x) The extent to which the fishery is already adequately managed by states, by state/federal programs, or by federal regulations pursuant to other FMPs or international commissions, or by industry self-regulation, consistent with the requirements of the Magnuson-Stevens Act and other applicable law.

In evaluating these factors, the Council considered the specific circumstances of the St. Croix fishery, based on the best scientific information available, to determine which species should be selected for federal management in the St. Croix John FMP.

### 2.2.1 Proposed Alternatives for Action 2

**Alternative 1**. No action. The St. Croix FMP is composed of all species within the fishery management units presently managed under the Reef Fish FMP, Spiny Lobster FMP, Queen Conch FMP, and the Coral FMP.

**Preferred Alternative 2**. For those species for which landings data are available (Appendix D), the Council would follow a stepwise application of a set of criteria to determine if a species should be included for management in the St. Croix FMP. The criteria under consideration include, in order:

***Criterion A***. Include for management those species that are presently classified as overfished in U.S. Caribbean federal waters based on NMFS determination, or for which historically identified harvest is now prohibited due to their ecological importance as habitat (corals presently included in the Coral FMP) or habitat engineers (midnight, blue, rainbow parrotfish), or those species for which seasonal closures or size limits apply (Table 2.2.1).

***Criterion B***. From the remaining species, *i.e*., those not included via Criterion A, <u>exclude</u> from federal management those species that have been determined to infrequently occur in federal waters based on expert analysis guided by available data (Table 2.2.2).

***Criterion C***. From the remaining species, *i.e*., those not included via Criterion A or excluded via Criterion B, <u>include</u> for management those species that are biologically vulnerable, constrained to a specific habitat that renders them particularly vulnerable, or have an essential ecological value, as determined by expert analysis (Table 2.2.3).

***Criterion D***. From the remaining species, *i.e*., those not included via Criteria A and C or excluded via Criterion B, <u>include</u> those species possessing economic importance to the national or regional economy based on a threshold of landings or value separately determined for each of the recreational, commercial, and aquarium trade sectors as appropriate (e.g., top

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90%) and those representing an important component of bycatch, as established by expert analysis (Table 2.2.4).

***Criterion E***. From the remaining list of species, include any other species that the Council determines are in need of conservation and management.

**Alternative 3**. Identify species to be managed by the Council in waters of the EEZ off St. Croix using, in any order, some or all of the criteria presented in **Preferred Alternative 2**. For those species for which landings data are available, the Council would choose a subset (possibly including all) of the **Preferred Alternative 2** criteria and apply those criteria in a pre-defined order to determine if a species should be managed under the St. Croix FMP. The criteria under consideration are the same those listed in **Preferred Alternative 2**. Briefly, the criteria include (A) the status of the stock and/or if it currently has a harvest prohibition, size limit, or seasonal closure in federal waters, (B) the degree to which the species occurs in state rather than in federal waters and can therefore be affected by federal management, (C) the ecological importance of a species within the coral reef ecosystem, (D) the extent of harvest relative to a pre-established threshold, and (E) other species that the Council determines are in need of conservation and management.

**Table 2.2.1**. Stocks included in the St. Croix FMP based on Preferred Alternative 2, *Criterion A*.

| Count | Family | Scientific Name | Common Name |
|---|---|---|---|
| 1 | Lutjanidae -- Snappers | *Apsilus dentatus* | Black snapper |
| 2 | | *Lutjanus buccanella* | Blackfin snapper |
| 3 | | *Lutjanus vivanus* | Silk snapper |
| 4 | | *Rhomboplites aurorubens* | Vermilion snapper |
| 5 | | *Lutjanus synagris* | Lane snapper |
| 6 | | *Lutjanus analis* | Mutton snapper |
| 7 | | *Ocyurus chrysurus* | Yellowtail snapper |
| 8 | Serranidae -- Groupers | *Epinephelus striatus* | Nassau Grouper |
| 9 | | *Epinephelus itajara* | Goliath grouper |
| 10 | | *Epinephelus guttatus* | Red hind |
| 11 | | *Mycteroperca bonaci* | Black grouper |
| 12 | | *Epinephelus morio* | Red grouper |
| 13 | | *Mycteroperca tigris* | Tiger grouper |
| 14 | | *Mycteroperca venenosa* | Yellowfin grouper |
| 15 | Scaridae -- Parrotfishes | *Scarus coeruleus* | Blue parrotfish |
| 16 | | *Scarus coelestinus* | Midnight parrotfish |
| 17 | | *Scarus taeniopterus* | Princess parrotfish |
| 18 | | *Scarus vetula* | Queen parrotfish |

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| Count | Family | Scientific Name | Common Name |
|---|---|---|---|
| 19 | | *Scarus guacamaia* | Rainbow parrotfish |
| 20 | | *Sparisoma rubripinne* | Redfin parrotfish |
| 21 | | *Sparisoma chrysopterum* | Redtail parrotfish |
| 22 | | *Sparisoma viride* | Stoplight parrotfish |
| 23 | | *Sparisoma aurofrenatum* | Redband parrotfish |
| 24 | | *Scarus croicensis* | Striped parrotfish |
| 25 | Strombidae -- True conchs | *Lobatus gigas* | Queen conch |
| 26 | Palinuridae -- Spiny lobsters | *Panulirus argus* | Caribbean spiny lobster |
| 27 | Corals | All corals | All corals |

**Table 2.2.2.** Stocks included in the St. Croix FMP under Action 1 that were previsously managed under the Reef Fish and Coral FMPs and then excluded from the St. Croix FMP based on Preferred Alternative 2, *Criterion B.*

| Count | Family | Scientific Name | Common Name |
|---|---|---|---|
| 1 | Lutjanidae - Snappers | *Pristipomoides aquilonaris* | Wenchman |
| 2 | | *Pristipomoides macrophthalmus* | Cardinal |
| 3 | | *Lutjanus jocu* | Dog snapper |
| 4 | | *Lutjanus mahogoni* | Mahogany snapper |
| 5 | Serranidae - Groupers | *Mycteroperca interstitialis* | Yellowedge grouper |
| 6 | Haemulidae - Grunts | *Haemulon album* | Margate |
| 7 | | *Haemulon aurolineatum* | Tomtate |
| 8 | | *Haemulon flavolineatum* | French grunt |
| 9 | | *Anisotremus virginicus* | Porkfish |
| 10 | Mullidae - Goatfishes | *Pseudupeneus maculatus* | Spotted goatfish |
| 11 | | *Mulloidichthys martinicus* | Yellow goatfish |
| 12 | Sparidae - Porgies | *Calamus bajonado* | Jolthead porgy |
| 13 | | *Archosargus rhomboidalis* | Sea bream |
| 14 | | *Calamus penna* | Sheepshead porgy |
| 15 | | *Calamus pennatula* | Pluma |
| 16 | Holocentridae - Squirrelfishes | *Myripristis jacobus* | Blackbar soldierfish |
| 17 | | *Priacanthus arenatus* | Bigeye |
| 18 | | *Holocentrus adscensionis* | Squirrelfish |
| 19 | Malacanthidae - Tilefishes | *Caulolatilus cyanops* | Blackline tilefish |
| 20 | | *Malacanthus plumieri* | Sand tilefish |
| 21 | Carangidae - Jacks | *Caranx crysos* | Blue runner |
| 22 | | *Caranx latus* | Horse-eye jack |
| 23 | | *Caranx lugubris* | Black jack |
| 24 | | *Seriola rivoliana* | Almaco jack |
| 25 | | *Caranx ruber* | Bar jack |

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| Count | Family | Scientific Name | Common Name |
|---|---|---|---|
| 26 | | *Seriola dumerili* | Greater amberjack |
| 27 | | *Caranx bartholomaei* | Yellow jack |
| 28 | Balistidae -- Triggerfishes | *Canthidermis sufflamen* | Ocean triggerfish |
| 29 | | *Xanthichthys rigens* | Sargassum triggerfish |
| 30 | | *Melichthys niger* | Black durgon |
| 31 | Monocanthidae - Filefishes | *Aluterus scriptus* | Scrawled filefish |
| 32 | | *Cantherhines macrocerus* | Whitespotted filefish |
| 33 | Ostraciidae – Boxfishes | *Lactophrys polygonia* | Honeycomb cowfish |
| 34 | | *Lactophrys quadricornis* | Scrawled cowfish |
| 35 | | *Lactophrys trigonus* | Trunkfish |
| 36 | | *Lactophrys bicaudalis* | Spotted trunkfish |
| 37 | | *Lactophrys triqueter* | Smooth trunkfish |
| 38 | Labridae - Wrasses | *Lachnolaimus maximus* | Hogfish |
| 39 | | *Halichoeres radiatus* | Puddingwife |
| 40 | | *Bodianus rufus* | Spanish hogfish |
| 1 | Aquarium Trade Species – Reef Fish FMP | *Antennarius* spp. | Frogfish |
| 2 | | *Apogon maculatus* | Flamefish |
| 3 | | *Astrapogen stellatus* | Conchfish |
| 4 | | *Ophioblennius atlanticus* | Redlip blenny |
| 5 | | *Bothus lunatus* | Peacock flounder |
| 6 | | *Chaetodon aculeatus* | Longsnout butterflyfish |
| 7 | | *Chaetodon capistratus* | Foureye butterflyfish |
| 8 | | *Chaetodon ocellatus* | Spotfin butterflyfish |
| 9 | | *Chaetodon striatus* | Banded butterflyfish |
| 10 | | *Amblycirrhitus pinos* | Redspotted hawkfish |
| 11 | | *Dactylopterus volitans* | Flying gurnard |
| 12 | | *Chaetodipterus faber* | Atlantic spadefish |
| 13 | | *Gobiosoma oceanops* | Neon goby |
| 14 | | *Priolepis hipoliti* | Rusty goby |
| 15 | | *Gramma loreto* | Royal gramma |
| 16 | | *Clepticus parrae* | Creole wrasse |
| 17 | | *Halichoeres cyanocephalus* | Yellowcheek wrasse |
| 18 | | *Halichoeres garnoti* | Yellowhead wrasse |
| 19 | | *Halichoeres maculipinna* | Clown wrasse |
| 20 | | *Hemipteronotus novacula* | Pearly razorfish |
| 21 | | *Hemipteronotus splendens* | Green razorfish |
| 22 | | *Thalassoma bifasciatum* | Bluehead wrasse |
| 23 | | *Echidna catenata* | Chain moray |
| 24 | | *Gymnothorax funebris* | Green moray |
| 25 | | *Gymnothorax miliaris* | Goldentail moray |

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| Count | Family | Scientific Name | Common Name |
|---|---|---|---|
| 26 | | *Ogcocepahalus spp.* | Batfish |
| 27 | | *Myrichthys ocellatus* | Goldspotted eel |
| 28 | | *Opistognathus aurifrons* | Yellowhead jawfish |
| 29 | | *Opistognathus whitehursti* | Dusky jawfish |
| 30 | | *Centropyge argi* | Cherubfish |
| 31 | | *Holacanthus tricolor* | Rock beauty |
| 32 | | *Abudefduf saxatilis* | Sergeant major |
| 33 | | *Chromis cyanea* | Blue chromis |
| 34 | | *Chromis insolata* | Sunshinefish |
| 35 | | *Microspathodon chrysurus* | Yellowtail damselfish |
| 36 | | *Pomacentrus fuscus* | Dusky damselfish |
| 37 | | *Pomacentrus leucostictus* | Beaugregory |
| 38 | | *Pomacentrus partitus* | Bicolor damselfish |
| 39 | | *Pomacentrus planifrons* | Threespot damselfish |
| 40 | | *Priacanthus cruentatus* | Glasseye snapper |
| 41 | | *Equetus acuminatus* | High-hat |
| 42 | | *Equetus lanceolatus* | Jackknife-fish |
| 43 | | *Equetus punctatus* | Spotted drum |
| 44 | | *Scorpaenidae* | Scorpionfishes |
| 45 | | *Hypoplectrus unicolor* | Butter hamlet |
| 46 | | *Liopropoma rubre* | Swissguard basslet |
| 47 | | *Rypticus saponaceus* | Greater soapfish |
| 48 | | *Serranus annularis* | Orangeback bass |
| 49 | | *Serranus baldwini* | Lantern bass |
| 50 | | *Serranus tabacarius* | Tobaccofish |
| 51 | | *Serranus tigrinus* | Harlequin bass |
| 52 | | *Serranus tortugarum* | Chalk bass |
| 53 | | *Symphurus arawak* | Caribbean tonguefish |
| 54 | | *Hippocampus spp.* | Seahorses |
| 55 | | *Syngnathus spp*. | Pipefishes |
| 56 | | *Synodus intermedius* | Sand diver |
| 57 | | *Canthigaster rostrata* | Sharpnose puffer |
| 58 | | *Diodon hystrix* | Porcupinefish |
| 1 | Aquarium Trade Species - Coral FMP | *Aphimedon compressa* | Erect rope sponge |
| 2 | | *Chondrilla nucula* | Chicken liver sponge |
| 3 | | *Cynachirella alloclada* | - |
| 4 | | *Geodia neptuni* | Potato sponge |
| 5 | | *Haliclona* spp. | Finger sponge |
| 6 | | *Myriastra* spp. | - |
| 7 | | *Niphates digitalis* | Pink vase sponge |

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| Count | Family | Scientific Name | Common Name |
|---|---|---|---|
| 8 | | *N. erecta* | Lavender rope sponge |
| 9 | | *Spinosella policifera* | - |
| 10 | | *S. vaginalis* | - |
| 11 | | *Tethya crypta* | - |
| 12 | | *Aiptasia tagetes* | Pale anemone |
| 13 | | *Bartholomea annulata* | Corkscrew anemone |
| 14 | | *Condylactis gigantea* | Giant pink-tipped anemone |
| 15 | | *Hereractis lucida* | Knobby anemone |
| 16 | | *Lebrunia* spp. | Staghorn anemone |
| 17 | | *Stichodactyla helianthus* | Sun anemone |
| 18 | | *Zoanthus* spp. | Sea mat |
| 19 | | *Discosoma* spp. (formerly Rhodactis) | False coral |
| 20 | | *Ricordia florida* | Florida false coral |
| 21 | | *Sabellastarte* spp. | Tube worms |
| 22 | | *S. magnifica* | Magnificent duster |
| 23 | | *Spirobranchus giganteus* | Christmas tree worm |
| 24 | | *Tridachia crispata* | Lettuce sea slug |
| 25 | | *Oliva reticularis* | Netted olive |
| 26 | | *Cyphoma gibbosum* | Flamingo tongue |
| 27 | | *Lima* spp. | Fileclams |
| 28 | | *L. scabra* | Rough fileclam |
| 29 | | *Spondylus americanus* | Atlantic thorny oyster |
| 30 | | *Octopus* spp. (except the Common octopus, O.vulgaris) | - |
| 31 | | *Alpheaus armatus* | Snapping shrimp |
| 32 | | *Paguristes* spp. | Hermit crabs |
| 33 | | *P. cadenati* | Red reef hermit |
| 34 | | *Percnon gibbesi* | Nimble spray crab |
| 35 | | *Lysmata* spp. | Peppermint shrimp |
| 36 | | *Thor amboinensis* | Anemone shrimp |
| 37 | | *Mithrax* spp. | Clinging crabs |
| 38 | | *M. cinctimanus* | Banded clinging |
| 39 | | *M. sculptus* | Green clinging |
| 40 | | *Stenorhynchus seticornis* | Yellowline arrow |
| 41 | | *Periclimenes* spp. | Cleaner shrimp |
| 42 | | *Gonodactylus* spp. | - |
| 43 | | *Lysiosquilla* spp. | - |
| 44 | | *Stenopus hispidus* | Banded shrimp |
| 45 | | *S. scutellatus* | Golden shrimp |

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| Count | Family | Scientific Name | Common Name |
|---|---|---|---|
| 46 | | *Analcidometra armata* | Swimming crinoid |
| 47 | | *Davidaster* spp. | Crinoids |
| 48 | | *Nemaster* spp. | Crinoids |
| 49 | | *Astropecten* spp. | Sand stars |
| 50 | | *Linckia guildingii* | Common comet star |
| 51 | | *Ophidiaster guildingii* | Comet star |
| 52 | | *Oreaster reticulatus* | Cushion sea star |
| 53 | | *Astrophyton muricatum* | Giant basket star |
| 54 | | *Ophiocoma* spp. | Brittlestars |
| 55 | | *Ophioderma* spp. | Brittlestars |
| 56 | | *O. rubicundum* | Ruby brittlestar |

**Table 2.2.3.** Stocks included in the St. Croix FMP based on Preferred Alternative 2, *Criterion C.*

| Family | Scientific Name | Common Name |
|---|---|---|
| Serranidae - Groupers | *Cephalopholis fulva* | Coney |
| | *Cephalopholis cruentata* | Graysby |
| | *Epinephelus adscensionis* | Rock hind |
| | *Hyporthodus mystacinus* | Misty grouper |
| Haemulidae - Grunts | *Haemulon sciurus* | Bluestriped grunt |
| Holocentridae - Squirrelfishes | *Holocentrus rufus* | Longspine squirrelfish |
| Acanthuridae - Surgeonfishes | *Acanthurus coeruleus* | Blue tang |
| | *Acanthurus tractus* | Ocean surgeonfish |
| | *Acanthurus chirurgus* | Doctorfish |
| Pomacanthidae - Angelfishes | *Holacanthus ciliaris* | Queen angelfish |
| | *Pomacanthus arcuatus* | Gray angelfish |
| | *Pomacanthus paru* | French angelfish |

**Table 2.2.4.** Stocks included in the St. Croix FMP based on Preferred Alternative 2, *Criterion D.* Species marked with an asterisk are new to federal management.

| Family | Scientific Name | Common Name |
|---|---|---|
| Lutjanidae - Snappers | *Etelis oculatus* | Queen snapper |
| | *Lutjanus griseus* | Gray snapper |
| | *Lutjanus apodus* | Schoolmaster |
| Haemulidae--Grunts | *Haemulon plumierii* | White grunt |
| Balistidae–-Triggerfishes | *Balistes vetula* | Queen triggerfish |
| Coryphaenidae – Dolphinfish | *Coryphaena hippurus* | Dolphin* |

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| Family | Scientific Name | Common Name |
|---|---|---|
| Scombridae -- Mackerels and tunas | *Acanthocybium solandri* | Wahoo* |

**Table 2.2.5.** Stocks included in the St. Croix FMP based on Preferred Alternative 2. The Caribbean Fishery Management Council proposed these species for management at their 153rd Regular Meeting (August 2015).

| Family or Class | # | Species Name | Common Name | Criterion |
|---|---|---|---|---|
| Strombidae -- True conchs | 1 | *Lobatus (Strombus) gigas* | Queen conch | A |
| Palinuridae -- Spiny lobster | 2 | *Panulirus argus* | Caribbean spiny lobster | A |
| Lutjanidae -- Snappers | 3 | *Apsilus dentatus* | Black snapper | A |
| | 4 | *Lutjanus buccanella* | Blackfin snapper | A |
| | 5 | *Lutjanus vivanus* | Silk snapper | A |
| | 6 | *Rhomboplites aurorubens* | Vermilion snapper | A |
| | 7 | *Lutjanus synagris* | Lane snapper | A |
| | 8 | *Lutjanus analis* | Mutton snapper | A |
| | 9 | *Ocyurus chrysurus* | Yellowtail snapper | A |
| | 10 | *Etelis oculatus* | Queen snapper | D |
| | 11 | *Lutjanus griseus* | Gray snapper | D |
| | 12 | *Lutjanus apodus* | Schoolmaster | D |
| Serranidae – Groupers | 13 | *Epinephelus striatus* | Nassau Grouper | A |
| | 14 | *Epinephelus itajara* | Goliath grouper | A |
| | 15 | *Epinephelus guttatus* | Red hind | A |
| | 16 | *Mycteroperca bonaci* | Black grouper | A |
| | 17 | *Epinephelus morio* | Red grouper | A |
| | 18 | *Mycteroperca tigris* | Tiger grouper | A |
| | 19 | *Mycteroperca venenosa* | Yellowfin grouper | A |
| | 20 | *Cephalopholis fulva* | Coney | C |
| | 21 | *Cephalopholis cruentata* | Graysby | C |
| | 22 | *Epinephelus adscensionis* | Rock hind | C |
| | 23 | *Hyporthodus mystacinus* | Misty grouper | C |
| Scaridae -- Parrotfishes | 24 | *Scarus coeruleus* | Blue parrotfish | A |
| | 25 | *Scarus coelestinus* | Midnight parrotfish | A |
| | 26 | *Scarus guacamaia* | Rainbow parrotfish | A |
| | 27 | *Scarus vetula* | Queen parrotfish | A |
| | 28 | *Scarus taeniopterus* | Princess parrotfish | A |
| | 29 | *Sparisoma chrysopterum* | Redtail parrotfish | A |
| | 30 | *Sparisoma viride* | Stoplight parrotfish | A |
| | 31 | *Sparisoma aurofrenatum* | Redband parrotfish | A |
| | 32 | *Sparisoma rubripinne* | Redfin parrotfish | A |
| | 33 | *Scarus iseri* | Striped parrotfish | A |
| Acanthuridae -- Surgeonfishes | 34 | *Acanthurus coeruleus* | Blue tang | C |
| | 35 | *Acanthurus tractus* | Ocean surgeonfish | C |
| | 36 | *Acanthurus chirurgus* | Doctorfish | C |
| Pomacanthidae -- Angelfishes | 37 | *Holacanthus ciliaris* | Queen angelfish | C |
| | 38 | *Pomacanthus arcuatus* | Gray angelfish | C |

| | | | | |
|---|---|---|---|---|
| | 39 | *Pomacanthus paru* | French angelfish | C |
| Haemulidae -- Grunts | 40 | *Haemulon sciurus* | Bluestriped grunt | C |
| | 41 | *Haemulon plumierii* | White grunt | D |
| Holocentridae -- Squirrelfish | 42 | *Holocentrus rufus* | Longspine squirrelfish | C |
| Balistidae -- Triggerfish | 43 | *Balistes vetula* | Queen triggerfish | D |
| Coryphaenidae -- Dolphinfish | 44 | *Coryphaena hippurus* | Dolphin | D |
| Scombridae -- Mackerels and tunas | 45 | *Acanthocybium solandri* | Wahoo | D |
| Class Holothuroidea -- Sea Cucumbers | 46 | All (several families and species) | Sea cucumbers | E |
| Class Echinoidea -- Sea Urchins | 47 | All (several families and species) | Sea urchins | E |
| All Corals | 48 | All (several families and species) | Corals | A |

### 2.2.2 Discussion of Action 2 Alternatives

Under **Alternative 1** (no action), the species included in the St. Croix (*i.e.*, the species previously managed under the Reef Fish, Spiny Lobster, Queen Conch, and Coral FMPs) would not be modified. Under **Alternative 1,** the St. Croix FMP would include 81 species of reef fish, 58 species of aquarium trade fish, spiny lobster, queen conch, 94 species or genera of corals, and 63 species or genera of aquarium trade invertebrates. **Alternative 1**would not allow that list of species to be tailored to the St. Croix EEZ, even though some of those species may not be present or may not be an economically important component of the St. Croix fishery. **Alternative 1** would also not allow new species to be included for management in the St. Croix FMP, which may result in the exclusion of a species that requires conservation and management.

**Preferred Alternative 2** uses an integrated attributes analysis to select species for management in St. Croix John. The five selection criteria (Criteria A-E [discussed below]) were based on attributes that reflected present management status, biological attributes such as ecological importance or vulnerability, and the importance and value of the fishery to the region. The Council's Scientific and Statistical Committee (SSC) and St. Croix District Advisory Panel (DAP) provided input and recommendations on the criteria used to select species in need of conservation and management. Species considered for management included those within the St. Croix FMP (as retained from the four species-based FMPs) as well as non-managed species for which the Southeast Fisheries Science Center (SEFSC) had landings (See Appendix D). These experts developed the initial list of species to be included in the St. Croix FMP by applying selection criteria A-D in a stepwise manner. The final list of proposed species was considered by the Council at their 153rd meeting in August 2015. A fifth criterion, *Criterion E*, was added at the Council's 162nd regular meeting in April 2018, as a means to deal with stocks for which

average landings during the reference period were so low as to be considered *de minimis*[13]. However, at their 163rd regular meeting in August 2018, the Council decided to reject *Criterion E* (see Appendix E for a discussion of the reasons why) and replace it with a new *Criterion E* that would include species the Council determined were in need of conservation and management, such as species of sea cucumbers and sea urchins that were not previously managed.

The stepwise approach proposed in **Preferred Alternative 2** begins with application of *Criterion A*, which ensures the inclusion of stocks in the St. Croix FMP that currently have specific management measures in place, including those classified as overfished in U.S. Caribbean waters, stocks for which historically identified harvest is now prohibited due to ecological importance as habitat or habitat engineers, and those stocks for which seasonal closures or size limits apply. Inclusion of *Criterion A* is necessary to ensure that management of those identified stocks continues to aid their recovery and/or conservation. Under *Criterion A* of **Preferred Alternative 2**, 24 finfish, queen conch, spiny lobster, and previously managed corals would be included in the St. Croix FMP (Table 2.2.1). Following a recommendation from the St. Croix DAP, the Council agreed that all corals[14] occurring in St. Croix EEZ waters were in need of conservation and management and therefore should be included in the FMP.

Under *Criterion B* of **Preferred Alternative 2**, species that infrequently occur in federal waters would be excluded from the St. Croix FMP, unless they were included under *Criterion A*. For these excluded species, the Council determined that the FMP would not be able to improve or maintain the condition of the stock and so they were not in need of conservation and management. Suitable harvest location data (e.g., catch from federal versus territorial waters) were not available from commercial catch reports. However, depth distribution data were available and were used in the expert determination as to whether the species predominantly occurred in St. Croix territorial waters (generally $\leq$ 30 m) and therefore not appropriate for federal management, or in federal waters (generally > 30 m) and therefore eligible for further consideration under *Criteria C* and *D*. Under *Criterion B* of **Preferred Alternative 2**, 40 individual species of finfish, all aquarium trade finfish species, and 56 aquarium trade invertebrate species originally included in the St. Croix FMP under Action 1 would be excluded from management (Table 2.2.2).

[13] Definition - too trivial or minor to merit consideration. The *de mininis* landings would not apply to previously identified conservation and management concerns that resulted in the application of specific management regulations (captured in Criterion A). The *de minimis* classification is appropriate when low landings of a stock reflect fishery socioeconomics rather than the biological condition of the stock.

[14] At their 153rd Regular meeting, the Council moved to include all soft, hard, mesophotic, and deep water corals under the new island-based FMPs. This would include all species in Orders Scleractinia (hard corals), Alcyonacea (soft corals), and Antipatharia (black corals).

Under *Criterion C* of **Preferred Alternative 2**, for species that were not excluded from federal management based on Criterion B, a species would be included in the St. Croix FMP if it is biologically vulnerable, constrained to a specific habitat that renders it particularly vulnerable, or has an essential ecological value. Under *Criterion C* of **Preferred Alternative 2**, 12 finfish would be included in the St. Croix FMP (Table 2.2.3).

Under *Criterion D* of **Preferred Alternative 2**, for species not already included for federal management based on Criteria A or C, or excluded based on Criterion B, a species would be included in the St. Croix FMP if the species possesses economic importance to the nation or regional economy or if it represents an important component of bycatch. Seven finfish species were selected for inclusion under this criterion, including two new pelagic species (dolphin and wahoo) (Table 2.2.4).

Each of the species added under Criterion D provides substantial value to the St. Croix fishery, either directly (harvested for consumption) or indirectly (used as bait). After careful consideration, pelagic species were included for federal management under this criterion. The Council recognized the economic importance of these stocks within the region and decided to include them for management under the St. Croix FMP, even though, given their migratory nature, they are exposed to harvest pressure across a wide area of the Atlantic Ocean.

As mentioned above, a new description for *Criterion E* was added to **Preferred Alternative 2** to allow the Council discretion to add those species they felt were in need of conservation or management. All sea cucumbers and sea urchins that were not previously managed under the Coral FMP as aquarium trade species, and thus included in the St. Croix under Action 1, but that occur in the St. Croix EEZ, would fall under this category. These groups were added to the St. Croix FMP by Council motion at their 153rd regular meeting in August 2015, because as slow-moving benthic invertebrates, they are commercially exploited for consumption through export to Asian markets and are highly vulnerable to overharvest.

In summary, **Preferred Alternative 2** would result in the following list of species to be included in the St. Croix FMP: queen conch, spiny lobster, all species of sea cucumbers, sea urchins, and coral occurring in St. Croix EEZ waters, and 43 species of finfish (Table 2.2.5).

**Alternative 3** is similar to **Preferred Alternative 2**, with two important exceptions. First, **Alternative 3** does not call for a stepwise application of the criteria. Second, **Alternative 3** does not require that all of the five criteria be used. Instead, **Alternative 3** allows for any subset of the criteria to be applied and in any order. As an example of the potential drawbacks of this *ad hoc* approach, if Criterion C or D were applied before Criterion B, then stocks could be included in the FMP for which federal management might not be as effective. Of even greater concern, if

one of the Criterion was not applied, then species that may be in need of conservation and management would be overlooked. **Alternative 3** presents 325 alternative criteria combinations, from which the Council could choose a different combination and order for each stock in the fishery. Without guidance from the Council regarding which criteria would be included when applying **Alternative 3**, it is not practically possible to compare all of the alternative outcomes. The Council considered **Alternative 3** and decided not to move forward with the alternative. Therefore, **Alternative 3** was eliminated from further detailed study.

**Comparison of Action 2 Alternatives and Summary of Effects**

**Alternative 1** would continue management of those stocks that are included under the existing FMPs, without alteration. When compared to **Alternative 1**, **Preferred Alternative 2** would identify species in need of conservation and management using an expert-based analysis of available data and information applied within an ordered set of evaluation criteria. The outcome of this ordered selection process would result in a change in the number of stocks subject to federal management in St. Croix EEZ waters relative to **Alternative 1**. Although two reef fish stocks would be newly included in the federal management regime, 40 reef fish stocks would be simultaneously removed from management, resulting in an overall decrease in the number and composition of managed reef fish (from 81 to 43). Both alternatives would include spiny lobster and queen conch. In **Preferred Alternative 2**, all species of sea cucumbers and sea urchins occurring in St. Croix EEZ waters would be added to the federal management regime, whereas this would not be the case in **Alternative 1**. Under **Alternative 1**, 94 species or genera of corals that were included in the Coral FMP would be managed in St. Croix EEZ waters. **Preferred Alternative 2** would result in an unknown number of additional coral species being included for management as a result of including all corals[15] in the FMP rather than only those species or genera previously managed under the Coral FMP. **Alternative 3** includes the same selection criteria described for **Preferred Alternative 2**, but does not require that all criteria be used, or that they be applied in a step-wise manner. The list of species selected under **Alternative 3** could be either very inclusive, if all species for which landings data are available were included, or minimal, if only those species determined to be overfished or undergoing overfishing, or likely to become overfished or subject to overfishing were included.

**Alternative 1** would not have direct physical, biological/ecological, socioeconomic, or administrative effects relative to the present situation. **Alternative 1** would be expected to have indirect biological/ecological, socioeconomic, and administrative effects because it would not extend management to other species in need of conservation and management based on the

[15] At their 153rd Regular meeting, the Council moved to include all soft, hard, mesophotic, and deep water corals under the new island-based FMPs. This would include all species in Orders Scleractinia (hard corals), Alcyonacea (soft corals), and Antipatharia (black corals).

criteria established in the Magnuson-Stevens Act. The Council would not set management reference points or other conservation measures for those species, or otherwise ensure those species are managed in a manner that prevents overfishing while achieving, on a continuing basis, the optimum yield (OY) from the fishery as required by National Standard 1 of the Magnuson-Stevens Act. Additionally, not including species that are economically important could have both short- and long-term socioeconomic effects on fishermen pursuing the locally occurring stocks of those species, if unregulated harvest results in depletion of the stock. Conversely, including stocks predominantly harvested from St. Croix territorial waters in a management plan applicable only to federal waters is administratively ineffective because of the lack of federal authority and resultant enforcement capacity in those local waters, particularly with respect to application of accountability measures (AM) in response to harvest exceeding the allowable catch limit.

When compared to the no action **Alternative 1**, implementing **Preferred Alternative 2** would be expected to have few if any direct or indirect physical effects on the environment, beyond those already experienced under the present management regime. For example, if fishing for a species that would be removed from management under **Preferred Alternative 2** continues as is regardless of federal management, no effects would be expected from its removal from the FMP. Removal of species preliminarily caught in territorial waters or those with low or infrequent catch levels in federal waters would allow management efforts to be concentrated on the more heavily targeted and exploited stocks that are in need of management, thus providing increased benefits to the biological/ecological environment. Contrary to **Alternative 1**, revising federal fishery management in the St. Croix EEZ in **Preferred Alternative 2** provides the opportunity to reevaluate managed species in response to changing environmental (e.g., habitat availability or health) or anthropogenic (e.g., fishing practices) factors to maximize biological as well as socioeconomic benefit.

Adding species previously not managed would potentially have indirect effects on the physical and/or biological/ecological environments if it resulted in new gear types, fishing areas, changes in the number of fish harvested or fishing effort not previously analyzed, but these routes are not expected for any of the species added in **Preferred Alternative 2**. However, future Council actions could affect the physical and the biological/ecological environments. For example, for newly added species, the Council could take action to reduce harvest of these species or change allowable harvest methods in a manner that changes effects to the these environments.

Like **Alternative 1**, **Preferred Alternative 2** would continue to manage species that are susceptible to excess fishing pressure and/or vulnerable to environmental conditions (e.g., species classified as overfished [Nassau, goliath grouper], species with harvest prohibitions due to ecological importance [midnight, rainbow, blue parrotfish], species with seasonal closures or

size limits [queen conch, spiny lobster, select snappers and groupers]). Unlike **Alternative 1, Preferred Alternative 2** would have the flexibility to include species that that were not included in the previous FMPs, but are currently considered to be biologically vulnerable or ecologically important (e.g., sea cucumbers, sea urchins). **Preferred Alternative 2** would also benefit the biological/ecological environment indirectly by establishing catch limits (not directly in this action, but later in Action 4) for highly targeted stocks that are currently without management measures, like dolphin and wahoo, thus providing a more comprehensive management of the St. Croix coral reef ecosystem. With respect to Endangered Species Act (ESA)-listed species, **Preferred Alternative 2** would include for management all corals, sea cucumbers, and sea urchins, which could reduce direct (habitat) and indirect (grazers) effects to ESA coral critical habitat.

When compared to the no action **Alternative 1**, **Preferred Alternative 2** could in the future create a short-term socioeconomic burden to fishermen that fish for those stocks newly added to management. This would occur if management measures applied to those newly added species, including for example annual catch limits (ACLs), trip limits, or size limits, resulted in a reduction in the allowable harvest or an increase in the effort required to obtain that harvest. However, in the long term, positive effects would be expected as the management measures work to prevent overfishing while achieving, on a continuing basis, the OY from the fishery as prescribed in NS1 of the Magnuson-Stevens Act.

When compared to the no action **Alternative 1**, **Preferred Alternative 2** would be more beneficial administratively because it would direct resources to the management and protection of species that occur in federally managed waters and that are therefore responsive to federal management measures.

Anticipated effects from application of **Alternative 3** would be similar to those described for **Preferred Alternative 2**. The actual direct or indirect effects of applying **Alternative 3** would depend on the criteria selected and the order those criteria are applied, both of which are unknown at this time. The list of species selected under **Alternative 3** could be either very inclusive if all species for which landings data are available were included, or minimal if only those species determined to be overfished or undergoing overfishing, or likely to become overfished or subject to overfishing were included. Both of these scenarios would be expected to have increased administrative effects when compared to **Alternative 1**, as the current management would need to be altered greatly. It is more difficult to compare effects of **Alternative 3** to **Preferred Alternative 2**, but they would generally not be as beneficial to the environments of St. Thomas/St. John unless the list of species selected was very similar or identical to the one generated under **Preferred Alternative 2**, as the Council and its panel of experts used the best information available to populate that list.

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In summary, relative to **Alternative 1** and **Alternative 3**, **Preferred Alternative 2** would be more beneficial to the human environment because it would (1) direct resources to the management and protection of species that are in the highest need of conservation and management; (2) allow inclusion of species that have not been previously subject to conservation and management; and (3) remove current management measures in place for species that are not targeted in federal waters. That reorganization of species to be managed would increase the likelihood of sustainable harvest, as a means both to enhance food security for the island of St. Croix and to rebuild and sustain the natural ecological balance of the coral reef ecosystem within the context of sustainable harvest.

## 2.3 Action 3: Compose Stock Complexes and Identify Indicator Stocks as Appropriate

Through Action 3, the Council would determine, for species selected for management in Action 2 (Preferred Alternative 2), whether those species are managed as individual stocks or within a stock complex, and if the latter then whether the species is assigned as an indicator stock, is governed by an indicator stock, or is managed as a group within the complex. As with Action 2, this action follows from selecting Alternative 2 in Action 1 and proceeding with establishing a St. Croix FMP composed of measures pertinent to St. Croix.

### 2.3.1 Proposed Alternatives for Action 3

**Alternative 1**. No action. In the St. Croix FMP, retain the stock complex arrangements previously established in the Reef Fish, Spiny Lobster, Queen Conch, and Coral FMPs for species that would continue to be managed under the St. Croix FMP. For stocks not previously included in the Reef Fish, Spiny Lobster, Queen Conch, and Coral FMPs, but which would be managed under the St. Croix FMP via Action 2, no stock complexes would be established and no indicator stocks assigned.

**Alternative 2**. Do not organize the species in the St. Croix FMP in stock complexes. Species selected for management in Action 2 would be managed as individual stocks.

**Preferred Alternative 3**. Manage species included for management in the St. Croix FMP as individual stocks or as stock complexes, based on scientific analysis, including one or more of the following: cluster analysis based on landings patterns; outcomes from the Southeast Data, Assessment, and Review (SEDAR) Caribbean Data Evaluation Workshop (2009) (only for species previously managed that would remain in the FMP); biological/life history similarities

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and vulnerability (for all species); and, expert opinion from the scientific and fishing communities (for all species).

**Alternative 4**. Where there are stock complexes, determine whether to assign one or more indicator stocks as follows:

**Preferred Sub-alternative 4a**. Indicator stocks would be used. One or more indicator stocks would be assigned within a stock complex based on the following criteria: percent of the catch, targeted, habitat co-occurrence, life history/vulnerability, catch co-occurrence, data availability, and market value. For stock complexes for which harvest is allowed and for which one or more indicator stocks is assigned, stocks in the stock complex would be subject to AMs as a group based on the ACL established for the indicator stock(s).

**Preferred Sub-alternative 4b**. No indicator stock(s) would be assigned. For stock complexes for which harvest is allowed, stocks in the complex would be subject to AMs as a group based on the aggregate ACL derived from information on all of the stocks in the complex.

### 2.3.2 Discussion of Action 3 Alternatives

**Alternative 1** is the no action alternative. Stocks selected for management in Action 2 would be grouped according to the same stock/stock complex organization brought in under Action 1 from the Reef Fish, Spiny Lobster, Queen Conch, and Coral FMPs (Table 2.3.1). Under **Alternative 1**, the stock complex organization would remain the same, but the composition of species within that complex may be reduced. For example, some stock complexes within the St. Croix FMP (established under Action 1, Preferred Alternative 2) were subsequently revised under Action 2, Preferred Alternative 2, as stocks within the complex were excluded based on *Criterion B*.

The original organization of the stock complexes under the four Council FMPs was based on biological, geographic, ecological, and/or economic characteristics. For some previously managed stocks, the stock/stock complex organization that would result from **Alternative 1** may not be based on the best currently available information, even if it was the best available information at the time the existing complexes were established. As a result, selecting **Alternative 1** could violate NS 2 of the Magnuson-Stevens Act, which establishes that "conservation and management measures shall be based upon the best scientific information available." 16 USC 1851(a)(2).

Additionally, stocks new to management under Action 2, Preferred Alternative 2 would be managed as individual stocks rather than grouped in a complex. Those stocks may have similar biological characteristics to stocks within a previously managed complex, which under NS 1

would suggest that they be managed within the stock complex. However, under **Alternative 1**, they would not be organized into a stock complex, but would be managed as single stocks.

**Table 2.3.1.** Stock/stock complex organization under Action 3, Alternative 1 for stocks that would be included for management as selected in Action 2, Preferred Alternative 2 in the St. Croix FMP (as established in Action 1). Note: as a result of Action 2, Preferred Alternative 2, all species in the boxfish, filefish, goatfish, porgies, jacks, tilefish, and wrasses complexes as well as the all of the aquarium trade reef fish species were removed from management, and thus those complexes would not be retained in Action 3, Alternative 1.

| Stocks/Stock Complexes | Stocks included in the St. Croix FMP |
|---|---|
| Snapper Unit 1[1] | Black, blackfin, silk, vermillion |
| Snapper Unit 2[2] | Queen |
| Snapper Unit 3[3] | Lane, mutton, gray, schoolmaster |
| Snapper Unit 4 | Yellowtail |
| Grouper Unit 1 | Nassau |
| Grouper Unit 2 | Goliath |
| Grouper Unit 3 | Red hind, coney, graysby, rock hind |
| Grouper Unit 4 | Black, red, tiger, yellowfin |
| Grouper Unit 5[4] | Misty |
| Acanthuridae – Surgeonfishes | Blue tang, ocean surgeonfish, doctorfish |
| Balistidae – Triggerfishes[5] | Queen triggerfish |
| Haemulidae – Grunts[6] | White grunt, bluestriped grunt |
| Holocentridae – Squirrelfish[7] | Longspine squirrelfish |
| Pomacanthidae - Angelfishes | Queen, gray, French |
| Scaridae – Parrotfishes | Blue, midnight, rainbow, queen, princess , redtail, stoplight, redband, striped, redfin |
| Class Holothuroidea - Sea Cucumbers[8] | Holothuria spp. |
| Class Echinoidea - Sea Urchins[8] | Long-spined, purple, pencil, pin cushion, and see egg urchins |
| Queen conch | Queen conch |
| Spiny lobster | Spiny lobster |
| Corals[9] | Corals |

[1]The previously established Snapper Unit 1 also included wenchman, which would be removed from management in Action 2, Preferred Alternative 2 (Criterion B).
[2]The previously established Snapper Unit 2 also included cardinal snapper, which would be removed from management in Action 2, Preferred Alternative 2 (Criterion B).
[3]The previously established Snapper Unit 3 also included dog and mahogany snapper. These species would be removed from management in Action 2, Preferred Alternative 2 (Criterion B).
[4]The previously established Grouper Unit 5 also included yellowedge grouper, which would be removed from management in Action 2, Preferred Alternative 2 (Criterion B).

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[5]The previously established triggerfish complex also included ocean triggerfish, and sargassum triggerfish. These species would be removed from management in Action 2, Preferred Alternative 2 (Criterion B).
[6]The previously established grunts complex also included tomtate, margate, and French porkfish. These species would be removed from management in Action 2, Preferred Alternative 2 (Criterion B).
[7]The previously established squirrelfish complex also included blackbar soldierfish, bigeye, and squirrelfish. These species would be removed from management in Action 2, Preferred Alternative 2 (Criterion B).
[8]Sea cucumbers and some sea urchin species were included in the Coral FMP as part of the aquarium trade species. Aquarium trade species (reef fish and invertebrates) would be removed from management in Action 2, Preferred Alternative 2 (Criterion B), and all species of sea cucumbers and sea urchins would be managed as two complexes under Action 2, Preferred Alternative 2.

**Alternative 1** would not be a preferred alternative if the Council implements Preferred Alternative 2 in Action 2 (Table 2.3.2), as species that were not previously managed in the St. Croix EEZ, would not be assigned into stock complexes. Based on Preferred Alternative 2 in Action 2, two finfish species would be new to management under the St. Croix FMP (dolphin and wahoo), along with multiple sea urchins, sea cucumbers, and all corals, including deep-water corals and mesophotic corals. Prior to taking action to revise the species list in Action 2, the St. Thomas/St. John FMP would have only included some species of sea urchins, sea cucumbers, and corals, as under the Coral FMP. Those species that would be newly added to the St. Croix FMP under Preferred Alternative 2 of Action 2 may share biological, geographic, ecological, and/or economic similarities with those species that would remain under federal management and/or share similarities with some of the other newly added species and therefore, it could be beneficial to group those species into stock complexes. However, **Alternative 1** would not group these species.

**Table 2.3.2.** New stocks that would be included for management in the St. Croix FMP based on Action 2, Preferred Alternative 2. These stocks would not be organized into stock complexes under Action 3, Alternative 1.

| Family or Class | Species Common Name |
|---|---|
| Mackerels and Tunas | Wahoo |
| Dolphinfish | Dolphin |
| Class Holothuroidea - Sea Cucumbers[1] | All species |
| Class Echinoidea - Sea Urchins[1] | All species |

[1]Some species of sea cucumbers and sea urchins were previously managed as aquarium trade species in the Coral FMP.

**Alternative 2** proposes that all stocks included in the St. Croix FMP be managed individually. None would be organized into stock complexes. Under **Alternative 2** some stocks may be appropriately managed as individual stocks, such as the queen conch and spiny lobster, because of their unique and individual characteristics. Additionally, many of the stocks that would be

included for management in the St. Croix FMP have issues with species identification (reported as a group or easily and often mis-identified) or unreliable landings through time (due to the rarity of the species or lack of targeted fishing effort). For those stocks, there may not be enough information available to establish management reference points and management measure proxies required under the Magnuson-Stevens Act or included in the NS guidelines for fishery management. The revised NS1 guidelines state that stocks may be grouped into complexes for various reasons, including "where there is insufficient data to measure a stock's status relative to SDC [status determination criteria]," 50 CFR 600.310(d)(2)(i). Under **Alternative 2**, those reference points would have to be established for each individual stock, even if there is insufficient information to set SDCs at the individual stock level or to monitor stock performance with respect to those SDCs. Additionally, setting an individual ACL for stocks with highly variable landings may result in frequent ACL overages because of the highly variable landings characteristic of those stocks, resulting in unnecessary application of AMs. In general, AMs create socioeconomic burdens on the fishing communities and additional workload burdens on fishery managers and enforcement officers, so they must be applied in the most effective and conscientious manner.

**Preferred Alternative 3** would manage stocks as individual stocks or as stock complexes, as appropriate, based on scientific analysis, including one or more of the following: cluster analysis based on landings patterns; outcomes from the SEDAR Caribbean Data Evaluation Workshop (2009) (only for species previously managed that would remain in the FMP); biological/life history similarities and vulnerability (for all species); and, expert opinion from the scientific and fishing communities (for all species). This analysis is consistent with the revised NS1 guidelines, which explain that, where practical, stocks grouped into a complex should have sufficiently similar in geographic distribution, life history characteristics, and vulnerabilities to the fishing pressure such that the impact of management actions on the stocks included in a complex is similar (50 CFR 600.310(d)(2)(i)). In addition, the guidelines indicate that the vulnerability of individual stocks should be considered when determining if a particular stock complex should be established or reorganized, or if a particular stock should be included in a complex (50 CFR 600.310(d)(2)(i)).

In contrast to **Alternative 2**, **Preferred Alternative 3** provides managers with the flexibility to choose to manage stocks individually or as a complex, depending on the information available and the goals of the management plan. As discussed under **Alternative 2**, grouping stocks into complexes allows management reference points to be specified for the complex as a whole, which can be particularly helpful in data-limited situations when it is not possible to evaluate an individual stock's status relative to status determination criteria or to otherwise specify management reference points at the individual stock level (50 CFR 600.310(d)(2)(i)). Grouping non-targeted or data-poor stocks into complexes helps buffer uncertainty in individual landings

histories, mitigates issues with species identification, and may reduce the likelihood of unnecessary implementation of AMs. In contrast and as previously noted, species such as spiny lobster and queen conch share few if any attributes with any other species proposed for management in the St. Croix FMP. These species are best managed as individual stocks, thereby ensuring to the greatest degree possible that management measures reflect their unique characteristics and are not unduly influenced by species that may share (for example) geographic or cultural affinities but fundamentally differ in their biological characteristics. In these cases, the Council has the option under **Preferred Alternative 3** to establish single stock management for those species that are harvested using methods that specifically target that species, have a unique life history, are physically separated from other stocks, are classified as overfished or undergoing overfishing, are in rebuilding plans, or are targeted by fishermen independent of other species by fishermen.

The Council's SSC and the St. Croix DAP met on several occasions to discuss grouping species into complexes as prescribed under **Preferred Alternative 3** and provided recommendations to the Council regarding if and how stocks should be grouped into a complex. Criteria discussed when considering whether to group stocks into complexes included the composition of the existing stock complexes, life history information (*i.e.*, habitat and depth, including federal versus territorial waters), fishery information (*i.e.*, gear and if the stock is targeted or bycatch), if members of the stock might be ciguatoxic, and if (and when) the stock was specifically included on landings forms. A combined SSC/DAP meeting occurred from March 15-17, 2016, at which time the SSC and DAP members discussed groupings using the methods discussed above. Members of the St. Croix DAP and SSC evaluated all of the species proposed for management in the St. Croix FMP (resulting from the application of Preferred Alternative 2 in Action 2) to determine if they should be managed as a single stock or as part of a stock complex. The resultant stocks (for individual species) and stock complexes (for groups of species) were presented to the Council at their March 17, 2016, meeting. Further review of the stock complexes occurred at the February 2017 SSC meeting and the March 2017 DAP meeting, and the recommendations were accepted at the April 2017 Council meeting.

**Preferred Alternative 3** would result in 13 single stocks and 13 stock complexes (Table 2.3.3). A discussion of how the stocks were composed under **Preferred Alternative 3** and how that organization compares to results from **Alternative 1** and **Alternative 2** can be found below.

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**Table 2.3.3.** Stocks and stock complexes managed in the St. Croix FMP based on Action 3, Preferred Alternative 3.

| Family or Class | Stock/Stock Complexes | Species Name | Common Name |
|---|---|---|---|
| **Strombidae -- True conchs** | Queen Conch | *Lobatus (Strombus) gigas* | Queen conch |
| **Palinuridae -- Spiny lobster** | Spiny Lobster | *Panulirus argus* | Caribbean spiny lobster |
| **Lutjanidae -- Snappers** | Snapper 1 | *Apsilus dentatus* | Black snapper |
| | | *Lutjanus buccanella* | Blackfin snapper |
| | | *Lutjanus vivanus* | Silk snapper |
| | | *Rhomboplites aurorubens* | Vermilion snapper |
| | Snapper 2 | *Etelis oculatus* | Queen snapper |
| | Snapper 3 | *Lutjanus griseus* | Gray snapper |
| | | *Lutjanus synagris* | Lane snapper |
| | Snapper 4 | *Lutjanus analis* | Mutton snapper |
| | Snapper 5 | *Lutjanus apodus* | Schoolmaster |
| | Snapper 6 | *Ocyurus chrysurus* | Yellowtail snapper |
| **Serranidae -- Groupers** | Grouper 1 | *Epinephelus striatus* | Nassau Grouper |
| | Grouper 2 | *Epinephelus itajara* | Goliath grouper |
| | Grouper 3 | *Cephalopholis fulva* | Coney |
| | | *Cephalopholis cruentata* | Graysby |
| | Grouper 4 | *Epinephelus adscensionis* | Rock hind |
| | | *Epinephelus guttatus* | Red hind |
| | Grouper 5 | *Mycteroperca bonaci* | Black grouper |
| | | *Epinephelus morio* | Red grouper |
| | | *Mycteroperca tigris* | Tiger grouper |
| | | *Mycteroperca venenosa* | Yellowfin grouper |
| | Grouper 6 | *Hyporthodus mystacinus* | Misty grouper |
| **Scaridae -- Parrotfish** | Parrotfish 1 | *Scarus coeruleus* | Blue parrotfish |
| | | *Scarus coelestinus* | Midnight parrotfish |
| | | *Scarus guacamaia* | Rainbow parrotfish |
| | Parrotfish 2 | *Scarus vetula* | Queen parrotfish |
| | | *Scarus taeniopterus* | Princess parrotfish |
| | | *Sparisoma chrysopterum* | Redtail parrotfish |
| | | *Sparisoma viride* | Stoplight parrotfish |
| | | *Sparisoma aurofrenatum* | Redband parrotfish |
| | | *Sparisoma rubripinne* | Redfin parrotfish |
| | | *Scarus iseri* | Striped parrotfish |
| **Acanthuridae -- Surgeonfish** | Surgeonfish | *Acanthurus coeruleus* | Blue tang |
| | | *Acanthurus tractus* | Ocean surgeonfish |
| | | *Acanthurus chirurgus* | Doctorfish |
| **Pomacanthidae -- Angelfish** | Angelfish | *Holacanthus ciliaris* | Queen angelfish |
| | | *Pomacanthus arcuatus* | Gray angelfish |
| | | *Pomacanthus paru* | French angelfish |
| **Haemulidae -- Grunts** | Grunts | *Haemulon sciurus* | Bluestriped grunt |
| | | *Haemulon plumierii* | White grunt |

| Family or Class | Stock/Stock Complexes | Species Name | Common Name |
|---|---|---|---|
| **Holocentridae -- Squirrelfish** | Squirrelfish | *Holocentrus rufus* | Longspine squirrelfish |
| **Balistidae -- Triggerfish** | Triggerfish | *Balistes vetula* | Queen triggerfish |
| **Coryphaenidae -- Dolphinfish** | Dolphin | *Coryphaena hippurus* | Dolphin |
| **Scombridae -- Mackerels and Tunas** | Wahoo | *Acanthocybium solandri* | Wahoo |
| **Class Holothuroidea -- Sea Cucumbers** | Sea Cucumbers | All species | Sea cucumbers |
| **Class Echinoidea -- Sea Urchins** | Sea Urchins | All species | Sea urchins |
| **Corals** | Corals | All species | Corals |

The stock complexes selected in **Preferred Alternative 3** were supported by the outcomes from a semi-quantitative productivity susceptibility analysis (PSA) conducted by the SSC in cooperation with the SEFSC. The PSA process used scores from a variety of biological and fishery attributes (see Appendix J) to categorize the relative biological productivity and fishery susceptibility of each stock included in the management plan. Although the SSC developed the PSA approach for deriving reference points, they recognized its utility for validating outcomes from the stock complex assignment process. The productivity score was of value in assessing the similarities in integrated biological characteristics (see Appendix J, Table J.1) of those stocks included in a common complex. Similarly, the susceptibility score provided insights into the relative exposure of the individual stocks comprising a complex to direct (e.g., gear) and indirect (e.g., management strategy) components of the fishery (see Appendix J, Table J.2). Evaluating the stock complexes in view of the productivity and susceptibility scores ensures that, to the greatest possible extent, the resultant stock complex arrangements meet MSA guidance regarding the formulation and performance of stock complexes. Specifically, application of those scores served to ensure that, where practical, stocks grouped into a complex should be sufficiently similar in geographic distribution, life history characteristics, and vulnerabilities to fishing pressure such that the impact of management actions on the stocks included in a complex is similar (50 CFR 600.310(d)(2)(i)). In addition, the guidelines indicate that the vulnerability of individual stocks should be considered when determining if a particular stock complex should be established or reorganized, or if a particular stock should be included in a complex. In the following paragraphs, the rationale applied by the St. Croix DAP and the SSC in recommending each stock/stock complex, as accepted by the Council, is described and compared relative to the applicable productivity and susceptibility scores (Table 2.3.4)

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**Table 2.3.4.** Results of the PSA for stocks included in the St. Croix FMP. Those stocks with bold print would be the designated indicator stock for the complex if the Council selects Action 3, Preferred Sub-Alternative 4a for that complex.

| Scientific Name | Common Name | Stock / Complex | Productivity | Susceptibility |
|---|---|---|---|---|
| *Panulirus argus* | Caribbean spiny lobster | Spiny Lobster | High | Low/Moderate |
| *Apsilus dentatus* | Black snapper | Snapper 1 | Moderate/High | Low |
| ***Lutjanus buccanella*** | **Blackfin snapper** | **Snapper 1** | **Moderate/High** | **Low** |
| ***Lutjanus vivanus*** | **Silk snapper** | **Snapper 1** | **Moderate/High** | **Low** |
| *Rhomboplites aurorubens* | Vermilion snapper | Snapper 1 | Moderate/High | Low |
| *Etelis oculatus* | Queen snapper | Snapper 2 | High | Low |
| *Lutjanus griseus* | Gray snapper | Snapper 3 | Low/Moderate | Low/Moderate |
| *Lutjanus synagris* | Lane snapper | Snapper 3 | Moderate | Low |
| *Lutjanus analis* | Mutton snapper | Snapper 4 | Low/Moderate | Moderate |
| *Lutjanus apodus* | Schoolmaster | Snapper 5 | Low/Moderate | Low |
| *Ocyurus chrysurus* | Yellowtail snapper | Snapper 6 | Moderate/High | Low/Moderate |
| *Epinephelus striatus* | Nassau Grouper | Grouper 1 | Low | High |
| *Epinephelus itajara* | Goliath grouper | Grouper 2 | Low | High |
| ***Epinephelus fulvus*** | **Coney** | **Grouper 3** | **High** | **Low/Moderate** |
| *Epinephelus cruentatus* | Graysby | Grouper 3 | Moderate/High | Low/Moderate |
| ***Epinephelus guttatus*** | **Red hind** | **Grouper 4** | **Moderate/High** | **Moderate/High** |
| *Epinephelus adscensionis* | Rock hind | Grouper 4 | Moderate/High | Low/Moderate |
| *Mycteroperca bonaci* | Black grouper | Grouper 5 | Low | Moderate/High |
| *Epinephelus morio* | Red grouper | Grouper 5 | Low | Moderate/High |
| *Mycteroperca tigris* | Tiger grouper | Grouper 5 | Low | Moderate/High |
| *Mycteroperca venenosa* | Yellowfin grouper | Grouper 5 | Low | Moderate/High |
| *Epinephelus mystacinus* | Misty grouper | Grouper 6 | Low | Low |
| *Scarus guacamaia* | Rainbow parrotfish | Parrotfish 1 | Moderate | High |
| *Scarus coeruleus* | Blue parrotfish | Parrotfish 1 | Moderate | High |
| *Scarus coelestinus* | Midnight parrotfish | Parrotfish 1 | Moderate | High |
| *Scarus taeniopterus* | Princess parrotfish | Parrotfish 2 | High | Moderate |
| *Scarus vetula* | Queen parrotfish | Parrotfish 2 | High | Moderate/High |
| *Sparisoma rubripinne* | Redfin parrotfish | Parrotfish 2 | High | Moderate/High |
| ***Sparisoma chrysopterum*** | **Redtail parrotfish** | **Parrotfish 2** | **High** | **Moderate/High** |
| ***Sparisoma viride*** | **Stoplight parrotfish** | **Parrotfish 2** | **High** | **Moderate/High** |
| *Sparisoma aurofrenatum* | Redband parrotfish | Parrotfish 2 | High | Moderate/High |
| *Scarus croicensis* | Striped parrotfish | Parrotfish 2 | High | Moderate/High |
| *Acanthurus coeruleus* | Blue tang | Surgeonfish | High | Moderate |

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| Scientific Name | Common Name | Stock / Complex | Productivity | Susceptibility |
|---|---|---|---|---|
| *Acanthurus bahianus* | Ocean surgeonfish | Surgeonfish | High | Moderate |
| *Acanthurus chirurgus* | Doctorfish | Surgeonfish | High | Moderate |
| *Balistes vetula* | Queen triggerfish | Triggerfish | Moderate | Moderate/High |
| *Holocentrus rufus* | Longspine squirrelfish | Squirrelfish | High | Low |
| *Holacanthus ciliaris* | Queen angelfish | Angelfish | High | Moderate |
| *Pomacanthus arcuatus* | Gray angelfish | Angelfish | Moderate | Moderate |
| *Pomacanthus paru* | French angelfish | Angelfish | Moderate/High | Moderate |
| *Haemulon plumieri* | White grunt | Grunts | High | Moderate |
| *Haemulon sciurus* | Bluestriped grunt | Grunts | High | Moderate |
| *Coryphaena hippurus* | Dolphin | Dolphin | High | Low |
| *Acanthocybium solandri* | Wahoo | Wahoo | Moderate/High | Low |
| *Lobatus gigas* | Queen conch | Queen Conch | Low/Moderate | Moderate/High |
| - | Sea Cucumbers | Sea Cucumbers | Low | High |
| - | Sea Urchins | Sea Urchins | Moderate | High |
| - | Corals | Corals | - | High |

**Snapper Stocks/Stock Complexes**

Under **Preferred Alternative 3**, snappers included for management in the St. Croix FMP would be managed as four individual stocks and two stock complexes, as follows:

<u>Snapper 1</u>

The Snapper 1 complex under **Preferred Alternative 3** would be composed of black, blackfin, silk and vermilion snappers. This stock complex organization under **Preferred Alternative 3** is the same as **Alternative 1**. Although the prior Snapper Unit 1 complex included wenchman, this species was removed from management in Action 2, Preferred Alternative 2 under Criterion B (species occurs infrequently in federal waters). **Alternative 1** builds from the preferred alternative in Action 2 (species to be managed) and retains the prior complex organization as applicable to species selected for management. **Preferred Alternative 3** differs from **Alternative 2**, which would manage each snapper stock individually. Snapper 1 includes snappers that inhabit relatively shallow to mid-depth water and that are commonly caught together. Statements made by the fishing community at Council meetings indicated that the fishery for species included in Snapper 1 is very valuable and the market demand substantial. Natural mortality for the members of this complex may exceed fishing mortality and larger individuals are not usually targeted (160$^{th}$ Council meeting minutes 2017). Outcomes from the

PSA supported the composition of the Snapper 1 complex. All members expressed moderate to high productivity along with low susceptibility to the fishery (Table 2.3.4).

Snapper 2

Under **Alternative 1**, **Alternative 2**, and **Preferred Alternative 3**, queen snapper would be managed as a single stock. Queen snapper was previously managed under the Council's Reef Fish FMP with cardinal snapper, as they are both deep-water species. This complex was retained in the St. Croix FMP under Action 1, Preferred Alternative 2. However, cardinal snapper was excluded from management in Action 2, Preferred Alternative 2 under Criterion B. **Alternative 1** reflects both of those decisions, retaining the stock complex groupings as they apply to species that would continue to be managed under the St. Croix FMP.

Snapper 3

Under **Preferred Alternative 3**, the Snapper 3 stock complex would be composed of gray and lane snappers due to their similarities in habitat, life history, and the way they are fished. Outcomes from the PSA expressed low/moderate (gray snapper) to moderate productivity (lane snapper) along with low (lane snapper) to low/moderate (gray snapper) susceptibility to the fishery. The difference in susceptibility score was due in part to the three-month seasonal closure for lane snapper in both St. Croix territorial waters and federal waters. This stock complex organization under **Preferred Alternative 3** would differ from **Alternative 1**. Under **Alternative 1**, the complex would consist of lane and gray snappers along with mutton snapper and schoolmaster. The previously managed Snapper Unit 3 complex included lane, gray, mutton, and schoolmaster, along with other shallow water snappers, namely dog and mahogany. This complex was brought into the St. Croix FMP under Action 1, Preferred Alternative 2. Dog and mahogany snappers were excluded for management in Action 2 , Preferred Alternative 2 under Criterion B, and thus because Action 3 builds on Actions 1 and 2, retaining the prior groupings as they apply to the species to be managed, dog and mahogany are not retained in the snapper 3 complex groupings under **Alternative 1**. **Preferred Alternative 3** would also differ from **Alternative 2** (individual stock management).

Snapper 4

Under **Preferred Alternative 3** and **Alternative 2,** mutton snapper would be managed as a single stock. There is a seasonally-closed area for mutton snapper in St. Croix, occurring when the species aggregates for spawning. Mutton snapper occur in shallow and deep waters. Mutton snapper was managed under the Council's Reef Fish FMP (**Alternative 1**) with gray, lane, dog, schoolmaster, and mahogany snapper in the Snapper 3 complex. As stated above, under Action 1, Preferred Alternative 2, the St. Croix FMP retains the species and complex groupings from the species-based FMPs. Under Action 2, the species to be managed are updated (Action 2, Preferred Alternative 2). **Alternative 1**, the no action alternative in this action, reflects those

decisions, retaining the prior groupings as they apply to the species for which management is continued. Thus, under **Alternative 1**, the snapper 3 complex would contain mutton, lane, gray, and schoolmaster snappers (and not the species removed from management under Action 2). Under **Alternative 1**, the snapper 4 complex would contain yellowtail snapper. Yellowtail was managed individually under the Reef Fish FMP, and this complex was retained in the St. Croix FMP under Action 1. Action 2 does not remove yellowtail from management, and thus, yellowtail will be managed individually under **Alternative 1**. **Alternative 2** reflects individual stock management, so mutton and yellowtail snapper would be managed individually.

Snapper 5

Under **Preferred Alternative 3** and **Alternative 2**, schoolmaster would be managed as a single stock. One reason for managing schoolmaster as a single stock is that it is generally found in shallower areas than some of the other species with which schoolmaster had been managed. Schoolmaster was managed under the Council's Reef Fish FMP with gray, lane, dog, mutton, and mahogany snapper, as discussed above in Snapper 3 and Snapper 4. **Alternative 1** retains this grouping, which was brought into the St. Croix FMP under Action 1, Preferred Alternative 2, as the grouping applies to species to be managed under Action 2, Preferred Alternative 2. Thus, **Alternative 1** groups schoolmaster, lane, mutton, and gray snapper in snapper 3. Under **Alternative 1**, there is no snapper 5 complex.

Snapper 6

Under **Preferred Alternative 3**, yellowtail snapper would be managed as a single stock. Yellowtail are targeted independently when compared to the other managed snappers. Management of this stock would be the same under **Alternative 2** and **Preferred Alternative 3**. **Alternative 1** manages yellowtail snapper on its own, but in the snapper 4 complex, as discussed above.

**Grouper Stocks/Stock Complexes**

Under **Preferred Alternative 3**, groupers included for management in the St. Croix FMP would be managed as three individual stocks and three stock complexes, as follows:

Grouper 1 and Grouper 2

Grouper 1 would consist of Nassau grouper and Grouper 2 would consist of goliath grouper. Nassau grouper and goliath grouper are each currently under rebuilding plans and managed with harvest prohibitions throughout the U.S. Caribbean EEZ; and these management measures would not change under the St. Croix FMP. Both stocks scored low with respect to productivity and high with respect to fishery susceptibility in the PSA. Management of these species as two individual stocks would be the same under **Alternative 1**, **Alternative 2**, and **Preferred Alternative 3**.

Grouper 3

Under **Preferred Alternative 3**, the Grouper 3 complex would be composed of coney and graysby. This management approach would differ from that proposed in **Alternative 1**, where the grouper 3 complex would consist of coney, graysby, red hind, and rock hind. This was the complex organization under the Council's Reef Fish FMP, which was brought into the St. Croix FMP under Action 1, Preferred Alternative 2. All of these species would continue to be managed in the St. Croix FMP under Action 2, Preferred Alternative 2. **Alternative 1** retains the complex groupings as applied to the species selected for continued management. In St. Croix, coney and graysby are generally found at the same depth and habitat and are caught together regardless of gear type used. Outcomes from the PSA for these stocks expressed high (coney) to moderate/high (graysby) productivity and low/moderate susceptibility to the fishery consistent with grouping them in a single complex. Under **Alternative 2**, these stocks would be managed individually.

Grouper 4

Under **Preferred Alternative 3**, the Grouper 4 complex would be composed of red hind and rock hind, which share the same habitat and depth and are harvested together. This management approach would differ from that proposed in **Alternative 1** as these species would be managed in a complex with coney and graysby (referred to as the Grouper 3 complex). Outcomes from the PSA for these species expressed moderate/high productivity and low/moderate (rock hind) to moderate/high (red hind) susceptibility to the fishery consistent with grouping them in a single complex. Under **Alternative 2**, the stocks would be managed individually.

The grouper 4 complex under the species-based plans, brought into the St. Croix FMP under Action 1, contains black, red, tiger, and yellowfin grouper. These species will continue to be managed in the St. Croix FMP under Action 2. Thus, Alternative 1 (no action) retains the grouper 4 complex consisting of black, red, tiger, and yellowfin grouper.

Grouper 5

Under **Preferred Alternative 3**, the Grouper 5 complex would be composed of black, red, tiger, and yellowfin groupers. This stock complex organization would be the same as the Grouper 4 complex under **Alternative 1**, as this is how the complex was previously managed under the Council's Reef Fish FMP (see above). The PSA outcomes support grouping black, red, tiger, and yellowfin groupers together in a complex. Outcomes from the PSA for these species expressed low productivity and moderate/high susceptibility to the fishery.

Under **Alternative 2**, each of these stocks would be managed individually.

Under **Alternative 1**, the grouper 5 complex would consist of misty grouper. The grouper 5 complex under the Reef Fish FMP, brought into the St. Croix FMP under Action 1, consists of misty and yellowedge grouper. Yellowedge grouper was removed from management under Action 2, Preferred Alternative 2. **Alternative 1**, the no action alternative in this action, reflects those decisions, and thus the grouper 5 complex under **Alternative 1** would consist solely of misty grouper.

Grouper 6

Under **Preferred Alternative 3** and **Alternative 2**, misty grouper would be managed as a single stock. Misty grouper was previously managed under the Council's Reef Fish FMP with yellowedge grouper in the grouper 5 complex, as they are both deep-water species, but yellowedge grouper was removed from management in Action 2, Preferred Alternative 2 under Criterion B. Thus, the grouper 5 complex under **Alternative 1** would consist of misty grouper (see above), which is consistent with individual management of misty grouper under **Preferred Alternative 3** and **Alternative 2**.

**Parrotfish Stock Complexes**

Under **Preferred Alternative 3**, parrotfish included for management in the St. Croix FMP would be managed as two stock complexes, as follows.

Parrotfish 1

Under **Preferred Alternative 3**, the three large-bodied species of parrotfish, midnight, blue, and rainbow parrotfish, would be managed in the Parrotfish 1 complex. Both the SSC and the St. Croix DAP agreed that these three stocks should be managed together. Each of these stocks was at one time relatively abundant but are now rarely seen. A prohibition on harvest from U.S. Caribbean EEZ waters was instituted in 2012 as an outcome of the 2010 Caribbean ACL Amendment (CFMC 2011a). That prohibition would be carried over into St. Croix FMP based on Action 1, Preferred Alternative 2, and is retained in the reference points set under the preferred alternative in Action 4. The PSA classified these parrotfish as moderately productive and highly susceptible to the fishery, which differed from the other parrotfish to be managed, warranting separate complexes.

Parrotfish 2

The smaller parrotfish species (*i.e.*, queen, princess, redtail, stoplight, redband, striped, and redfin parrotfish) would be managed together as a stock complex under **Preferred Alternative 3**. Although these species can be classified into two separate size classes (redband and striped parrotfish are smaller species – See Appendix C), the rationale for managing all together in a complex was due to the fact that they all occur in the same habitat and are commonly fished

using the same gear under the same circumstances. The SSC recommended managing these stocks together in within a single complex and the DAP concurred. The Council accepted this recommendation, as reflected in this alternative. The PSA resulted in all seven of these parrotfish classified with high productivity and moderate (princess) to moderate/high susceptibility to the fishery.

The organization of parrotfish into two different stock complexes (Parrotfish 1 and Parrotfish 2) in **Preferred Alternative 3** differs from management under **Alternative 1** which would continue to manage all parrotfish together as a single stock complex. It also differs from **Alternative 2** where all species would be managed as individual stocks.

**Surgeonfish Stock Complex**

Under **Preferred Alternative 3**, blue tang, ocean surgeonfish, and doctorfish would be managed together as one stock complex. In the U.S. Caribbean region, these species commonly occur in small to moderately sized schools, typically in association with coral reef habitat. Surgeonfish are not targeted by commercial or recreational fishermen, instead most commonly being caught as bycatch in traps, nets and hand lines. However, all three stocks serve an important ecological function as grazers in the coral reef ecosystem, which served as the basis for their proposed inclusion in the St. Croix FMP (see Action 2, Preferred Alternative 2, Criterion C, Section 5.2). Both the SSC and the DAP recommended continuing to group the three surgeonfish stocks in a single complex, and the Council accepted this recommendation, as reflected in this alternative. That approach is consistent with PSA outcomes indicating all three stocks express high productivity and moderate susceptibility to the fishery. This organization is identical to that proposed in **Alternative 1**, but different to **Alternative 2**, where all species would be managed as individual stocks.

**Triggerfish Stock**

Under **Preferred Alternative 3** and **Alternatives 1** and **2** queen triggerfish would be managed as an individual stock. Queen triggerfish was previously managed under the Council's Reef Fish FMP in a stock complex with ocean and sargassum triggerfish, and this complex organization was brought into the St. Croix FMP under Action 1, Preferred Alternative 2. However, ocean and sargassum triggerfish were removed from management in Action 2, Preferred Alternative 2 under Criterion B. Under **Alternative 1**, the complex grouping would reflect these decisions, and thus the triggerfish complex would also consist solely of queen triggerfish.

**Squirrelfish Stock**

Under **Preferred Alternative 3** and **Alternatives 1** and **2**, longspine squirrelfish would be managed as an individual stock. Longspine squirrelfish were previously managed under the

Council's Reef Fish FMP in a complex with blackbar soldierfish, bigeye, and squirrelfish, and this complex organization was brought into the St. Croix FMP under Action 1, Preferred Alternative 2. However, blackbar soldierfish, bigeye, and squirrelfish were removed from management in Action 2, Preferred Alternative 2 under Criterion B. Under **Alternative 1**, the complex grouping would reflect these decisions, and thus the squirrelfish complex would consist solely of longspine squirrelfish.

**Angelfish Stock Complex**

Under **Preferred Alternative 3** and **Alternative 1**, gray, queen, and French angelfish would be managed together as a stock complex. All three angelfish species were identified by the SSC and the Council as being in need of conservation and management in Action 2 based on Criterion C, specifically their ecological importance to the coral reef ecosystem. Angelfish graze sponges, thereby clearing space for recruitment of coral propagules in a manner similar to that recognized for parrotfish and surgeonfish. Although productivity scores differ per species, from moderate (gray angelfish) to moderate/high (French angelfish) to high (queen angelfish), all three exhibit a moderate susceptibility to the fishery consistent with grouping them in a single complex. Under **Alternative 2**the stocks would be managed individually.

**Grunts Stock Complex**

Under **Preferred Alternative 3** and **Alternative 1**, white and bluestriped grunts would be managed together as a stock complex. Outcomes from the PSA for these species expressed high productivity and moderate susceptibility to the fishery, which is consistent with grouping them in a single complex. White and blue striped grunt were previously managed under the Council's Reef Fish FMP in a complex with margate, tomtate, French grunt, and porkfish. However, margate, tomtate, French grunt, and porkfish were removed from management in Action 2, Preferred Alternative 2 under Criterion B. Under **Alternative 1**, the complex grouping would reflect these decisions, and thus the grunts complex would consist of white and blue striped grunt. Under **Alternative 2,** these two stocks would be managed individually.

**Dolphin Stock**

Under **Preferred Alternative 3** and **Alternative 2**, dolphin would be managed as an individual stock. This management differs from **Alternative 1**, as dolphin would be new to management under the St. Croix FMP. **Alternative 1** retains the complex groupings from the species-specific FMPs brought into the St. Croix FMP under Action 1, as updated to reflect the species for which management is continued under Action 2. **Alternative 1** does not group species new to management.

**Wahoo Stock**

Under **Preferred Alternative 3** and **Alternative 2**, wahoo would be managed as an individual stock. This management differs from **Alternative 1**, as wahoo would be new to management under the St. Croix FMP. **Alternative 1** retains the complex groupings from the species-specific FMPs brought into the St. Croix FMP under Action 1, as updated to reflect the species for which management is continued under Action 2. **Alternative 1** does not group species new to management.

**Sea Cucumbers Stock Complex**

At their August 19-20, 2015 meeting, the Council moved to include sea cucumbers in the St. Croix FMP, with the intent of including all species of sea cucumbers occurring in the St. Croix EEZ in this stock complex to avoid overexploitation of these ecologically important species. Under **Preferred Alternative 3**, all sea cucumbers (Class Holothuridae) would be managed in the Sea Cucumbers stock complex, including *Holothuroidea mexicana*, a species valuable for consumption in certain foreign markets. A class-level PSA indicated that sea cucumber stocks are of low productivity and high susceptibility to the fishery, a combination requiring careful and conservative management particularly within a framework of limited information on their species-specific distribution and abundance patterns. Management of sea cucumbers under **Preferred Alternative 3** would be similar to **Alternative 1** as these species were previously managed as a stock complex as part of the aquarium trade unit within the Coral FMP. It is not known how many individual species of sea cucumbers occur in and are available for harvest from the St. Croix EEZ; their harvest is recorded under the generic name "sea cucumber." Thus, it would not be possible to establish individual stock management, as proposed under **Alternative 2.**

**Sea Urchins Stock Complex**

At their August 19-20, 2015 meeting, the Council moved to include sea urchins in the St. Croix FMP, with the intent of including all species of sea urchins occurring in the St. Croix EEZ in this stock complex to avoid overexploitation of these ecologically important species. All sea urchins in Class Echinoidea would be managed in the Sea Urchins stock complex. Species in this complex would include the long-spined urchin (*Diadema antillarum*), the pencil urchin (*Eucidaris tribuloides*), and the sea egg (*Tripneustes ventricosus*), species that were managed as part of the aquarium trade invertebrates under the Council's Coral FMP, a grouping that was brought into the St. Croix FMP under Action 1. A class-level PSA indicated that sea cucumber stocks are of moderate productivity and high susceptibility to the fishery. A precautionary approach to management is therefore advised, requiring conservative management particularly within a framework of limited information on their species-specific distribution and abundance patterns. **Preferred Alternative 3** is would result in management of additional sea urchins than under **Alternative 1** because only select urchin species were previously included in the aquarium

trade unit within the Coral FMP. **Preferred Alternative 3** is not comparable to **Alternative 2** because it is not known how many individual species of sea urchin occur in and are available for harvest from the St. Croix EEZ. Thus, it would not be possible to establish individual stock management, as proposed under **Alternative 2**.

**Coral Stock Complex**

At their August 19-20, 2015 meeting, the Council moved that all corals present in the EEZ of St. Croix (soft, hard, mesophotic, and deepwater corals) be included for management in the St. Croix FMP. The Council decided to continue managing the corals for which harvest had been prohibited under the Coral FMP under Action 2, Criterion A and, at this meeting, expanded the scope of corals to be managed under the St. Croix FMP. This comprehensive approach to managing coral species ensures that cryptic species (those that are difficult to tell apart) as well as any as yet unidentified or undescribed species that may be vulnerable to exploitation are included in management. Corals constitute the foundation of most (if not all) St. Croix EEZ fisheries, along with the wealth of other ecological, economic, and cultural contributions they provide the region. The St. Croix DAP, the SSC, and the Council are in agreement that management is essential. The PSA assigned a high fishery susceptibility to the coral group, but no productivity score was assigned due to the diverse and in many cases unknown biology of the many species constituting the Corals stock complex. **Preferred Alternative 3** differs from **Alternative 1** because the previous Coral FMP only included a select number of coral species, none of which were deepwater species. The inclusion of all coral species present in the St. Croix EEZ under **Preferred Alternative 3** is broader. **Preferred Alternative 3** also differs from **Alternative 2**, which would manage each species independently.

**Indicator Stocks**

Under **Alternative 4**, the Council can choose whether or not to select an indicator stock for the stock complexes proposed in **Preferred Alternative 3** (See Section 2.3.1 for Magnuson-Stevens Act NS1 Guidelines for indicator stocks).

By following the NS1 guidelines, using indicator stocks in a stock complex will not increase the risk of overfishing other stocks within the complex. Relying on stock complexes and indicator stocks in accordance with the NS guidelines can serve a useful role in managing data poor stocks and/or stocks that cannot be targeted independently of one another or when managing in the face of high scientific uncertainty.

**Alternative 4**, **Preferred Sub-alternative 4a** allows for the selection of one or more indicator stocks in those cases where stocks are being managed within a stock complex. **Alternative 4**, **Sub-alternative 4a** was selected as the preferred alternative for the Snapper 1, Grouper 3,

Grouper 4, and Parrotfish 2 stock complexes, as those complexes were established under **Preferred Alternative 3**. The SSC identified seven criteria (defined below) to guide the selection of an indicator stock for each of these stock complexes. All or a subset of these seven criteria were used by the SSC in their process of recommending one or more indicators for each of the stock complexes to which **Alternative 4**, **Preferred Sub-alternative 4a** was applied. Under **Alternative 4**, **Preferred Sub-alternative 4a**, the acceptable biological catch and ACL for the stock complex would be derived from the indicator stock. Stocks in the stock complex would be subject to AMs as a group, based on the average landings of the indicator stock or stocks during the most recent three years of available landings data (see Chapter 10).

1. Percent Catch: Indicator stock represents a predominant component of the complex's catch.
2. Targeted: Indicator stock is specifically pursued by the fishery.
3. Life History/Vulnerability: Life history characteristics or the vulnerability of the indicator stock is representative of the complex or is more vulnerable than that of other members of the complex (where the vulnerabilities of the complex differed).
4. Habitat Co-occurrence: Indicator stock occurs in the same habitat as the others in the complex.
5. Catch Co-occurrence: Indictor stock co-occurs in the catch with other members of the complex.
6. Data Availability: Amount of information on the indicator stock is sufficient for providing catch advice and establishing SDC.
7. Market Value: Indicator stock is considered to have equal or greater market value relative to other species.

The SSC recommended one or more indicator stocks for each of these complexes based on the best available scientific information, input from the St. Croix DAP, and the expert opinion of the SSC members. Below is a summary of the indicator stock(s) chosen for each of the stock complexes for which the Council selected **Alternative 4**, **Sub-alternative 4a** as the preferred alternative.

For Snapper 1 (black, blackfin, silk, and vermilion snapper), blackfin and silk snappers would be the indicator stocks based on the SSC's recommendation as they constitute a high percentage of the Snapper 1 catch, are targeted stocks in the complex, and co-occur in the habitat and in the catch with the other stocks in the complex (black and vermilion snappers). Furthermore, because they are targeted, listed on the commercial reporting form, and frequently reported in the landings, both stocks are likely candidates for a successful stock assessment. The PSA outcome

revealed blackfin and silk snappers to be equally productive (moderate/high) and equally susceptible to the fishery (low) as the other stocks in the complex and therefore possess a representative vulnerability for the complex.

For Grouper 3 (coney and graysby), coney would be indicator stock based on the SSC's recommendation because it constitutes a high percentage of the Grouper 3 catch, it is the targeted stock in the complex, and it co-occurs in the habitat and in the catch with the other stock in the complex (graysby). Furthermore, because it is targeted, listed on the commercial reporting form, and frequently reported in the landings, it is a likely candidate for a successful stock assessment. The PSA outcome revealed coney to be less productive (low versus moderate/high) and equally susceptible to the fishery (low/moderate) as graysby, therefore it is slightly more vulnerability than the other stock in the complex, leading to more conservative management.

For Grouper 4 (red hind and rock hind), red hind was would be the indicator stock based on the SSC's recommendation because it constitutes a high percentage of the Grouper 4 catch, it is the targeted stock in the complex, and it co-occurs in the habitat and in the catch with the other stock in the complex (rock hind). Furthermore, because it is targeted, listed on the commercial reporting form, and frequently reported in the landings, it is a likely candidate for a successful stock assessment. The PSA outcome revealed red hind to be equally productive (moderate/high) and equal to greater susceptibility to the fishery (moderate/high versus low/moderate) as rock hind, therefore possessing a representative vulnerability or slightly greater vulnerability than the other stock in the complex. Red hind is the most abundant larger grouper on deeper reefs and forms seasonal spawning aggregations that can be subject to heavy fishing pressure.

For Parrotfish 2 (princess, queen, redfin, redtail, stoplight, redband, and striped parrotfish), redtail and stoplight parrotfish would be the indicator stocks based on the SSC's recommendation because they are the two most commonly seen species in the market on St. Croix , are targeted most by the fishery, their combined landings represent the largest proportion of Parrotfish 2 catch, and they co-occur with the other stocks in the complex (princess, queen, redfin, redband, and striped parrotfish). They are listed on the commercial reporting form and frequently reported in the landings, it are likely candidates for successful stock assessments. The PSA outcome revealed redtail and stoplight equally productive (high) and equally or more susceptible to the fishery as the other stocks in the complex (they possess a moderate/high susceptibility, as with all of the other stocks in the complex except for princess parrotfish, which was found to be moderately susceptible to the fishery), therefore possessing a representative or slightly greater vulnerability than the other stocks in the complex.

**Alternative 4**, **Sub-alternative 4b** was selected as the preferred alternative for those stock complexes for which none of the seven criteria was useful to make a determination, landings

information for any of the stocks in the complex did not allow for a clear definition of an indicator stock, or the composition of the complex was balanced and therefore required no indicator to be assigned. For the stock complexes selected under **Preferred Alternative 3**, this includes the Snapper 3, Grouper 5, Parrotfish 1, Surgeonfish, Angelfish, and Grunts complexes.

For Snapper 3 (lane and gray snappers), although gray dominates the catch, the two stocks are not targeted in the same areas or with the same gear types, and so one would not be a good indicator for both. For the larger groupers in Grouper 5 (black, red, tiger, and yellowfin), the landings data for the stocks were low and inconsistent. These species were grouped together as they represent incidental catch. Thus, it would be appropriate to manage them based on total landings for the complex, not based on one or more of the stocks in the complex... For Parrotfish 1, no indicator stock was selected because these stocks are managed together with a harvest restriction (as a result of Action 4, the species would continue to be managed with an ABC and ACL of zero). For the Grunts complex (white and bluestriped), white grunt dominated the catch for fishermen using trap gear, but landings of bluestriped were greater for fishermen using dive gear. The SSC decided that since the two grunts are targeted using different gear, one could not be selected as an indicator over the other. For the Surgeonfish and Angelfish complexes, the SSC reviewed the information available for the stocks within each complex, but could not identify a basis for recommending indicator stocks for these complexes.

**Preferred Sub-alternative 4b** would also be applied to those stock complexes for which harvest is set as zero in Action 4 and thus determined to be vulnerable to overfishing, including the Sea Cucumbers, Sea Urchins, and Corals stock complexes.

**Comparison of Action 3 Alternatives and Summary of Effects**

**Alternative 1** would continue management of stocks and stock complexes as established in the St. Croix FMP under Action 1 as previously managed under the species-based FMPs. This alternative reflects current management as closely as possible; however, species that would no longer be managed as a result of Action 2 would be removed from the complexes, and species that are new to management as a result of Action 2 would not be organized into complexes.

**Alternative 1** would not be expected to have additional direct physical, biological/ecological, economic, or social effects as it is largely administrative and because, to the extent possible, it would not alter current management. However, **Alternative 1** would have indirect biological effects as it would not allow for stocks/stock complexes in the St. Croix FMP to be updated in order to reflect the most current or best information available. Similarly, **Alternative 1** would not include the option to establish stock complexes for stocks new to management. These limitations could directly increase the administrative burden associated with managing stocks

and stock complexes, especially if the current management measures result in frequent administrative actions, such as the application of AMs. Without reliable and consistent data, particularly for those newly added species that would not be assigned to a complex as appropriate, the reference points that are established and accountability measures that could follow may create closures and other problems that disrupt current fishing patterns. Each of these outcomes would likely result in negative indirect economic and social effects associated with lost harvest opportunity and resultant fishing community impacts.

Under **Alternative 2**, each stock would be managed individually regardless of the amount of data available for that stock, or whether there are similarities among two or more stocks in life history or fishing practices that would allow those stocks to be more effectively managed as a complex. When compared to **Alternative 1** and **Preferred Alternative 3**, **Alternative 2** would likely have the greatest direct and indirect effects on the physical, biological/ecological, economic, social, and administrative environments, and those effects would be expected to be negative in most respects. The least impactful direct and indirect effects would be on the physical environment, because impacts of fishing activities on the physical environment (*i.e.*, the habitat, particularly that constituting the coral reef) would remain relatively constant regardless of the distribution (or not) of stocks among complexes.

Direct impacts could be expected from **Alternative 2** via bycatch-related overharvest of a stock experiencing regulatory closure as the fishermen pursue those coincident stocks not governed by the regulatory closure. Economically, managing at the level of individual stock is likely to result in more regulatory discards and lost financial benefit than that which would occur under **Alternative 1** or **Preferred Alternative 3**. Hence, benefits associated with **Alternative 2** are less than those of **Alternative 1** or **Preferred Alternative 3**. Similarly with regard to social effects, any outcomes that result in more frequent application of management measures, particularly those that reduce access to a stock and particularly if that access is limited in an overly precautionary manner, would have indirect effects on the fishing communities reliant on those stocks. Administratively, tracking the performance of many individual stocks rather than fewer stock complexes requires considerably more administrative effort, likely would require more individual management actions, and would require a greater level of enforcement. Additionally, the resultant stock-specific management measures could potentially be insufficient and inefficient, resulting in more frequent and potentially overly precautionary future actions.

In contrast to **Alternative 2**, **Preferred Alternative 3** provides managers with the flexibility to choose to manage stocks individually or as a complex, depending on the information available and the goals of the management plan. **Preferred Alternative 3** would be expected to have beneficial effects resulting from allowing the species to be managed either as individual stocks or as stock complexes using the best available information. There may be some short-term

administrative effects associated with creating new management measures for the new stocks/stock complexes. However, the long-term administrative effects of **Preferred Alternative 3** would be expected to be more beneficial than **Alternative 1** or **Alternative 2** because the flexibility of this alternative allows for the stocks/stock complexes to be best tailored to the St. Croix fishery. **Preferred Alternative 3** ensures the process includes consideration of all managed stocks, in direct opposition to **Alternative 2**, which allows no grouping, and well beyond **Alternative 1**, which limits the number of stocks available for grouping. That tailoring should result in the establishment of more appropriate management measures, which would in turn result in fewer unnecessary ACLs exceeded or AMs applied. There is likely a better chance of setting ACLs that would provide adequate protection of the stock with **Preferred Alternative 3** than with **Alternative 2**, which, through time, would provide greater indirect economic benefits. **Preferred Alternative 3** therefore provides the direct and indirect benefits to the physical, biological/ecological, economic, and social environment largely denied by **Alternative 2** and limited by **Alternative 1**.

**Alternative 4** would build upon the benefits of **Preferred Alternative 3**, as the stocks and stock complexes would remain the same, but an indicator stock could be selected (**Preferred Sub-alternative 4a**) or not selected (**Preferred Sub-alternative 4b**) depending on the information available for the stocks in the stock complex. All effects would be expected to be identical between **Preferred Alternative 3** and **Preferred Sub-alternative 4b**, because not choosing an indicator for all stock complexes results in the same list as **Preferred Alternative 3**. In contrast, **Preferred Sub-alternative 4a** may result in a greater benefit to the physical, biological/ecological, economic, social, and administrative environments. Essentially, selecting an indicator stock that is targeted by the fishery, best represents the vulnerability of the other stocks in the complex, or otherwise meets the criteria established above, would provide more conservative management for all the stocks in the complex, because once the ACL for the indicator is reached, then all stocks in the complex would be subject to AM-based management. Conversely, if an appropriate indicator stock is available for the complex but is not assigned, the ACL would instead be based on the landings of all stocks in the complex, potentially allowing harvest to exceed a level that is not sustainable for some of the stocks within the complex, especially those that may be most vulnerable to fishing pressure. However, not all stock complexes have the necessary data or information available to establish an indicator stock, or in other ways are inappropriate or not in need of indicator assignment. In instances where all the stocks in the complex are infrequently landed, or are landed at low levels, selecting an indicator stock could result in an ACL that was so low that it was easily exceeded, thereby triggering AMs and prohibiting harvest of the other stocks in the complex, which may be able to withstand a higher rate of harvest. Using an established set of criteria, the Council's SSC determined, for each stock complex, whether or not an indicator stock would provide additional benefits, specifically to the biological/ecological and administrative (*i.e.*, management) environments.

Those benefits then extend to the physical environment by ensuring that species caught together are managed together and fishing activity would respond accordingly to minimize fishing impacts to the environment. Benefits also extend to the economic environment by increasing the likelihood that implementation of management measures is appropriate and necessary, to the social environment by reducing the likelihood of unnecessary and inappropriate management interventions, and to the administrative environment by reducing the number of stocks for which landings must be monitored against the ACL and by reducing the frequency of management interventions particularly with respect to ACL overages.

## 2.4 Action 4: Establish SDC and Management Reference Points

The Magnuson-Stevens Act requires each federal FMP to assess and specify the present and probable future condition of, and the maximum sustainable yield (MSY) and optimum yield (OY) from, the fishery, and include a summary of the information utilized in making such specification" (16 U.S.C. 1853(a)(3)). The MSY is the largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological and environmental conditions and fishery technological characteristics (e.g., gear selectivity), and the distribution of catch among fleets (50 CFR 600.310(e)(1)(i)(A)). To guide effective management, the Magnuson-Stevens Act also requires FMPs to specify objective and measurable criteria for determining stock status (*i.e.*, status determination criteria (SDC)), specifically whether the stock is overfished or undergoing overfishing (16 U.S.C. 1853(a)(10)).

**Status determination Criteria and Management Reference Point**

**Maximum Sustainable Yield (MSY)** – The largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological, environmental conditions and fishing technology characteristics (e.g., gear characteristics) and the distribution of catch among fleets.

**Maximum Fishing Mortality Threshold (MFMT)** – The level of fishing mortality (F), on an annual basis, above which overfishing is occurring. The MFMT or reasonable proxy may be expressed either as a single number (a fishing mortality rate or F value), or as a function of spawning biomass or other measure of reproductive potential.

**Overfishing Limit (OFL)** – the annual amount of catch that corresponds to the estimate of MFMT applied to a stock or stock complex's abundance and is expressed in terms of numbers or weight of fish.

**Minimum Stock Size Threshold (MSST)** – The biomass level below which the capacity of the stock to produce MSY on a continuing basis has been jeopardized. A stock or stock complex is considered **overfished** when its biomass has declined below MSST.

The National Marine Fisheries Service (NMFS) guidelines regarding this statutory requirement describe those SDC to include: 1) the maximum fishing mortality threshold (MFMT) and associated overfishing limit (OFL) or their proxies, indicative of an annual harvest level that jeopardizes the capacity of the stock or stock complex to produce MSY on a continuing basis (*i.e.*, overfishing), and; 2) the minimum stock size threshold (MSST), or its proxy, indicative of a level of biomass below

which the capacity of the stock or stock complex to produce MSY on a continuing basis has been jeopardized (*i.e.*, overfished) (50 CFR 600.310(e)(2)(i)(B)-(F)).

When data are not available to specify SDC based on MSY or MSY proxies, NMFS guidelines at 50 CFR 600.310(e)(2)(ii) also provide that alternative types of SDC that promote sustainability of the stock or stock complex can be used. If alternative types of SDC are used, a Fishery Management Council should explain how the approach would promote sustainability of the stock or stock complex on a long-term basis. Appendix G provides an overview of the National Standard 1 Guidelines including a description of each of the SDC and management reference points in this action. Chapter 5 also provides more information about the resulting SDC and management reference points for stocks in the St. Thomas/St. John FMP.

Action 4 describes alternative approaches for establishing SDC and management reference points. As with Action 3, this action follows from selecting Alternative 2 in Action 1 and proceeding with establishing a St. Thomas/St. John FMP composed of those regulations and measures included in the Reef Fish, Spiny Lobster, Queen Conch and Coral FMPs that are pertinent to St. Thomas/St. John. Three alternatives provide different approaches to setting SDCs and reference points. Both **Preferred Alternative 2** and **Alternative 3** include a stepwise process for setting the management reference points and/or SDC.

### 2.4.1 Proposed Alternatives for Action 4

**Alternative 1**. No action. In the St. Croix FMP, as created in Action 1, retain the management reference point values and SDC (MSY, OFL, ABC, OY, ACL) specified in the 2010 and 2011 Caribbean ACL Amendments, as applicable. Retain the definitions for the MFMT and MSST specified in the Sustainable Fisheries Act (SFA) Amendment (CFMC 2005).

**Preferred Alternative 2**. Apply the three-step process described below to define MSY (or its proxy), SDC, ABC and ACL for each stock or stock complex in the St. Croix FMP.

***Preferred Alternative 2 - Step 1:*** Adopt and apply the ABC CR described in Table 2.4.1.

***Preferred Alternative 2 - Step 2***. Establish the proxy that would be used when $F_{MSY}$ cannot be determined:

**Sub-alternative 2a**. The proxy for $F_{MSY} = F_{max}$

**Sub-alternative 2b**. The proxy for $F_{MSY} = F_{40\%SPR}$

**Preferred Sub-alternative 2c**. The proxy for $F_{MSY} = F_{30\%SPR}$

***Preferred Alternative 2 - <u>Step 3</u>***. Determine the OY and the ACL based on the formula in one of the sub-alternatives below and the ABC established in **Preferred Alternative 2**, **Step 1** above.

**Sub-alternative 2d.** OY = ACL = ABC (Preferred for queen conch)

**Sub-alternative 2e.** OY = ACL = ABC x 0.95 (Preferred for all stocks except angelfish, parrotfish, surgeonfish, queen conch)

**Sub-alternative 2f.** OY = ACL = ABC x 0.90

**Sub-alternative 2g.** OY = ACL = ABC x 0.85 (Preferred for angelfish, parrotfish, surgeonfish)

**Sub-alternative 2h**. OY = ACL = ABC x 0.75

**Sub-alternative 2i.** OY = ACL = 0

**Table 2.4.1.** Caribbean Fishery Management Council Acceptable Biological Catch Control Rule from Action 4, Preferred Alternative 2.

| **Tier 1: Data Rich** | |
|---|---|
| **Condition for Use** | Full stage-structured stock assessment available with reliable time series on (1) catch, (2) stage composition, and (3) index of abundance. The assessment provides estimates of minimum stock size threshold (MSST), maximum fishing mortality threshold (MFMT), and the probability density function (PDF) of the overfishing limit (OFL). |
| **MSY** | MSY = long-term yield at $F_{MSY}$ (or, $MSY_{proxy}$ = long-term yield at $F_{MSY}$ proxy); assumes spawner-recruit relationship known. |
| **SDC** | MFMT = $F_{MSY}$ or proxy<br>MSST = 0.75*Spawning Stock Biomass $(SSB)_{MFMT}$<br>OFL = Catch at MFMT |
| **ABC** | ABC = OFL as reduced (buffered) by scientific uncertainty[1] and reflecting the acceptable probability of overfishing[2]. The buffer is applied to the PDF of OFL ($\sigma$), where the PDF is determined from the assessment (where $\sigma > \sigma_{min}$) [3].<br>ABC= $d$ * OFL where $d$ = $\begin{cases} \text{Scalar} & \text{if } B \geq B_{MSY} \\ \text{Scalar} * (B-B_{critical}) / (B_{MSY}- B_{critical}) & \text{if } B < B_{MSY} \end{cases}$<br>Scalar = 1 if acceptable probability of overfishing is specified (<0.5), < 1 if not specified (=0.5).<br>$B_{critical}$ is defined as the minimum level of depletion at which fishing would be allowed. |
| | [1]Scientific uncertainty would take into account, but not be limited to, the species life history and ecological function.<br>[2]Acceptable probability of overfishing determined by Council.<br>[3] $\sigma_{min}$ could be equal to coefficient of variation; $\sigma_{min}$ is in a log scale. |
| **Tier 2: Data Moderate** | |

| | |
|---|---|
| **Condition for Use, MSY, SDC** | Data-moderate approaches where two of the three time series (catch, stage composition, and index of abundance) are deemed informative by the assessment process, and the assessment can provide MSST, MFMT, and PDF of OFL. |
| **ABC** | Same as Tier 1, but variation of the PDF of OFL ($\sigma$) must be greater than 1.5 $\sigma_{min}$ (in principle there should be more uncertainty with data-moderate approaches than data-rich approaches). |
| **Tier 3: Data Limited: Accepted Assessment Available** | |
| **Condition for Use** | Relatively data-limited or out-of-date assessments |
| **MSY** | $MSY_{proxy}$ = long-term yield at proxy for $F_{MSY}$ |
| **SDC** | MFMT = $F_{MSY}$ proxy<br>MSST = 0.75* $SSB_{MFMT}$<br>OFL = Catch at MFMT |
| **ABC** | ABC determined from OFL as reduced (buffered) by scientific uncertainty[4] and reflecting the acceptable probability of overfishing[2]<br>a. Where the buffer is applied to the PDF of OFL when the PDF is determined from the assessment (with $\sigma \geq 2\sigma_{min}$)<br>**OR**<br>b. Where ABC = buffer * OFL, where buffer must be $\leq$ 0.9<br>[4]Scientific uncertainty would take into account, but not be limited to, the species life history and ecological function, the perceived level of depletion, and vulnerability of the stock to collapse.<br>[2]Acceptable probability of overfishing determined by Council. |
| **Tier 4: Data Limited: No Accepted Assessment Available** | |
| **MSY** | $MSY_{proxy}$ = long-term yield at proxy for $F_{MSY}$[5]. |
| **SDC** | MFMT = $F_{MSY}$ proxy<br>MSST = 0.75* $SSB_{MFMT}$<br>OFL = unknown[6] |
| **Tier 4a**<br>**Conditions for Use** | No accepted[7] assessment, but the stock has relatively low vulnerability to fishing pressure. A stock's vulnerability to fishing pressure is a combination of its productivity and its susceptibility to the fishery. Productivity refers to the capacity of the stock to produce MSY and to recover if the population is depleted. Susceptibility is the potential for the stock to be impacted by the fishery. If SSC consensus[8] cannot be reached on the use of Tier 4a, Tier 4b should be used. |
| **SYL** | The SYL is the maximum level of landings that can be sustained over the long term give. Used when information is not available to determine the MSY or corresponding reference points.<br>SYL = Scalar * ***75th percentile*** of reference period landings, where the reference period of landings is chosen by the Council, as recommended by the SSC in consultation with the SEFSC.<br>Scalar $\leq$3 depending on perceived degree of exploitation, life history and ecological function. |
| **ABC** | ABC = buffer * SYL, where buffer must be $\leq$ 0.9 (e.g., 0.9, 0.8, 0.75, 0.70…) based on the SSC's determination of scientific uncertainty.[7] |
| **Tier 4b**<br>**Conditions for Use** | No accepted[7] assessment, but the stock has relatively high vulnerability to fishing pressure (see definition in Tier 4a Condition for Use), or SSC consensus[7] cannot be reached on the use of Tier 4a. The ABC for a Tier 4b stock cannot exceed the mean landings during the reference period. |
| **SYL** | SYL = Scalar * ***mean*** of the reference period landings, where the reference period of landings is chosen by the Council, as recommended by the SSC in consultation with the SEFSC[9].<br>Scalar < 2 depending on perceived degree of exploitation, life history, and ecological function. |
| **ABC** | ABC = buffer * SYL, where buffer must be $\leq$ 0.9 (e.g., 0.9, 0.8, 0.75, 0.70…) based on the SSC's determination of scientific uncertainty[10]. |

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| | |
|---|---|
| | [5] MSY ≥ SYL.<br>[6] SYL is a proxy for OFL.<br>[7] Accepted means that the assessment was approved by the SSC as being appropriate for management purposes.<br>[8]The SSC defines consensus as having 2/3 of the participating members in favor of a Tier 4a assignment, otherwise the assignment would be Tier 4b of the ABC CR.<br>[9] See Appendix J for an explanation of how the SYL is calculated.<br>[10]Scientific uncertainty would take into account, but not be limited to, deficiencies in landings data, availability of ancillary data, species life history, and ecological function, perceived level of depletion, and vulnerability of the stock to collapse. |

**Alternative 3**. Apply the four-step process used in the 2010 Caribbean ACL Amendment and/or the 2011 Caribbean ACL Amendment, as applicable, to set management reference points and/or SDC for a stock or stock complex in the St. Croix FMP as described in the sub-alternatives below. Choose a sub-alternative from each step, in order (1-4), for each stock or stock complex.

***Alternative 3 – Step 1***. **Time Series**: select a time series of landings data to establish management reference points for a stock, as applicable. A different sub-alternative can be chosen for each stock or stock complex.

> **Sub-alternative 3a**. Use the longest year sequence of reliable[16] landings data available to set management reference points, as applicable.
>
> **Sub-alternative 3b**. Use the longest time series of pre-Caribbean SFA Amendment landings data that is considered to be consistently reliable[17] to set management reference points.
>
> **Sub-alternative 3c**. Use 2012-2016 as the most recent five years of available landings data to set management reference points.
>
> **Sub-alternative 3d**. Use another year sequence, as recommended by the Council's SSC, to set management reference points.

***Alternative 3 – Step 2***. **$MSY_{proxy}$**: establish the $MSY_{proxy}$ as described by any of the sub-alternatives below. A different sub-alternative can be chosen for each stock or stock complex. The OFL would be set equal to the $MSY_{proxy}$ resulting from this alternative ($MSY_{proxy}$ = OFL).

> **Sub-alternative 3e**. Median annual landings from year sequence selected in Alternative 3, Step 1.
>
> **Sub-alternative 3f**. Mean annual landings from the year sequence selected in Alternative 3, Step 1.

***Alternative 3 – Step 3***. **Acceptable Biological Catch**: establish the ABC as described by any of the sub-alternatives below and the OFL established in Alternative 3, Step 2. A different sub-alternative may be chosen for each stock or stock complex.

[16] Defined in both the 2010 and 2011 Caribbean ACL Amendments: more recent time-series landings data that are more reliable than baseline but that are affected by recent regulatory changes.
[17] Defined in both the 2010 and 2011 Caribbean ACL Amendments: reflects landings prior to implementation of the Caribbean SFA Amendment in 2006, thereby approximating sustainable yield.

**Sub-alternative 3g**. Do not specify an ABC Control Rule. Adopt the ABC recommended by the Council's SSC. The SSC would develop the ABC on an ad hoc basis for each stock or stock complex.

**Sub-alternative 3h**. Adopt an ABC Control Rule where ABC= OFL

**Sub-alternative 3i**. Adopt an ABC Control Rule where ABC= OFL x 0.90

**Sub-alternative 3j**. Adopt an ABC Control Rule where ABC= OFL x 0.85

**Sub-alternative 3k**. Adopt an ABC Control Rule where ABC= OFL x 0.75

***Alternative 3 – Step 4*. Annual Catch Limit and Optimum Yield**: Determine the ACL based on the formula in one of the sub-alternatives below and the ABC established in Alternative 3, Step 3. The OY would be set equal to the ACL resulting from this alternative (OY = ACL). A different sub-alternative may be chosen for each stock or stock complex.

**Sub-alternative 3l**. OY = ACL = ABC

**Sub-alternative 3m**. OY = ACL = ABC x 0.95

**Sub-alternative 3n**. OY = ACL = ABC x 0.90

**Sub-alternative 3o**. OY = ACL = ABC x 0.85

**Sub-alternative 3p**. OY = ACL = ABC x 0.75

**Sub-alternative 3q**. OY = ACL = 0

### 2.4.2 Discussion of Action 4 Alternatives

**Alternative 1** is the no action alternative. Established values of the SDC and reference points, including the $MSY_{proxy}$, OFL, ABC, and ACL, would be retained from the 2010 Caribbean ACL Amendment (CFMC 2011a) and the 2011 Caribbean ACL Amendment (CFMC 2011b). The procedures used to derive the values provided in those amendments are incorporated by reference and summarized in Appendix H. **Alternative 1** would also retain the definitions for MFMT and MSST that were specified in the Caribbean SFA Amendment (CFMC 2005).

Reference points established in the 2010 and 2011 Caribbean ACL Amendments should be updated to be consistent with the composition (Action 2) and organization (Action 3) of managed stocks. That update would allow for the inclusion of more up-to-date landings data, which better reflects recent fishing effort and catch. Improvements in landings data resulting from monitoring program upgrades in the region would not be incorporated into the reference points brought over under **Alternative 1**. Following closely from the preceding point, new analytical methods for establishing reference points and SDC for data-limited stocks have become available since implementation of the 2010 and 2011 Caribbean ACL Amendments (Carruthers et al. 2014).

Those new methods would not be applied if the process described in **Alternative 1** was chosen for implementation.

As described in Action 2 of this document, a primary reason for revising federal fisheries management in the St. Croix EEZ would be to shift the management focus away from stocks occurring primarily in territorial waters toward stocks occurring in and harvested from St. Croix EEZ waters under federal jurisdiction. As a result of this shift, many stocks would no longer qualify as federally managed stocks. Moreover, no reference points would be established for those stocks that would be added to federal management through Preferred Alternative 2 of Action 2, as required by the Magnuson-Stevens Act.

Compared to the preferred alternative, the approach taken in **Alternative 1** is less consistent with NMFS' revised NS1 guidance on developing reference points in the data-limited context, and the opinion on the best scientific approach recommended by scientific experts. The NS1 guidelines provide flexibility when data are not available to specify SDCs based on MSY or MSY proxies. In those cases, the guidelines provide that the plan can specify alternative types of SDC that promote the sustainability of the stock or stock complex, as long as the SDC allow for an evaluation of stock status and as long as the plan contains other required elements, such as MSY, ACLs, and AMs, and identifies overfishing and overfished thresholds. The Southeast Fisheries Science Center (SEFSC) guidance to the Council is that, because the Council does not have successful outputs from a quantitative assessment model, quantitative values for either MSY or OFL should not be set for stocks or stock complexes in the St. Croix EEZ. Instead, the SEFSC recommends relying on proxies for MSY and OFL based on qualitative estimates of fishing mortality rates and biomass expected when achieving MSY, and on a newly-developed metric called the sustainable yield level (SYL). Application of **Alternative 1** establishes an $MSY_{proxy}$ for all managed stocks and equates OFL to that $MSY_{proxy}$. Such outcomes do not reflect current thinking on the ways to set reference points in the data limited context in the St. Croix EEZ.

**Preferred Alternative 2** reflects the work of the Council's ABC CR Working Group, which in coordination with the Council's SSC, developed the ABC CR described in Step 1 (below). The ABC CR in Step 1 of **Preferred Alternative 2** contains four tiers to be used by the SSC in specifying ABC recommendations and other management reference points for stocks managed by the Council in the St. Croix FMP. Depending on the tier: MSY = long-term yield at $F_{MSY}$ (or, $MSY_{proxy}$ = long-term yield at $F_{MSYproxy}$); MFMT = $F_{MSY}$ (or $F_{MSYproxy}$); OFL = catch at MFMT; and MSST = 0.75*Spawning Stock Biomass (SSB) at $F_{MSY\ (or\ MSYproxy)}$ or proxy ($SSB_{MSY}$ or proxy). The choice of which of the four tiers to apply, and the degree to which MSY (or its proxy) and SDC can be quantitatively established, depend on the type and validity of assessment data available. Beginning with Tier 4 and moving up the tier levels, successful application of each tier requires an increasing amount of information. However, even the data rich and data

moderate Tiers 1 and 2 may rely on MSY proxies in those cases when spawner-recruit relationships cannot be well-estimated. Data limitations (discussed in Appendix I) require the use of MSY proxies in Tiers 3 and 4. In Tier 4, the most data-limited of the options, an MSY proxy, MFMT, and MSST are defined with respect to assumptions about fishing mortality rate and biomass, but cannot be quantified due to data limitations. In addition, Tier 4 introduces the SYL. The SYL (discussed in Appendix J) is the maximum level of landings that can be sustained over the long term. It is intended to be used when the information or resources needed to produce a quantitative stock assessment are not available to determine the MSY or corresponding reference point such as the OFL. As such, the SYL may be determined on the basis of historic landings patterns, Productivity Susceptibility Analyses, or other available information including expert opinion. Because OFL and MSY cannot be quantified in Tier 4, the SYL would be used as a proxy for OFL and MSY would be greater than or equal to the SYL.

The SYL is an equilibrium (long-term) concept. This is in contrast to OFL, which is a non-equilibrium (short-term) quantity defined as the annual amount of catch that corresponds to the estimate of the MFMT applied to a stock's abundance. The value of OFL thus increases or decreases in accordance with the abundance of the stock, and MSY is the long-term average of such catches. OFLs are set accounting for this variation and are intended to represent the annual metric that corresponds to MSY. The SYL, as a long-term average, can be considered to be a minimum estimate of MSY, and it is intended to ensure a stock is maintained at a sustainable level until the stock's status relative to formal stock assessment-based MSY-related reference points can be determined. Thus, SYL would be used to understand the sustainability of the fishery. While landings in excess of SYL would not establish that overfishing is occurring, they would indicate that catch could be above a sustainable level and would need to be investigated to determine whether overfishing is occurring, and whether, as a result of continued SYL exceedances, the stock or stock complex would become overfished.

Tier 4 of the ABC CR would enable the Council to comply with the Magnuson-Stevens Act requirement "to assess and specify…the maximum sustainable yield and optimum yields from the fishery" (16 U.S.C. 1853(a)(3)), and to specify SDC, when data are not available to apply either Tier 1, 2, or 3. The process and rationale for applying Tier 4 of the ABC CR are described in Appendix J.

**Preferred Alternative 2** would define a *three-step process* to establish SDC and allowable harvest levels (*i.e.*, ACLs) for managed stocks caught in the St. Croix EEZ. In *Step 1*, the Council's ABC CR, composed of four tiers designed to respond to different levels of data availability (Table 2.4.1), results in quantitative reference point estimates culminating in an ABC for each managed stock. *Step 2* establishes a proxy to use when $F_{MSY}$ cannot be determined. *Step 3* then applies a reduction factor, which reflects the Council's estimate of management

uncertainty and is specific to each stock or stock complex, to the resultant ABC to establish the ACL for that stock or stock complex.

*Preferred Alternative 2, Step 1*:

Step 1 would require application of the Council's four-tier ABC CR. As mentioned above, for stocks/stock complexes with valid assessments, CR Tiers 1, 2, or 3 would be applied, depending on the extent of data used in the assessment and the fishing mortality level (F) at MSY or its spawning potential ratio (SPR)-based proxy chosen by the Council. In contrast, Tier 4 would be applied when inadequate data are available with which to assess stock status. Within Tier 4, a SYL would first be defined based on the product of the 75$^{th}$ percentile (Tier 4a) or mean (Tier 4b) of the landings during a reference period and an adjustment scalar (See Appendix J). That SYL is then reduced to the ABC using a buffer that reflects the SSC's determination of scientific uncertainty associated with the data used to calculate SYL.

Tiers 1-3 of the ABC CR each require inputs from a quantitative assessment of stock status. Tier 1 is applicable in a data-rich environment that supports a full stage-structured stock assessment dependent on the availability of reliable time series of catch, stage composition, and index of abundance. Inputs to the ABC CR, from the stage-structured assessment, include MSST, MFMT, and the PDF of the OFL. Both OFL and ABC are derived by applying assessment outcomes within the ABC CR process, tempered by consideration of scientific uncertainty and a Council-defined risk of overfishing. Tier 1 outcomes are characterized by a minimal level of parameter uncertainty relative to the following tiers. Tier 2 is applicable in a data-moderate environment where two of the three time series described above are deemed informative. The approach and outcomes are the same as for the Tier 1 approach, but a higher level of parameter uncertainty is associated with those outcomes. Tier 3 is applicable in a data-limited environment that remains supportive of a quantitative assessment, but may also be applicable in the case of an out-of-date assessment. The data-limited assessment is expected to provide MFMT but it is likely MSST would be unknown. The OFL remains a quantitative output, but the ABC is more strongly constrained by application of conservative estimates of scientific uncertainty and risk of overfishing as determined by the Council. Tier 3 of the ABC CR results in a higher level of parameter uncertainty relative to Tiers 1 and 2. Note that for each of Tiers 1-3, MSY also may be quantified from the assessment, assuming the spawner-recruit relationship is well estimated, but is not a necessary requirement of the ABC CR process to produce OFL and ABC estimates.

Tier 4 is applicable in situations where an accepted quantitative assessment is not available, which is the present case for all stocks proposed for management in the St. Croix FMP. Defining reference points within this tier instead relies on landings data, ancillary information on the species in question such as life history traits and characteristics of the fishery, and expert opinion. Two sub-tiers are defined within Tier 4. Tier 4a is applicable when the Council's SSC

determines the stock has a relatively low or moderate vulnerability to fishing pressure. A stock's vulnerability to fishing pressure reflects a combination of its biological productivity and its susceptibility to the fishery (Patrick et al. 2009); 50 CFR 600.310(b)(4). Tier 4b is applied when the Council's SSC determines the stock has relatively high vulnerability to fishing pressure or when SSC consensus (= 2/3 or more members concur) cannot be reached on the use of Tier 4a. Additional information about the process to apply Tier 4 can be found in Appendix J.

*Preferred Alternative 2, Step 2*:

In the ABC CR specified in Step 1 of **Preferred Alternative 2**, MSY is equal to the yield at $F_{MSY}$. However, each tier of the ABC CR indicates that a $F_{MSY}$ proxy can be used in situations where $F_{MSY}$ cannot be estimated. The Magnuson-Stevens Act allows for the use of proxies in situations where MSY-related parameters cannot be estimated from available data, or when estimated values are determined to be unreliable. **Preferred Alternative 2**, Step 2 specifies a proxy to use when $F_{MSY}$ cannot be determined.

Step 2 provides three sub-alternatives for setting an $F_{MSY}$ proxy based on various fishing mortality rates. The $F_{MSY}$ proxies identified in **Sub-alternative**s **2a-c**, which are commonly used in fisheries management, can be easily calculated because relatively few data are required. The $F_{MSY}$ proxy specified in **Sub-alternative 2a** ($F_{MAX}$) is derived from yield-per-recruit (YPR) analyses. $F_{MAX}$ is the fully-recruited fishing mortality rate, which produces the maximum YPR; whereas, $F_{MSY}$ is the fishing mortality that maximizes the sustainable yield. $F_{MAX}$ is one of the earliest measures used as a proxy for $F_{MSY}$. $F_{MAX}$ is always greater than or equal to $F_{MSY}$; however, because it does not account for the fact that recruitment must decline at low spawning stock sizes, it is often believed to be an overestimate of $F_{MSY}$ (Gabriel and Mace 1999).

The $F_{MSY}$ proxies identified in **Sub-alternative 2b** and **Preferred Sub-alternative 2c** are calculated from spawning-stock-biomass-per-recruit (SPR) analyses. Under conditions of no fishing mortality, 100% of a stock's spawning potential is obtained. A fishing mortality rate denoted by $F_{40\%SPR}$ (**Sub-alternative 2b**) or $F_{30\%SPR}$ (**Preferred Sub-alternative 2c**) would allow stock to attain 40% or 30%, respectively, of the maximum spawning potential, which would have been obtained under conditions of no fishing mortality. Thus, as fishing mortality rates increase, spawning stock biomass per recruit decrease as more spawning opportunities are lost over the lifetime of the cohort.

$F_{30\%SPR}$ is the most commonly used $F_{MSY}$ proxy for data poor snapper-grouper stocks managed by the South Atlantic Fishery Management Council (South Atlantic Council; SAFMC 1998). In addition, the $F_{30\%SPR}$ was selected by the South Atlantic Council as the $F_{MSY}$ proxy for South Atlantic red snapper (SAFMC 2010). Gabriel and Mace (1999) recommend that fishing mortality rates in the range $F_{30\%SPR}$ to $F_{40\%SPR}$ be used as general default proxies for $F_{MSY}$ where

$F_{30\%SPR}$ used for stocks believed to have relatively high resilience to overfishing and $F_{40\%SPR}$ for stocks believed to have low to moderate resilience to overfishing.

*Preferred Alternative 2, Step 3*:

Fisheries in the EEZ around St. Croix would be managed by the Council and NMFS based on ACLs and AMs. The ACL can equal the SSC's ABC recommendation, but in the U.S. Caribbean region the ACL (previously specified in the species-specific plans) has generally been reduced from the ABC to account for management uncertainty. Management uncertainty refers to uncertainty in the ability of managers to constrain catch so the ACL is not exceeded, and the uncertainty in quantifying the true catch amounts (*i.e.*, estimation errors). The sources of management uncertainty could include: late catch reporting; misreporting; underreporting of catches; lack of sufficient in-season management, including in-season closure authority; or other factors.

In Step 3 of **Preferred Alternative 2**, the Council is considering six alternative reduction buffers to account for management uncertainty in the transition from ABC to ACL, ranging from no buffer reduction (**Preferred Sub-alternative 2d**), through reduction multipliers of 0.95 (**Preferred Sub-alternative 2e**), 0.90 (**Sub-alternative 2f**), 0.85 (**Preferred Sub-alternative 2g**), 0.75 (**Sub-alternative 2h**), and a 0.00 multiplier resulting in an ACL = 0 (**Sub-alternative 2i**). The Council could choose a different sub-alternative for each stock and stock complex (see Appendix J), reflecting their understanding of the effectiveness and response time of management measures. Similar to the 2010 and 2011 Caribbean ACL Amendments, OY would be set equal to the ACL.

> **Preferred Sub-alternative 2d**, the Council's preferred sub-alternative for queen conch, would establish an ACL equal to the ABC. This sub-alternative assumes no management uncertainty.
>
> **Preferred Sub-alternative 2e**, the Council's preferred sub-alternative for all managed stocks except queen conch, angelfish, parrotfish and surgeonfish, would establish an ACL equal to the ABC x 0.95. This sub-alternative assumes a thorough, but not complete, understanding of the factors influencing management decisions and the ability to apply those decisions in a timely and effective manner.
>
> **Sub-alternative 2f** would establish an ACL equal to the ABC x 0.90. This level of reduction to account for management uncertainty was previously used by the Council when establishing an ACL for those stocks identified as not undergoing overfishing in the 2011 Caribbean ACL Amendment.

**Preferred Sub-alternative 2g**, the Council's preferred sub-alternative for angelfish, parrotfish and surgeonfish, would establish an ACL equal to the ABC x 0.85. This level of reduction to account for management uncertainty was previously used by the Council when establishing an ACL for those stocks identified as undergoing overfishing in the 2010 Caribbean ACL Amendment.

**Sub-alternative 2h** would establish an ACL equal to the ABC x 0.75. This level of reduction to account for management uncertainty was previously used by the Council when establishing an ACL for those stocks identified as being of ecological importance to the coral reef ecosystem in both the 2010 and 2011 Caribbean ACL Amendments.

**Sub-alternative 2i** would establish an ACL equal to the ABC x 0. This level of reduction to account for management uncertainty would be applied when the ability to manage the stock is minimal, or for those stocks for which any level of management is inadequate to ensure the continued stability and resilience of the coral reef ecosystem upon which the federally managed stocks considered in the St. Croix FMP depend.

**Alternative 3** uses the stepwise process for establishing references points in the 2010 and 2011 Caribbean ACL Amendments, but allows for the selection of sub-alternative combinations that may result in SDC and reference point outcomes that differ from those presently in place for federally managed stocks. This contrasts with the outcomes from **Alternative 1**, which result in the direct transfer of SDC and/or reference points established in the 2010 and 2011 Caribbean ACL Amendments and presently in place.

Step 1 of **Alternative 3** would identify a year sequence of landings to be used as the baseline for establishing SDC and reference points. The chosen year sequence should represent a period of stable and sustainable landings, as defined and discussed in the 2010 and 2011 Caribbean ACL Amendments. The year sequence chosen for a particular stock could differ. Similarly, the year sequence chosen for each of the various stocks identified as in need of conservation and management in Action 2 and then classified into complexes (including identification of indicator stocks) in Action 3 may differ. Step 1 of **Alternative 3** includes four sub-alternatives, and each is described in turn below.

**Sub-alternative 3a** would use the longest year sequence of reliable landings data available to set management reference points, as applicable. As described in the 2011 Caribbean ACL Amendment (See Appendix H), the Council determined that landings for St. Croix's commercial fishing sector prior to 1999 could not be used because they were assigned based on the gear used rather than on the species caught. For all stocks, the end year for the longest period of reliable

catch data is 2016, the most recent year for which a complete compilation of landings data is available.

**Sub-alternative 3b** would use the longest time series of pre-Caribbean SFA Amendment landings data that is considered to be consistently reliable to set management reference points. The Caribbean SFA Amendment, implemented in 2005 (CFMC 2005), instituted a variety of new management measures for federal waters in the U.S. Caribbean region. The specific details regarding those management measures are incorporated here by reference, the salient point for the purpose of **Sub-alternative 3b** is that the year 2005 represents a shift in federal fishery management in the region. This proposed sub-alternative calls for only using commercial landings data reported during 1999-2005 for determining reference points. It is important to note, however, that throughout the history of fishing activity in St. Croix waters, many factors have influenced fisher behavior and fishing success, including various changes to the regulatory regime along with other influences such as hurricanes and shifting markets. Thus, while implementation of the Caribbean SFA Amendment was a noteworthy event, other events are equally or perhaps even more influential to fishermen and the fish populations upon which they depend. Within that context, the value of choosing 2005 as a demarcation is not clear.

**Sub-alternative 3c** would use the most recent five years (2012-2016) of available landings data to set SDC and management reference points for a stock. This sub-alternative has value because it reflects the most recent fishing activity in St. Croix. However, the most recent period of St. Croix fishing activity may not represent a period of stable landings and almost certainly does not represent a period suitable for representing the MSY proxy. At least two reasons explain this under-representation of the MSY proxy. First, St. Croix shared in the global economic downturn that began around 2008, reducing market opportunities for the fishermen that resulted in reduced fishing activity. Second, and more specifically with regard to this sub-alternative, both the 2011 and 2012 Caribbean ACL Amendments were implemented beginning in January 2012, and these revisions to the St. Croix federal fishery management regime placed upper limits on the allowable catch of each federally managed stock. By definition, those caps reduced harvest below the MSY proxy. That outcome is legitimate and appropriate, but not necessarily for determining an MSY proxy designed to reflect long-term sustainability. If such an approach is taken, the long-term outcome would be a constantly declining allowable catch level, as each new iteration of reference points would result in the new MSY proxy being brought down to the existing allowable catch level, and the new allowable catch level being equal to or below that revised MSY proxy. Because uncertainty is inherent in fisheries management, the latter would be the most common outcome.

**Sub-alternative 3d** would use another (presently undefined) year sequence, based on a recommendation of the Council's SSC, to set management reference points for a stock. The

implications of this sub-alternative cannot be fully analyzed until the SSC identifies the year sequence to be used. It is likely, however, that the chosen year sequence would fall between 1999 and 2016. The SSC has already determined that landings data acquired prior to 1999 are not applicable, so it's unlikely the SSC would choose any years prior to 1999 for use in reference point determinations. At the other end of the landings data spectrum, even if St. Croix landings data more recent than 2016 became available, those landings data would be unrepresentative and substantially lower than a typical year due to the impacts of hurricanes Irma and Maria on the island in 2017, its inhabitants, and the markets that support fishing activity.

Step 2 of **Alternative 3** would establish an $MSY_{proxy}$ for a stock as described by any of the sub-alternatives described below. A different sub-alternative could be chosen for each stock. Following the procedures described in the 2010 and 2011 Caribbean ACL Amendments, the OFL would then be set equal to the $MSY_{proxy}$ resulting from the chosen sub-alternative.

**Sub-alternative 3e** would establish an $MSY_{proxy}$ based on median annual landings derived from the year sequence selected in **Alternative 3** Step 1. When establishing SDC for some stocks in the 2012 Caribbean ACL Amendment, the SSC used the median rather than the mean of annual landings to account for a lack of landings information for those stocks. This was generally the case when few years of data were available for the stock, with the result that the mean calculated from those landings would be very low and likely unrepresentative of the capacity of the stock to produce MSY. In contrast, use of the median in such situations generally (but not always) would result in an outcome more representative of the stock's capacity to support harvest.

**Sub-alternative 3f** would establish an $MSY_{proxy}$ based on mean annual landings derived from the year sequence selected in **Alternative 3** Step 1. This is the most common approach historically used to establish an $MSY_{proxy}$ for federally managed fish stocks in the U.S. Caribbean region. When a generally complete and stable fishery is operating, this approach best captures the capacity of the stock to support harvest if the year sequence chosen in **Alternative 3** Step 1 represents a period of stable and sustainable landings.

Step 3 of **Alternative 3** would establish the ABC as described by any of the sub-alternatives below and using the $MSY_{proxy}$ (=OFL) established in **Alternative 3** Step 2. A different sub-alternative may be chosen for each stock.

**Sub-alternative 3g** would not specify an ABC Control Rule to be used for establishing the ABC from the $MSY_{proxy}$ (=OFL). Instead, the Council would adopt the ABC recommended by the SSC. The SSC would develop the ABC on an ad hoc basis for each stock. The SSC previously used this approach in the 2010 Caribbean ACL Amendment when setting management reference points for queen conch and some species of parrotfish.

**Sub-alternative 3h** would adopt an ABC Control Rule where ABC = $MSY_{proxy}$ (=OFL). This sub-alternative assumes a complete understanding of the many factors involved in obtaining and understanding the scientific data used to determine the $MSY_{proxy}$ (=OFL). The factors taken into account when establishing scientific uncertainty were described in Step 2 of **Preferred Alternative 2**. This sub-alternative was previously used by the SSC when establishing management reference points for most stocks (except queen conch and some species of parrotfish) in both the 2010 and 2011 Caribbean ACL Amendments.

**Sub-alternatives 3i** through **3k** would adopt an ABC Control Rule where ABC = $MSY_{proxy}$ (=OFL) x various buffer reductions including 0.90 (**Sub-alternative 3i**), 0.85 (**Sub-alternative 3j**), and 0.75 (**Sub-alternative 3k**). These buffer reductions represent an increasing level of scientific uncertainty resulting from variations in and the vagaries of the data upon which the $MSY_{proxy}$ (=OFL) was established. The factors taken into account when establishing scientific uncertainty were described in Step 2 of **Preferred Alternative 2**.

Step 4 of **Alternative 3** would establish the ACL based on the buffer reduction factor described in one of the sub-alternatives below and using the ABC established in **Alternative 3** Step 3. A different sub-alternative may be chosen for each stock. Reducing from the ABC to the ACL is designed to account for management uncertainty, as discussed in Step 2 of **Preferred Alternative 2**. **Sub-alternatives 3l-3q** are similar to **Sub-alternatives 2a-2f** in **Preferred Alternative 2**, and the discussion above applies here as well. Following the procedures and logic included in the 2010 and 2011 Caribbean ACL Amendments, OY would be set equal to the ACL.

**Comparison of Action 4 Alternatives and Summary of Effects**

**Alternative 1**, the no action alternative, would result in the continuation of SDC and management reference points established in the 2010 and 2011 Caribbean ACL Amendments and the Caribbean SFA Amendment. Implementation of **Alternative 1** would be expected to have negative short- and long-term effects on the human environment, including the physical, biological/ecological, social, and economic environments. **Alternative 1** simply carries over the existing reference points and SDC. There is no allowance to respond to availability of additional data, and no opportunity to adapt to a changing suite of managed stocks. In particular, stocks newly added to the St. Croix FMP would not be accounted for in **Alternative 1**. This is not in compliance with the Magnuson-Stevens Act. Moreover, assuming **Alternative 1** was legally viable, selecting it would create potential short- and long-term negative effects on the physical environment because harvest levels and associated fishing activities would not be specified, monitored, or managed for newly added stocks. This could result in higher levels of gear

deployment, potentially including those presently employed gear types that may negatively impact the physical environment. That same lack of opportunity to monitor and manage harvest levels relative to established reference points likely would create negative short- and long-term effects on the biological/ecological environment by allowing overharvest and resultant depletion of target species, thereby reducing reproductive capacity and excessively altering ecological interactions such as grazing capacity. Those negative biological/ecological effects, and associated physical effects, likely would result in long-term negative effects on the social and economic environments due to decreased fishing opportunities and concomitant reductions in income and cultural vibrancy for the fishing communities dependent on those fishery resources. Negative effects would be made worse by establishing reference points based on the previous FMPs, without updating the values to account for new information. This could result in unnecessary management intervention resulting in inappropriate social and economic effects to fishing communities. Whether those effects are positive or negative, and the extent of the effect, would depend on the degree to which the reference point should be updated, and the direction of the change. For example, if the ACL is too low, the biological/ecological environment could benefit as a result of lower harvest levels, potentially resulting in a more viable reproductive stock. In contrast, socioeconomic effects could be negative due to actual harvest falling below OY. Such effects may not be felt in the short-term, and in fact short-term social and economic effects might be positive. But in the long-term, depletion of fishery resources and resultant degradation of the habitats upon which those resources depend would have negative social and economic effects. Similarly, short-term administrative effects might be neutral because no additional action needs to be taken.

**Preferred Alternative 2** would replace the ABC CRs established in each of the 2010 and 2011 Caribbean ACL Amendments and provide a complete revision of references points relative to what would result from **Alternative 1**. With respect to **Alternative 3**, specific comparisons of quantitative outcomes cannot be made unless sub-alternatives are selected by the Council for each of the four steps included in the action. However, the process established by **Preferred Alternative 2** would fundamentally differ from the process defined in **Alternative 3** regardless of the specific differences resulting from choice of sub-alternatives, and would provide explicit advantages relative to either **Alternative 1** or **Alternative 3**. Compared with **Alternative 1**, **Preferred Alternative 2** provides access to more recent landings data, thereby ensuring to the greatest practicable extent that an appropriate period of stable and sustainable landings is identified. Although Step 1 of **Alternative 3** provides multiple sub-alternatives for choosing a year-sequence of landings, including optional outcomes that could be identical to the year-sequence outcome applied in **Preferred Alternative 2**, the latter alternative provides additional advantages and better meets the obligations of scientific rigor and quality. Most importantly, the tiered approached included in the **Preferred Alternative 2** ABC CR better positions the Council to take advantage of future improvements in data and analytical methodologies

As data collection initiatives begin to show results, the assessment process would advance from Tier 4 (no accepted assessment) to Tier 3 (data limited, but an accepted assessment is available) and eventually to Tier 2 (data moderate) and Tier 1 (data rich). No such capacity is provided by **Alternative 3**, which instead obligates a less rigorous approach based on statistics of landings data.

**Preferred Alternative 2** would be expected to have positive short- and long-term effects on the physical, biological/ecological, social, and economic environments associated with the St. Croix EEZ. Applying the best scientific information available through the action taken in **Preferred Alternative 2** would ensure that federally managed stocks are harvested sustainably while protecting reproductive capacity and maintaining effective ecological contributions. Establishing appropriate harvest reference points, taking into account both the biological needs and the ecological contributions of the stock as would be prescribed by **Preferred Alternative 2**, provides positive short- and long-term benefits to the physical and biological/ecological environment both directly by managing fishing effort and associated gear impacts and indirectly by managing the ecological integrity of the coral reef ecosystem.

The Council and their SSC applied considerable expertise and effort to the process of developing their ABC CR, establishing the process and protocols for implementing that ABC CR, and identifying the best available scientific data and expertise to be used in the ABC CR analytical process. That effort would ensure, to the greatest practicable extent, the most appropriate quantitative estimates of SYL and ABC to ensure sustainability of a stock or stock complex. The Council carefully considered the process applied by the SSC, along with the environment within which management would be applied, when assigning an appropriate buffer to derive the ACL from the ABC established by the SSC. These outcomes provide positive short- and long-term benefits to the biological/ecological environment by reducing the likelihood of stock depletion and by providing guideposts on (SYL) and limits to (ACL) indicative of potential negative trends in reproductive capacity and ecological function. Management measures implemented to achieve the harvest objectives set by the $F_{MSY}$ proxy would directly impact the biological environment in the form of controlling fishing effort. By being more conservative, **Sub-alternative 2b** would provide greater assurance overfishing would not occur thus, the biological benefits of **Sub-alternative 2b** would be greater than **Sub-alternative 2a** and **Preferred Sub-alternative 2c**.

Those positive short- and long-term biological/ecological effects, and the associated positive short- and long-term effects to the physical environment, translate to positive short- and long-term effects on the social and economic environments by stabilizing harvest and thereby increasing the predictability of harvest opportunities. **Sub-alternative 2b** would be expected to

result in greater constraints on harvest than **Sub-alternative 2a** and **Preferred Sub-alternative 2c** resulting in the greatest short-term negative socioeconomic impacts.

Regarding administrative effects, in general, **Preferred Alternative 2** would be expected to result in minor negative short-term effects as effort is expended to modernize landings tracking protocols to account for establishment of new reference points and inclusion of new species.

**Alternative 3** would follow the SDC and reference point setting methodologies developed in the 2010 and 2011 Caribbean ACL Amendments. Those same methodologies were used to establish the SDC and reference points that would be applied if **Alternative 1** was chosen by the Council. The substantial differences between **Alternative 1** and **Alternative 3** include that the former is number-based, whereas, the latter is process-based and therefore provides for a wider range of outcomes. Additionally, the latter allows the process to be applied across the full suite of stocks and stock complexes (as appropriate) that would be chosen by the Council in Actions 2 and 3 of this EA whereas the former is constrained to only those stocks already under management in the St. Croix EEZ.

For **Preferred Alternative 2** and **Alternative 3**, the final step in the process of establishing reference points is to set the ACL. In both cases, the ACL is set by applying a reduction buffer to the ABC to account for uncertainty in the management process. These reduction alternatives reflect the process applied in the 2010 and 2011 Caribbean ACL Amendments. Under **Preferred Alternative 2**, Step 3, the Council identified **Sub-alternative 2d** (no buffer reduction) as their preferred for queen conch, **Sub-alternative 2e** (buffer coefficient = 0.95) as their preferred alternative for all remaining stocks except for parrotfish, angelfish, and surgeonfish, and **Sub-alternative 2g** (buffer coefficient = 0.85) for parrotfish, angelfish, and surgeonfish. This choice reflects aspects of the uncertainty equation. First, the Council's SSC accounted to some degree for management uncertainty when establishing SYL to ABC (*i.e.*, scientific uncertainty) reductions in their control rule. Thus, the Council determined it was appropriate to apply a relatively minimal additional reduction to account for management uncertainty. Second, because parrotfish, angelfish, and surgeonfish provide ecological services to the coral reef ecosystem, further buffer reductions were appropriate for those stocks. Those reductions are slightly less than the reductions inherent in **Alternative 1**. However, in both the 2010 and 2011 Caribbean ACL Amendments, no reduction to account for scientific uncertainty was applied. Thus, the full uncertainty reduction that would be applied under **Preferred Alternative 2**, Step 3, for all managed stocks, is more conservative when compared to the outcome inherent in **Alternative 1**. The range of reduction buffers included in **Preferred Alternative 2**, Step 3 is identical to the range of buffers included in **Alternative 3**, Step 4. Assuming the Council chose as their preferred alternative for **Alternative 3** the same buffer reduction options, the effects would be expected to be the same. Ultimately, the anticipated

effects to the physical, biological/ecological, social, economic, and administrative environments would depend on the Council's choice of sub-alternative, although it would be expected that choice would be essentially the same regardless of the sub-alternative chosen because the uncertainty associated with the management process would not depend on the reference point alternative. The specific effects would depend on the choice of sub-alternative and cannot be fully analyzed prior to that Council decision. Suffice to say that, in general, the benefits to the physical and biological/ecological environments would be enhanced with a larger buffer between ABC and ACL, whereas, the benefits to the social and economic environments would be lessened with a larger buffer. Administrative effects likely would be neutral. In all cases, the OY would be set equal to the ACL.

Effects to the physical, biological/ecological, social, and economic environments resulting from implementation of **Alternative 3** would be expected to be more beneficial than those that would result from implementation of **Alternative 1**, but less beneficial than those that would result from implementation of **Preferred Alternative 2**. Providing a mechanism for developing reference points for all managed stocks, as called for in **Alternative 3**, would result in positive effects, but the extent of those positive effects would be limited by an inability to consider and apply the best scientific information available and to update management as those data expand and improve. Unlike the tiered control rule in **Preferred Alternative 2**, **Alternative 3** does not provide different processes for deriving MSY, SDC, and reference points based on available information. Those relative effects apply across the suite of environments introduced above could result in unnecessary management intervention with potentially unnecessary negative social and economic effects to fishing communities. Short-term administrative effects would be negative but minor, due to the additional administrative effort to update regulations and public awareness documents.

## 2.5 Action 5: Accountability Measures for Stocks and Stock Complexes

Through Action 5, the Council would re-establish AMs for previously managed stocks and stock complexes and establish AMs for stocks new to management in the St. Croix FMP. This action follows from selecting Preferred Alternative 2 in Action 1 and proceeding with establishing a St. Croix FMP, composed of measures contained in the Reef Fish, Spiny Lobster, Queen Conch, and Coral FMPs that are pertinent to St. Croix. For a stock or stock complex, an AM would be triggered based on annual landings from the commercial fishing sector. Commercial landings data are obtained from commercial catch reports collected by the USVI DPNR.

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### 2.5.1 Proposed Alternatives for Action 5

**Alternative 1**. No action. Do not revise the determinant for triggering an AM or the specific AM that would be applied to a stock or stock complex in the St. Croix FMP. The AMs applicable to reef fish, spiny lobster, queen conch, and coral resources established in the Council's Reef Fish, Spiny Lobster, Queen Conch, and Coral FMPs and that would be brought into the St. Croix FMP based on Action 1, Preferred Alternative 2 would continue to be applied to previously managed stocks/stock complexes in the St. Croix EEZ. This action would not establish AMs for stocks/stock complexes that are new to management.

**Preferred Alternative 2**. For a stock/stock complex in the St. Croix FMP, trigger an AM if commercial landings, as determined in one of the sub-alternatives below, exceeds the established ACL for that stock/stock complex, unless NMFS' SEFSC determines the overage occurred because data collection/monitoring improved rather than because catch increased. If an AM is triggered, NMFS would reduce the length of the fishing season for the applicable stock/stock complex the year following the overage determination by the amount necessary to ensure (to the greatest practicable extent) landings do not again exceed the ACL in the year of application. Any fishing season reduction resulting from an AM application would be applied from September 30 backward, toward the beginning of the fishing year. If the length of the required fishing season reduction exceeds the time period of January 1 through September 30, any additional fishing season reduction would be applied from October 1 forward, toward the end of the fishing year.

> **Sub-alternative 2a**. A single year of commercial landings, beginning with the most recent available complete year of landings.
>
> **Sub-alternative 2b**. A single year of commercial landings, beginning with the most recent available complete year of commercial landings, then a 2-year average of commercial landings from that single year and the subsequent year, and thereafter a progressive running two-year average.
>
> **Sub-alternative 2c**. A single year of commercial landings, beginning with the most recent available complete year of commercial landings, then a 2-year average of commercial landings from that single year and the subsequent year, then a three-year average of commercial landings from those two years and the subsequent year, and thereafter a progressive running three-year average.
>
> **Preferred Sub-alternative 2d**. A single year of commercial landings, using commercial landings from 2018; then a single year of commercial landings, using commercial

landings from 2019; then a 2-year average of commercial landings from 2019 and the subsequent year (2019-2020); then a three-year average of commercial landings from those two years and the subsequent year (2019-2021); and thereafter a progressive running three-year average (2020-2022, 2021-2023, etc.). The Regional Administrator in consultation with the Council may deviate from the specific time sequences based on data availability.

**Preferred Alternative 3**. For the pelagic stocks (dolphin and wahoo) only, apply a two-step process to establish an ACT for each stock that would be used as an AM (Step 1), and establish the determinant for triggering an AM (Step 2). Choose a sub-alternative from each step, for each stock.

***Alternative 3 - Step 1.*** Establish an ACT for each pelagic stock, using any of Sub-alternatives 3a-3c listed below, and use the established ACT as the AM.

**Preferred Sub-alternative 3a**. The ACT would be 90% of the ACL

**Sub-alternative 3b**. The ACT would be 80% of the ACL.

**Sub-alternative 3c**. The ACT would be 70% of the ACL.

***Alternative 3 - Step 2.*** Trigger an AM if the commercial landings as determined in one of the sub-alternatives below, exceeds the ACT for that stock. If an AM is triggered, the Council in consultation with the SEFSC would assess whether corrective action is needed.

**Sub-alternative 3d**. A single year of commercial landings, beginning with the most recent available complete year of commercial landings.

**Sub-alternative 3e**. A single year of commercial landings, beginning with the most recent available complete year of commercial landings, then a 2-year average of commercial landings from that single year and the subsequent year, and thereafter a progressive running two-year average.

**Sub-alternative 3f**. A single year of commercial landings, beginning with the most recent available year of commercial landings, then a 2-year average of commercial landings from that single year and the subsequent year, then a three-year average of commercial landings from those two years and the subsequent year, and thereafter a progressive running three-year average.

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**Preferred Sub-alternative 3g**. A single year of commercial landings, using commercial landings from 2018; then a single year of commercial landings, using commercial landings from 2019; then a 2-year average of commercial landings from 2019 and the subsequent year (2019-2020); then a three-year average of commercial landings from those two years and the subsequent year (2019-2021); and thereafter a progressive running three-year average (2020-2022, 2021-2023, etc.). The Regional Administrator in consultation with the Council may deviate from the specific time sequences based on data availability.

Preferred for queen conch **Alternative 4**. Establish an in-season AM. Harvest of a stock or stock complex would be prohibited for the remainder of the fishing season when the ACL for the stock/stock complex is reached or projected to be reached.

**Preferred Alternative 5**. For a stock with harvest prohibitions, the prohibition would serve as the AM.

### 2.5.2 Discussion of Action 5 Alternatives

Accountability measures are management controls to prevent ACLs from being exceeded, and to correct or mitigate overages of the ACL if they occur. Accountability measures should address and minimize both the frequency and magnitude of overages and correct the problems that caused the overage in as short a time as possible. NMFS identifies two categories of AMs, in-season AMs and AMs for when the ACL is exceeded (600.310(g)(1)).

Action 5 would re-establish AMs for previously managed stocks and stock complexes and depending on the chosen alternative, establish AMs for stocks new to management in the St. Croix FMP proposed for creation by the Council in Action 1, Preferred Alternative 2. As identified in Action 2 (Preferred Alternative 2), the new draft list of species to be managed under the St. Croix FMP includes queen conch (1 species), spiny lobster (1 species), 43 finfish species, sea cucumbers (Holothuroidea), sea urchins (Echinoidea), and all corals[18]. From these, two species of finfish are new to federal management as are a number of the sea cucumbers, sea urchins, and corals that were not historically managed in the Coral FMP. In addition, the composition and organization of stock complexes would change as a result of Action 3 and new ACLs would be set (or revised) as a result of Action 4. By revising AMs as proposed in Action 5, the Council would ensure ACL overages are accounted for with responsive management

[18] At their 153rd Regular meeting, the Council moved to include all soft, hard, mesophotic, and deep water corals under the new island-based FMPs. This would include all species in Orders Scleractinia (hard corals), Alcyonacea (soft corals), and Antipatharia (black corals).

actions, thereby minimizing the risk of depleting a stock while ensuring to the greatest possible degree that OY is achieved.

**Alternative 1**, the no action alternative, would not change the existing AMs for those stocks carried into the St. Croix FMP from the Reef Fish, Spiny Lobster, Queen Conch, and Coral FMPs. The current determinant for triggering AMs, as well as the presently established response to an ACL overage, would continue to be applied to those stocks/stock complexes. However, AMs would not be established for those stocks/stock complexes newly added to the St. Croix FMP, nor would a trigger for applying an AM be defined. These topics are further discussed below.

Under **Alternative 1**, an AM would be triggered when the average of the most recent three years of landings[19] for a stock/stock complex exceeds the ACL established for that stock/stock complex. The AM would reduce the length of the fishing season in the year following the determination by the amount necessary to ensure that landings do not exceed the ACL applicable to that stock/stock complex.

Under **Alternative 1**, the trigger determination is conditional, in that if NMFS' SEFSC (in consultation with the Council and its SSC) determines the ACL exceedance resulted from enhanced data collection or monitoring rather than reflecting an actual increase in landings, an AM would not be triggered. This conditional clause responds to continuing efforts by the Council, state agencies, NMFS, and the fishermen to improve reporting of landings data. Such reporting enhancements likely would increase reported landings, thereby pushing the three-year average used for comparison upward despite no increase in the actual harvest. The conditional clause is designed to ensure fishermen would not be punished for enhancements to data collection and reporting patterns.

Under **Alternative 1**, for both reef fish and spiny lobster, any fishing season reduction resulting from an AM application would be applied from September 30 backward toward the January 1 beginning of the fishing year. If the length of the required fishing season reduction exceeds the January 1 through September 30 time period, any additional fishing season reduction would be applied from October 1 forward, toward the end of the fishing year.

In the St. Croix EEZ, the harvest of corals is prohibited under the Coral FMP. That harvest prohibition would be carried over into the St. Croix FMP. The harvest prohibition serves as the

[19] With the exceptions of goliath grouper, Nassau grouper, midnight parrotfish, blue parrotfish, and rainbow parrotfish, ACLs are based on the combined Caribbean EEZ and territorial landings for the St. Croix management area.

AM in the Coral FMP and would continue to do so under **Preferred Alternative 5** of Action 5 (discussed below).

**Preferred Alternative 2** would use a stepwise temporal approach to calculate average landings for comparison against the applicable ACL. This contrasts with **Alternative 1**, which would use the most recent three years of landings data as the determinant to trigger an AM. **Sub-alternative 2a** would use the most recent single year of landings for comparison against the ACL. For example, assuming that the first year of operation under the St. Croix FMP is 2019, only landings data from the 2018 fishing year (assuming this is the most recent year of available and complete landings) would be compared against the applicable ACL to determine if an AM would be applied to any stock/stock complex in 2019. That single year approach would be continued into the future; only landings data from the 2019 fishing year would be compared against the applicable ACL to determine if an AM would be applied to any stock/stock complex in 2020. This stepwise, single-year approach would be continued into the future.

Under **Sub-alternative 2b**, a single year of landings would be used during the first year of FMP operation, as in **Sub-alternative 2a**, but in the second year of operation an average of landings from the two most recent years of complete landings would be compared against the applicable ACL. The two-year averaging approach would then be continued in a stepwise fashion (*i.e.*, a running two-year average) into the future. For example, assuming the first year of operation under the St. Croix FMP is 2019, only landings data from the 2018 fishing year (assuming this is the most recent year of available and complete landings) would be compared against the applicable ACL to determine if an AM would be applied to any stock/stock complex in 2019. An average of landings from 2018 and 2019 would be compared against the applicable ACL to determine if an AM would be applied to any stock/stock complex in 2020. This stepwise, two-year running average approach would be continued into the future.

**Sub-alternative 2c** is similar to **Sub-alternative 2b**, but instead of using a two-year running average approach in the third year and into the future, a three-year average of landings would be compared against the applicable ACL. The three-year running average approach would then be continued into the future. As in the previous examples, if 2019 were to be the first year of St. Croix FMP operation, 2018 landings data would be used in the 2019 management year, 2018 and 2019 landings data would be used in the 2020 management year, 2018, 2019 and 2020 landings data would be used in the 2021 management year, and 2019, 2020, and 2021 landings data would be used in the 2022 management year.

**Preferred Sub-alternative 2d** differs from **Sub-alternatives 2a-2c** in that **Preferred Sub-alternative 2d** calls for a modified stepwise approach to determine if an AM would be triggered. Under **Preferred Sub-alternative 2d**, landings data from 2018 alone (assuming this is the most

recent year of available and complete landings) would be compared against the applicable stock/stock complex ACL to determine if an AM would be triggered during the first year (2019) of operation under the St. Croix FMP. In the second year of FMP operation (2020), landings data from 2019 alone would be compared against the applicable stock/stock complex ACL to determine if an AM would be triggered. In the third year (2021) of FMP operation, an average of the landings from 2019 and 2020 would be compared against the applicable ACL. In the fourth year (2022) of operation, an average of the landings from 2019, 2020, and 2021 would be compared against the applicable ACL. The three-year running average approach would then move forward each year, by one year, into the future (e.g., 2020+2021+2022 for the 2023 operating year).

Regarding the choice of years to be used when averaging landings for comparison against the ACL for a stock/stock complex, using average landings provides benefits because of the diffuse and variable nature of St. Croix fisheries. While a few stocks provide predominate harvest from the St. Croix EEZ, most harvested stocks contribute only a small proportion of the total landings. Additionally, the relative proportion of landings contributed by any single stock commonly varies from year to year, even in the case of those stocks providing large contributions. These fluctuations may result from biological (e.g., year-class variability) and economic (e.g., market demand) factors, either alone or in concert. Regardless, the fewer years of landings used, the more variable would be the resultant year-to-year comparison against the established ACL. An averaged time-series of landings would damp that variability, and the longer the time-series the more damped would be the variation. When using a single year of landings, the expected outcome would be more frequent exceedance of the ACL interspersed with years when the landings for any stock/stock complex fell well below the established ACL. Because some or all of the variability results from natural biological fluctuations, little biological/ecological advantage is obtained from using a single year of landings for comparison against the ACL, whereas potentially substantial negative socioeconomic impacts would accrue resulting from more frequent AM applications. Overall, OY would be achieved less frequently when using a single year of landings for identifying an ACL overage. To a point, the longer the time-series, the more closely management would achieve OY. That point is identified in the Magnuson-Stevens Act as three years, which defines the longest time period considered in the **Preferred Alternative 2** (and **Preferred Alternative 4**) sub-alternatives as three years.

For all sub-alternatives, **Preferred Alternative 2** also differs from **Alternative 1** in that the SEFSC would not consult with the Council and its SSC prior to making a determination that the ACL was exceeded due to enhanced data collection or monitoring rather than to an actual increase in landings. This revision reflects the authoritative position of the SEFSC with regard to changes in landings reporting characteristics in the U.S. Caribbean region. As with all management actions and events in the U.S. Caribbean region, the Council would be notified of

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any AM applications, but with **Preferred Alternative 2** there would be no obligation to consult with the Council and their SSC prior to making the determination that an ACL exceedance resulted from enhanced data collection and monitoring.

Regarding the application of AMs in response to an ACL overage, **Preferred Alternative 2** is very similar in most respects to **Alternative 1**. As discussed above for **Alternative 1**, when an AM is triggered, application of that AM would result in a reduction in the length of the fishing season in the year following the determination, by the amount necessary to ensure to the greatest practicable extent that such an overage would not occur again in the year following the determination. This approach to management anticipates that fishing effort of the pertinent stock/stock complex, remains relatively constant between consecutive years (although not necessarily in the long-term). By adjusting the fishing year (*i.e.*, reducing the length of the fishing season) to allow fishing at that level of anticipated effort for the number of days necessary to meet but not exceed the ACL, the Council would ensure the target stock or stock complex is harvested in a sustainable manner within the context of OY. The AM application process in **Preferred Alternative 2** could be applied to each of the managed stocks for which harvest is allowed in the St. Croix EEZ (reef fish, spiny lobster, and, pelagic stocks[20]). Similar to **Alternative 1**, any fishing season reduction resulting from application of an AM would be applied from September 30 backward, toward the beginning of the fishing year. If the length of the required fishing season reduction exceeds the time period of January 1 through September 30, any additional fishing season reduction would be applied from October 1 forward, toward the end of the fishing year.

**Preferred Alternative 3** applies specifically to pelagic stocks new to management in St. Croix EEZ waters. Based on Preferred Alternative 2 of Action 2 (species to manage in the FMP) and Preferred Alternatives 3 and 4 of Action 3 (stock organization), those newly added pelagic stocks would include dolphin and wahoo. Landings data for these stocks are available, but it is unknown to what extent those landings data fully represent harvest of these pelagic stocks. Because these pelagic stocks were not previously managed in either state or EEZ waters surrounding St. Croix, less emphasis was placed on data collection relative to those stocks previously under state or federal management. That approach to data collection may fail to capture the temporally and spatially variable nature of these pelagic fisheries, both within the year due to migratory timing and fishing tournament events that target some or all of these stocks, and among years due to factors such as variation in inter-annual recruitment success and changing migratory pathways. As a result, while available landings provide guidance on a minimum level of sustainable harvest, those landings data may not provide adequate guidance concerning the capacity of the stock to support sustainable harvest. For both recreational and commercial fishermen, dolphinfish represent one of the most commonly targeted and

[20] Pelagic stocks/stock complexes in the St. Croix FMP resulting from Action 2 are dolphin and wahoo.

economically important of harvested stocks. Reflecting these economic and cultural considerations, the Council requested a more deliberative approach to their management until a more complete understanding of these important fisheries is obtained. **Preferred Alternative 3** provides that deliberative approach. Instead of applying an AM-based season length reduction in the event of an ACL overage, as proposed in **Alternative 1** and **Preferred Alternative 2**, the Council would establish an ACT as a percentage of the ACL that would serve as the AM, based on one of the sub-alternatives in Step 1 of this alternative. An ACT is an amount of annual catch of a stock or stock complex that may appropriately serve as a management target for the fishery, and accounts for management uncertainty in controlling the catch at or below the ACL. National Standard 1 of the Magnuson-Stevens Act recommends the use of ACT within the hierarchy of management reference points. For fisheries without in-season management control to prevent the ACL from being exceeded, it may be beneficial to utilize ACTs that are set below ACLs to better manage the risk of catches exceeding the ACL, and thus to reduce the probability of triggering the applicable AM.

Three sub-alternatives are provided in Step 1 of **Preferred Alternative 3** for setting the ACT relative to the ACL. **Preferred Sub-alternative 3a** would set the ACT at 90% of the ACL, **Sub-alternative 3b** would set the ACT at 80% of the ACL, and **Sub-alternative 3c** would set the ACT at 70% of the ACL (Table 2.5.1). That range of alternative ACTs provides balance between management uncertainty and economic opportunity, with **Sub-alternative 3c** more carefully addressing management uncertainty and **Preferred Sub-alternative 3a** more carefully managing economic opportunity.

**Table 2.5.1.** Annual catch targets (ACT) for pelagic stocks under each of the sub-alternatives in Alternative 3, based on the Council's preferred alternatives in Action 4 for establishing annual catch limits (ACL). Values in bold represent the ACT resulting from the preferred sub-alternative selected by the Council.

| Stock/Stock Complex | ACL | Sub-alt 3a ACT = ACL * 0.90 | Sub-alt 3b ACT = ACL * 0.80 | Sub-alt 3c ACT = ACL * 0.70 |
|---|---|---|---|---|
| Dolphin | 86,633 | **77,970** | 69,307 | 60,643 |
| Wahoo | 27,260 | **24,534** | 21,808 | 19,082 |

Under **Preferred Alternative 3**, if the ACT established in Step 1 is exceeded based on one of the four trigger sub-alternatives in Step 2, the AM would be applied and the Council in consultation with the SEFSC would review the available data and evaluate what factors led to the exceedance and whether corrective action (such as an ACL revision) would be needed. **Sub-alternatives 3d-3f** and **Preferred Sub-alternative 3g** of **Preferred Alternative 3** would use the same approach proposed in **Sub-alternatives 2a-2c** and **Preferred Sub-alternative 2d** of **Preferred Alternative 2** to calculate average landings for comparison against the applicable ACT as the

determinant to trigger an AM. This approach is discussed above for **Sub-alternatives 2a-2c** and **Preferred Sub-alternative 2d** of **Preferred Alternative 2** and the reader is referred to that discussion as it would similarly apply to **Sub-alternatives 3d-3f** and **Preferred Sub-alternative 3g**.

**Preferred Alternative 4** pertains to those stocks/stock complexes for which data are available to make an AM trigger determination within the fishing year. For stocks proposed for inclusion in the St. Croix FMP, in-season data are available only for queen conch. In both state and federal waters around St. Croix, queen conch presently are managed based on both an ACL and a defined fishing season (November 1 of each year to May 31 of the following year). If, based on in-season monitoring, the ACL is reached prior to the end of the fishing season, an AM is applied and harvest is closed. **Preferred Alternative 4** would provide the mechanism for that process to continue. For other Council-managed stocks, state and federal efforts to improve the timing and extent of data acquisition for stocks harvested from the St. Croix EEZ continue, and those improvements may result in the availability of in-season data with which to monitor and manage fishing activity for more stocks/stock complexes.

**Preferred Alternative 5** addresses those stocks for which harvest would be prohibited based on the preferred alternatives identified in Action 4 that result in an ABC of zero. This alternative would apply to Nassau grouper, goliath grouper, blue parrotfish, midnight parrotfish, rainbow parrotfish, sea cucumbers, sea urchins, and corals. Under **Preferred Alternative 5**, the harvest prohibition would serve as the required AM.

**Comparison of Action 5 Alternatives and Summary of Effects**

**Alternative 1** (no action) follows from choosing to transition to island-based management in Preferred Alternative 2 of Action 1, thereby creating a St. Croix FMP that retains AMs established in the existing species-based FMPs. However, **Alternative 1** would not be compliant with the requirements of the Magnuson-Stevens Act for several reasons. First, AMs would not be carried over for those stocks newly added to the St. Croix FMP. Second, for those stocks previously managed in the Reef Fish, Spiny Lobster, Queen Conch, and Coral FMPs and brought into the St. Croix FMP via Action 1, Preferred Alternative 2, **Alternative 1** would ensure accountability to new ACLs established under Action 4, but would not account for reorganization of the stock complexes resulting from the Council's preferred alternatives in Action 3. As a result, the assigned ACL would not appropriately reflect the composition of the stock complex and, because of that, would not faithfully follow the process proposed in Action 4, Preferred Alternative 2 for setting reference points. These outcomes would likely negatively affect the socioeconomic and biological/ecological environments by potentially failing to achieve OY or to minimize the risk of stock depletion due to a failure to properly manage harvest.

In contrast to outcomes from **Alternative 1**, outcomes resulting from application of **Preferred Alternative 2** or (if and when appropriate) **Preferred Alternative 4** would ensure AMs are properly structured for application to all stocks/stock complexes proposed for inclusion in the St. Croix FMP. Under **Preferred Alternative 2**, positive benefits to the biological/ecological environment would result because landings would be constrained to the ACL in the year following an ACL exceedance, thereby ensuring fishing effort is managed as necessary to prevent a subsequent exceedance of the ACL. These positive biological/ecological benefits translate directly into positive socioeconomic benefits resulting from a reliable and sustained resource base. The choice of sub-alternative within **Preferred Alternative 2** could influence the frequency with which an AM-based closure is implemented, and the length of that closure among years, but the specific effects associated with each sub-alternative depend on the stock in question and the variability in landings associated with that stock. Without that information, it is difficult to assess the relative effects of each sub-alternative. **Preferred Alternative 4** achieves these same goals but more responsively by applying effort control in a pro-active rather than reactive manner. **Preferred Alternative 4** therefore provides enhanced benefits relative to **Preferred Alternative 2**, and much greater benefits relative to **Alternative 1**, because it provides a mechanism to prevent ACL overages within the fishing year rather than responding in a subsequent year to an already realized ACL overage. As previously discussed, the Council, its federal and state partners, and its constituents are working toward fishery data collection and reporting mechanisms that would support in-season management. When those mechanisms are achieved for stocks/stock complexes other than queen conch, application of **Preferred Alternative 4** would be feasible. Because such timely data reporting may be imminent for one or more additional stocks/stock complexes included in the St. Croix FMP, inclusion of **Preferred Alternative 4** is valid despite its present lack of applicability. In any case, both **Preferred Alternative 2** and **Preferred Alternative 4** provide the framework for managing fishing effort on all stocks/stock complexes proposed for inclusion in the St. Croix FMP. **Alternative 1** does not. Successful management of fishing effort on all managed stocks, to ensure a sustainable harvest, is the essence of fishery management and brings to fruition the entirety of conceptual and analytical processes resulting from Actions 1-6 of this document.

Additional positive biological/ecological effects would result from re-establishing AMs for previously managed stocks and by establishing AMs for newly managed stocks, as proposed in **Preferred Alternatives 2** and **4**. Again, **Preferred Alternative 4** is advantageous relative to **Preferred Alternative 2**, because **Preferred Alternative 4** provides an anticipatory rather than a reactive response as would be the case with **Preferred Alternative 2**. The more natural population size distribution resulting from sustainable harvest would provide biological benefit, ensuring reproductive interactions are maintained especially for the plethora of sequentially hermaphroditic reef fish occupying the U.S. Caribbean coral reef ecosystem. Similarly,

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enhancing the size distribution of managed stocks contributes to ecological function of the coral reef complex, for example by maintaining essential (and size-dependent) grazing services provided by herbivores such as parrotfish and surgeonfish. Conversely a negative effect to both the biological/ecological and socioeconomic environments may result from the potential increase in regulatory discard of prohibited species caught during an AM closure while fishermen continue harvest of legally available species. Although it is the desire of fishermen and managers to ensure species caught as bycatch are returned to the water with minimal harm, the normal routine of those fish would be disturbed and their fate upon resubmergence is unknown.

**Preferred Alternative 5** equates the AM with a complete prohibition on harvest, as would result for several stocks from implementation of the Council's preferred alternatives for Action 4. Biological/ecological effects resulting from the application of **Preferred Alternative 5** would be positive and more substantial than those realized from any of the other Action 5 alternatives. But those benefits would only apply to stocks already assigned an ABC of zero based on the Council's preferred alternatives in Action 4. For the remainder of managed stocks, **Preferred Alternative 5** would not apply and no effects would therefore be realized. Similarly, for those stocks to which **Preferred Alternative 5** would apply, socioeconomic effects would be negative and more substantial than those realized from any of the other Action 5 alternatives, although that outcome already would be established in Action 4. It is possible that beneficial long-term biological/ecological and socioeconomic effects may result from a prohibition on harvest and equivalent AM, as that prohibition would allow rebuilding of depleted stocks to a level at which harvest is sustainable and ecological function revived. While these considerations apply to all stocks for which a prohibition on harvest would be in place, they are particularly pertinent to midnight, blue, and rainbow parrotfish. Historically, stocks of those three species have been harvested from the St. Croix EEZ by both commercial and recreational fishermen. Rebuilding those stocks to levels sufficient to again support harvest would therefore provide socioeconomic benefits to the fishing community and, to the extent those stocks are then sustainably managed at OY, also would provide enhanced biological/ecological benefits to the coral reef community via their unique contributions to grazing capacity.

Under **Preferred Alternative 3**, biological/ecological effects would likely be less beneficial relative to the other alternatives because the AM would not close harvest when triggered, risking potential depletion of the resource. In contrast, socioeconomic effects resulting from application of **Preferred Alternative 3** would be more beneficial relative to the other alternatives, at least in the short-term, because harvest would not be constrained without additional action from the Council. However, the Council would be expected to revise their management approach in response to recommendations from the SEFSC, with a reasonable expectation that those management revisions would benefit stock productivity in the long-term with resultant benefits to the biological/ecological and socioeconomic environments. **Sub-alternative 3c** provides the

most conservative response because the ACT trigger represents the smallest percentage of the ACL and therefore provides the greatest likelihood the Council and the SEFSC would convene. That likelihood decreases with **Sub-alternative 3b** and bottoms out with **Preferred Sub-alternative 3a**. Note, however, that even **Preferred Sub-alternative 3a** does not prevent a response, it simply requires the highest level of landings to invoke the Council's and SEFSC response.

In summary, **Preferred Alternative 4** of Action 5 provides the greatest overall benefit to the environment because only this alternative ensures AM implementation prevents an ACL overage rather than simply responding to an ACL overage. Unfortunately, at the present time this is the least feasible alternative because, with the exception of queen conch, in-season landings data are not available for St. Croix's commercial fisheries. Except in the case of queen conch, **Preferred Alternative 4** therefore remains unavailable for application in the St. Croix EEZ although, as mentioned above, in-season landings data may become available in the foreseeable future for some additional commercial stocks harvested from the St. Croix EEZ. While **Preferred Alternative 5** also prevents rather than responding to an ACL overage, that alternative simply reinforces an outcome proscribed in Action 4. Application of **Preferred Alternative 5** would not establish authentic in-season management opportunities, but it would provide the best approach for managing stocks for which harvest is prohibited. **Preferred Alternative 2** would provide biological/ecological and socioeconomic benefits similar to those provided by **Preferred Alternative 4**, but would do so based on a post-season rather than an in-season schedule. In most cases, because it is feasible within the reality of data availability, **Preferred Alternative 2** would provide the greatest overall benefit for those stocks for which harvest is allowed and data are sufficient to ensure a balanced approach to biological/ecological and socioeconomic outcomes. **Preferred Alternative 3** provides the greatest overall benefit for those stocks for which that balance is not well understood, specifically pelagic stocks newly added to management in the St. Croix FMP, because it would not result in unnecessary constraints to harvest for those prolific, wide-ranging stocks.

## 2.6 Action 6: Describe and Identify EFH for Stocks not Previously Managed in the St. Croix Exclusive Economic Zone (EEZ)

This action follows from selecting Alternative 2 in Action 1 and proceeding with establishing a St. Croix FMP comprised of measures pertinent to St. Croix.

Through Action 6, the Council would describe and identify EFH for species that would be new to federal management in the St. Croix FMP (See Appendix H). All species managed by the Council to date have EFH designations; thus, EFH designations are not required at this time for

those species. The St. Croix FMP would maintain the EFH designations from species that were retained from the existing FMPs. Action 2, if approved, would result in changes to the species managed by the Council in the St. Croix FMP. A number of species would be removed while two new finfish species and a number of invertebrates, including sea cucumbers (Holothuroidea), sea urchins (Echinoidea) and corals, would be added for federal management.

### 2.6.1 Proposed Alternatives for Action 6

**Alternative 1**. No action. Do not describe and identify EFH for species not previously managed in federal waters of St. Croix.

**Preferred Alternative 2**. Describe and identify EFH according to functional relationships between life history stages of federally-managed species and St. Croix marine and estuarine habitats.

**Alternative 3**. Use other method(s) to describe and identify EFH for species not previously managed in federal waters of St. Croix. The March 2004 Final Environmental Impact Statement for the Generic EFH Amendment explored a number of concepts that could be used depending on data availability. At this time there are no data to explore any of the following methods to describe EFH and thus an analysis of this alternative is not prudent. The 2004 EFH-FEIS discusses in detail the data needed to use the methods considered in this alternative. Some of these methods for describing EFH include:

1) Designating EFH based on distribution data (distribution of habitat types, fish species and fishing effort) (*Level 1 data – surveys of presence/absence; simple habitat/species associations).*

2) Designating EFH based on habitat-related densities of the species (EFH would be defined as the area where the density or relative abundance of a species life stage is above a threshold level) *(Level 2 – Survey/fishery related catch per unit effort as proxy for density; or spatial modeling of probability of occurrence, or other forms of habitat suitability models).*

3) Using spatial data to designate EFH (*would use spatially explicit, qualitative or quantitative information that link fish distributions and habitat to describe and identify EFH) (Level 2)*

4) Habitat suitability models (uses habitat suitability modeling prepared by National Ocean Service to infer information about species distribution, and possibly relative density (*i.e*. assuming that habitats with a higher suitability support greater abundances of a species life stage).

5) Designating EFH based on data on growth, reproduction, or survival rates within habitats (obtained from tagging data (growth), fecundity data by area).

6) Designating EFH based on production rates by habitat.

### 2.6.2 Discussion of Action 6 Alternatives

Under the Magnuson-Stevens Act, Councils, under the required provisions in the development of FMPs, have to "describe and identify essential fish habitat for the fishery based on the guidelines established by the Secretary under section 305(b)(1)(A), minimize to the extent practicable adverse effects on such habitat caused by fishing, and identify other actions to encourage the conservation and enhancement of such habitat;" (16 USC 1852(a)(7)) the alternatives considered provide compliance with the provisions of the Act to describe and identify EFH. These alternatives have been previously considered for all species in the Council's FMPs and have resulted in the banning of fishing gear from particularly sensitive areas, for example spawning grounds. In describing and identifying EFH and minimizing adverse effects on such habitat, the Council should consider the best scientific information available.

As identified in Action 2 (Preferred Alternative 2), the draft list of species to be managed under the St. Croix Fishery Management Plan (FMP) includes queen conch (1 species), spiny lobster (1 species), 43 finfish species, sea cucumbers, sea urchins, and all species of coral. From these, two species of finfish are new to federal management: dolphin and wahoo. There are also number of invertebrates proposed for federal management that include sea cucumbers (Holothuroidea), sea urchins (Echinoidea), and corals not previously included in the Coral FMP. Previously described EFH for these invertebrates was reviewed in light updated information on the occurrence of these species beyond the 100-fathom fishable habitat as it was defined in various Amendments to the four species-based FMPs. The Magnuson-Stevens Act requires that each FMP describe and identify EFH for each fishery. Thus, this action would identify and describe EFH for the proposed invertebrates mentioned above and the two finfish species new to federal management: wahoo and dolphin. The remaining species identified for inclusion in the St. Croix FMP in Action 2 (Preferred Alternative 2) were previously managed under the Caribbean Fishery Management Council's (Council) Reef Fish, Spiny Lobster, Queen Conch, and Coral FMPs and already have existing EFH designations. These existing designations would be evaluated during the ongoing EFH 5-year Review.[21]

[21] Under the MSA, the FMP is required to both identify EFH and minimize to the extent practicable adverse effects on such habitat caused by fishing. The need to include an action to prevent, mitigate, or minimize adverse effects on EFH for species not previously managed in St. Croix federal waters would depend on the results of the analysis of the gear and techniques used to fish for those new species.

The Magnuson-Stevens Act defined EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." 16 USC 1802(10). NMFS EFH guidelines require maps depicting areas of proposed EFH for each alternative, and strongly encourage maps of proposed Habitat Areas of Particular Concern (HAPCs) for each alternative. The most significant impediments to describing and identifying EFH and mapping the extent of EFH have been the lack of information on species distributions and the paucity of habitat mapping information deeper than about 25 m (82 ft), the limited information available from mesophotic reefs (30-50 m [98-164 ft]) and the limited data on pelagic species in the region.

Under **Alternative 1** (no action), the Council would not be complying with the requirements of the Magnuson-Stevens Act for the new species proposed for federal management. EFH would not be described and identified for the new finfish, sea cucumbers, sea urchins, and corals in the St. Croix FMP. The new finfish species for which EFH designations would not be provided include dolphin (*Coryphaena hippurus*) and wahoo (*Acanthocybium solandri)*. These species are identified as coastal migratory pelagic fish and although their habitat also overlaps that of the reef fish, the Council has not described or identified EFH for these species. These pelagic species cross jurisdictional boundaries, but because of their significant seasonal presence in the U.S. Caribbean EEZ, would require designation of EFH.

**Alternative 1** would also not identify EFH for any new species of sea cucumbers, sea urchins, and corals that have not been previously under management in the federal waters and that occur deeper than 100 fathoms (600 ft; 1097 m), currently defined as fishable habitat, within the U.S. Caribbean EEZ. Recent exploration of the deep-sea around Puerto Rico and the USVI have shown presence of sea cucumbers, sea urchins and corals to depths of over 3,000 meters in areas not currently fished.

**Preferred Alternative 2** would describe and identify EFH according to functional relationships between life history stages of federally-managed species and St. Croix marine and estuarine habitats. This alternative is the same as the preferred alternative in the Comprehensive Sustainable Fisheries Act (SFA) Amendment that described and identified EFH as the functional relationships between life history stages of federally-managed species and Caribbean marine and estuarine habitats (CFMC 2005). The methodology previously used to establish EFH, based on the best available scientific information, including expert opinion, would provide the basis for EFH determination for the new species proposed for management. Data considered in **Alternative 3** (e.g., abundance, densities, predator-prey interactions) are incomplete or not available at this time. The methodology in **Preferred Alternative 2** fulfills the requirements of the Magnuson-Stevens Act in describing EFH using information available and would identify HAPCs (e.g., spawning aggregation sites). Applying **Preferred Alternative 2** would result in EFH designations that include identification of habitats used by fish and invertebrates during

different life cycle stages. Due to data limitations, **Alternative 3** would not result in the designation of EFH for these species. The effects for this methodology were analyzed in the 2004 EFH FEIS (CFMC 2004). **Preferred Alternative 2** specifies functional relationships for life stages and habitat types that might be regarded as meriting special attention for their importance to managed species. The Magnuson-Stevens Act defined EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity." 16 USC 1802(10). These are the functions that marine and estuarine habitats support. Under **Preferred Alternative 2**, the distribution of species and life stages is inferred from information on these functional relationships. In particular, EFH is defined for finfish, and corals, sea cucumbers and sea urchins as follows in the Council's Reef Fish FMP and the Coral FMP (CFMC 2005).

For reef fish: Per Action 1, Alternative 2, the St. Croix FMP retains EFH designations for all previously managed species in St. Croix. For those species, EFH in the US Caribbean consists of all waters from mean high water to the outer boundary of the EEZ – habitats used by eggs and larvae – (Figure 2.2; 2004 EFH-FEIS) and all substrates from mean high water to 100 fathoms depth – used by other life stages – (Figure 2.41; 2004 EFH-FEIS), shown in the aggregate as Figure 2.39 (2004 EFH-FEIS)."

**Preferred Alternative 2** would establish EFH for all life stages of the two new finfish proposed for management. Identification and description of EFH for these finfish was not previously described in the U.S. Caribbean. Pelagic species (*i.e.*, dolphin and wahoo) feed on a very wide variety of fish, including several life stages of reef fish. These species are considered part of the coral-based, reef-associated fisheries, occupying the water column above these reef habitats near the shelf edge.

Information on the life history stage and preferred habitat was summarized for each stock or stock complex new to management throughout its range (Table 2.6.1). Much of the information available is from geographical ranges to the north of the area of interest (USVI). All references are included in Appendix H. Information on eggs and larvae are generally at the family level because species-specific identification of larvae from local waters was not available. The information available includes the use of habitat type by each life history stage of the new stocks and stock complexes proposed for federal management and maps with associated distributions within these habitats. Specific information on the use of habitats by life history stage was minimal or limited to the presence or absence of the species at the sites. Information was provided by experts (SSC meetings, DAPs meetings, unpublished data, non-peer reviewed reports, and published literature) and published literature. Areas other than U.S. Caribbean waters were also considered for the designation of EFH.

**Table 2.6.1.** Stocks and stock complexes new to management under the St. Croix FMP and information on their habitats per life stage.

| Stock/Stock Complex | Common Name | Eggs | Larvae | Post larvae | Juveniles | Adults | Spawning Adults |
|---|---|---|---|---|---|---|---|
| *Coryphaena hippurus* | Dolphin | Pelagic | Pelagic, flotsam, Sargassum | Pelagic | Pelagic/migratory/ no temperature barrier/ Sargassum/ flotsam | Pelagic/migratory/ Sargassum/ flotsam/ weed lines/ trap buoys | Pelagic/ wide geographic range |
| *Acanthocybium solandri* | Wahoo | Pelagic | Pelagic/ oceanic | Pelagic | Pelagic | Pelagic | Pelagic |
| Holothuroidea | Sea Cucumbers | Pelagic/ internal | Pelagic/ brooding/ live young | - | Sand, seagrass, Pelagic | Sand, seagrass, Pelagic | Sand, seagrass, Pelagic |
| Echinoidea | Sea Urchins | Pelagic /brooding | Pelagic/ brooding | - | Sand, seagrass | Sand, seagrass | Sand, seagrass, coral |
| Corals | Corals | Pelagic | Pelagic | hard substrate | coral, hard substrate | sand, coral, hard substrate | sand, coral, hard substrate |

Sargassum appears to be an important habitat for dolphin, but both the presence of the habitat and the fish are seasonal. Changes in environmental and oceanographic conditions, such as winds, eddies, tidal changes and currents, influence the presence and permanence of Sargassum in local waters. Ageing of Sargassum will also influence the timing of its presence on the surface waters locally. These factors determine the amount of time the Sargassum will remain afloat and thus available for dolphin.

The 100-fathom fishable habitat defined previously is being re-evaluated as the fisheries have been expanding into deeper waters and as research and exploration continue in the deep-waters around Puerto Rico and the USVI. However, the data are not available except to continue to determine maximum depth of species seen and the habitat in which they are found. The majority of the exploration being conducted in the U.S. Caribbean is well beyond the 100-fathom depth leaving a gap in the data needed to re-evaluate the definition of fishable habitat.

Under **Preferred Alternative 2**, EFH for the newly proposed stocks for federal management in St. Croix would be defined as:

**EFH for eggs and larvae of dolphin and wahoo** in the St. Croix FMP consists of all waters from the mean high water to the outer boundary of the EEZ. These waters are the habitats used by eggs and larvae of these two finfish species.

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**EFH for dolphin** in the St. Croix FMP consists of all waters from the mean high water to the outer boundary of the EEZ – habitats used by eggs, larvae, juveniles and adults. Dolphin is a pelagic species, being migratory through the U.S. Caribbean and its Atlantic range, for which it is not known yet if there is a local stock. EFH for this species includes Sargassum, weed lines, flotsam, and floating objects even those attached to traps. These habitats provide shelter and food. Dolphin can be found in open water where bottom depths are beyond the previously described 100-fathom fishable habitat.

**EFH for wahoo** in the St. Croix FMP consists of all waters from the mean high water to the outer boundary of the EEZ – habitats used by eggs and larvae as well as juveniles and adults. All life stages are pelagic. Wahoo area either seasonally present or seasonally targeted, the distinction is not very clear. The only distinctive zonation reported for wahoo shows a preference for the shelf edge.

Table 2.6.2 summarizes the habitat type used by the new stocks and stock complexes proposed for management showing the specific functional relationship by life history: "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity" as based on the information found in Appendix H.

**Table 2.6.2.** Summary of functional relationship (feeding [F], growth [G], spawning [S], breeding [B]) by habitat type utilized by life history stages (egg [E], larvae [L], juvenile [J], adult [A]) of newly added stocks and stock complexes proposed for federal management in St. Croix.

| Stock/Stock Complex | Common Name | Mangrove | Seagrass | Coral Reef | Hard Bottom | Sand | Mud | Algal Plains | Pelagic/ Water column | Sargassum |
|---|---|---|---|---|---|---|---|---|---|---|
| *Coryphaena hippurus* | Dolphin | - | - | J/A F G | J/A F G | - | - | - | L/J/A F G S | L/J/A F G |
| *Acanthocybium solandri* | Wahoo | - | - | J/A F G | J/A F G | - | - | - | L/J/A F G S | L/J/A F G |
| Holothuroidea | Sea Cucumbers | J/A F G S | J/A F G S | J/A F G S | J/A F G S | J/A F G S | | J/A F G S | E/L/J/A (deep water) F G S | - |
| Echinoidea | Sea Urchins | J/A F G S | J/A F G S | J/A F G S | J/A F G S | J/A F G S | J/A F G | J/A F G S | E/L/J/A F G | - |
| Corals | Corals | - | - | J/A F G S | J/A F G S | - | - | - | E/L F G | - |

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Section 4.7.1 of the Caribbean SFA Amendment (CFMC 2005) described EFH for coral and species of sea cucumbers and sea urchins as: "EFH for the coral fishery in the U.S. Caribbean consists of all waters from mean low water to the outer boundary of the EEZ – habitats used by larvae – (Figure 2.2; EFH FEIS) and coral and hard bottom substrates from mean low water to 100 fathoms depth – used by other life stages – (Figure 2.42; EFH FEIS), shown in the aggregate as Figure 2.39 (EFH FEIS)."

**Preferred Alternative 2** would also describe EFH for all species of sea cucumbers, sea urchins, and corals. However, it is known that there are species of these groups that occur in waters deeper than 100 fathoms, the Council would have to describe and identify EFH for these species to include the depths of the mostly unexplored EEZ.

The list of new species of sea cucumbers and sea urchins under management (Appendix H) include species that have been reported from depths of over 3,000 m. These organisms are found in rocky bottoms, sandy bottoms, mud-like bottoms, they are associated with both the benthos and the water column, with feeding taking place over sand-like sediment. Sea urchins feed on algae, sessile organisms, and carrion and provide a food source (e.g., triggerfishes) or shelter (e.g., juvenile grunts) for fish. Deep-water urchins are detritus feeders. Sea cucumbers are in the Class Holothuroidea with over 500 species. Elasipodida are the deep-water holothurids that can be pelagic and benthic. Mostly are deposit or suspension feeders.

Under **Preferred Alternative 2**, **EFH for sea urchins and sea cucumbers** in the St. Croix FMP consists of all waters from the mean high water to the outer boundary of the EEZ – habitats used by eggs and larvae – and all substrates from mean high water to the maximum depth at which sea urchins and cucumbers may be found [it is known that sea urchins and sea cucumbers can be found deeper that 100 fathoms] – used by eggs (brooding behavior by adult), young born from ovary of cucumber, and other life stages. The specific habitats reported to be utilized by sea urchins and sea cucumbers include mangroves, reefs, rocky outcrops, coral reefs, coral banks, reefs to at least 50 m depth, sand, mud, algal plains, and water column (swimming cucumbers).

Under **Preferred Alternative 2**, **EFH for corals** in the St. Croix FMP consists of all waters from the mean high water to the outer boundary of the EEZ – habitats used by eggs and larvae – and all substrates from mean high water to the maximum depth at which corals (ahermatypic, solitary corals) may be found [it is known that corals are found deeper that 100 fathoms] – used by other life stages. The specific habitats reported to be utilized by corals include reefs, rocky outcrops, coral reefs, coral banks, reefs to at least 50 m depth, other organisms that offer a hard substrate, and sand.

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**Alternative 3** proposes the use of other method(s) to describe and identify EFH for species not previously managed in federal waters of St. Croix. The 2004 EFH FEIS explored a number of concepts that could be used depending on data availability.

The Council could consider and decide to reject **Alternative 3** due to the lack of data to attempt the designation of EFH based on the six approaches within **Alternative 3**. The Council is engaged in endorsing projects to further data collection and analysis of the data that would result in viable EFH designations. The Caribbean Fishery Ecosystem Plan is one such collaborative effort. NOAA Coral Reef Conservation Program grants to the Council have resulted in the baseline characterizations of mesophotic reefs (30-50 m [98-164ft]) and the extended description of habitat with depth for species within the fish communities at these depths. The 5-year EFH Review would include an evaluation of the data available to determine the potential of refining designations for species proposed and currently under management. The Council has also been engaged in the development of a GIS database of the reported commercial landings to determine the feasibility to use spatial data in the description and identification of EFH. This project is currently underway. All these efforts would provide the basis for changes in the EFH designations. The EFH Final Rule requires using the highest level of information (production rates) first (if available), followed by the second highest level (growth, reproduction or survival rates) and so on. The guidelines also call for applying this information in a risk-averse fashion to ensure adequate areas are protected as EFH. The most complete information available should be used to determine EFH for each species and life stage. If higher level information is available only for a portion of the species/life stage range then a decision needs to be made regarding how the information should be used – for example, if the knowledge from the portion of the range covered could be extrapolated to the rest of the range. Additionally, the final rule says that Councils and NMFS should periodically review and revise the EFH components of FMPs based on available pertinent information.

The six concepts under **Alternative 3** were fully discussed in the 2004 EFH FEIS and the discussion is incorporated by reference herein. "No information was identified that could be used to distinguish between the total distribution of species/life stages and subsets of the distribution with sufficient contrast to indicate that one part of a species/life stage distribution should be identified as EFH and another should not". Due to the paucity of this type of information in the US Caribbean, for the purposes of this EIS (*i.e.*, 2004 EFH FEIS), the distribution of species/life stages in the U.S. Caribbean was assumed to be the distribution of all habitats that the species/life stage was known to associate with, based on all available information (as organized in the habitat use database). No information was available from other sources to distinguish habitat utilization in one region of the U.S. Caribbean from another. All habitat used by a species/life stage was considered of equal value" (CFMC 2004).

**Comparison of Action 6 Alternatives and Summary of Effects**

Under **Alternative 1** (no action), the Council would not be complying with the requirements of the Magnuson-Stevens Act for the new species proposed for federal management. EFH would not be described and identified for the new finfish, sea cucumbers, sea urchins, and corals in the St. Croix FMP. **Alternative 1** would not provide the necessary information to minimize adverse effects on EFH from fishing for these new species being considered for federal management. The EFH described for these species could result in the identification of important parts of the ecosystem that have not been afforded protection before but **Alternative 1** would not allow for their inclusion in the St. Croix FMP. Under **Alternative 1** it would not be possible to determine if there is a need for specific or additional management to protect EFH for the two new finfish species. Not identifying EFH for the newly proposed species would have a negative administrative impact by not complying with the provisions of the Magnuson-Stevens Act, as well as a negative biological and ecological impact by not providing information on EFH of managed species.

**Alternative 1** would not alter the current EFH descriptions for species already under management as this action does not address those species. It would not establish EFH for species new to management. This would not be in compliance with the Magnuson-Stevens Act.

Under **Preferred Alternative 2**, all new species proposed for management would have EFH described and identified as required by law in the St. Croix FMP. Two new finfish species are proposed for federal management in the St. Croix FMP as well as a number of sea cucumbers, sea urchins, and corals. Many of the species proposed for federal management under the St. Croix FMP have been reported from protected areas near St. Croix, including areas that have a seasonal closure in place prohibiting all fishing during the closure. These areas have been designated as HAPCs under the SFA Amendment (CFMC 2005). **Preferred Alternative 2** could be the best approach to describe and identify EFH for the new finfish species proposed for management under the St. Croix FMP. The addition of pelagic species, seasonally present in the area would result in extending the description of EFH for those species that are currently under federal management in other jurisdictions.

Under **Alternative 3**, the Council would require data that are not currently available in usable format to consider any of the concepts or methodology for describing EFH presented in this alternative for the new species proposed for management. Specifically, spatial data are not available to populate the models that would contribute to a more precise description of EFH or to more specifically identify EFH. Gathering data is not feasible at this stage. **Alternative 3** includes concepts that would provide the most refined description of EFH for all species under management but these are also data hungry concepts. The Council strives to obtain the data

needed to improve on the identification of EFH. The use of these concepts in the future would prove to have positive ecological, biological, and administrative benefits when the data become available.

**Alternative 1** contrasts with **Preferred Alternative 2** and **Alternative 3** and would not address the legal mandate to describe and identify EFH. The new St. Croix FMP would not meet the required provisions of the Magnuson-Stevens Act, namely to describe and identify EFH for the new finfish species and additional species of coral, sea cucumbers, and sea urchins proposed for federal management under the preferred alternative in Action 2 (Preferred Alternative 2). These newly added species, depending on the selection of alternatives under Action 3 would be managed in single or multi-species complexes or they could be included in pre-existing and already managed complexes. All species new to management co-occur in the same habitats as those already managed, there are a number of species that have a much more extensive distribution and that are only seasonally present in the St. Croix EEZ (e.g., dolphinfish). Other species new to management are known to be present in the EEZ but there is very limited information about the specifics of their EFH. **Preferred Alternative 2** of Action 6 incorporates the best information available. **Alternative 3** provides mechanisms to improve on the description of EFH as data become available to move from basic levels of presence and absence (Level 1 in the guidelines) EFH descriptions to Level 4, the highest level of data using production rates by habitat. **Preferred Alternative 2** provides the Council with the use of the best available data and information to describe EFH for species in the fisheries that did not have EFH designation before.

In identifying EFH (**Preferred Alternative 2** and **Alternative 3**), the benefits outweigh the negative impacts. In identifying EFH for the new finfish and a number of invertebrate species proposed for management, there could be the potential to identify new areas or new threats to already designated EFH. The fishing gear used in fishing for the new species added have already been analyzed for impacts to EFH in the St. Croix EEZ.

Unless management measures are proposed to decrease fishing impact to habitats, bycatch or other aspects that impact EFH, **Preferred Alternative 2** and **Alternative 3** -description of EFH- would have non-significant effects on the physical, biological, ecological, economic, social and administrative environments. **Alternative 1** however does not complying with the requirements of the Magnuson-Stevens Act would have significant impact on the administrative environment.

To summarize, identification and designation of EFH would not have a direct effect on the biological or physical environment but is likely to present indirect effects to the administrative environment due to consultation requirements and result in controversy within the social environment due to differences in desired methodologies for designating EFH. It is expected

that the identification and description of EFH would indirectly benefit the biological and physical environments, due to the EFH consultation requirements.

## 2.7 Action 7: Framework Procedures for the St. Croix FMP

Through Action 7, the Caribbean Fishery Management Council (Council) would determine the framework procedure to be included under the new St. Croix FMP. This action follows from selecting Alternative 2 in Action 1 and proceeding with establishing a St. Croix FMP comprised of measures pertinent to St. Croix. The purpose of the framework is to allow the Council to more expeditiously adjust reference points and management measures in response to changing fishery conditions. Amendments done through frameworks (Framework Amendments) typically take less time to develop than a traditional plan amendment, while continuing to ensure a thorough evaluation of the effects of alternative approaches to achieving management goals.

### 2.7.1 Proposed Alternatives for Action 7

In Action 7, **Alternative 1** is the no action alternative and would retain the framework procedures included in the Reef Fish FMP, Spiny Lobster FMP, Queen Conch FMP, and Coral FMP under the St. Croix FMP created per Action 1, Preferred Alternate 2. Therefore, no new or modified framework procedures would be added to the St. Croix FMP. **Preferred Alternative 2** proposes a framework procedure that includes both closed and open framework procedures (*see discussion of alternatives below)* and, within the open framework, the additional option of using an abbreviated framework. **Alternative 3** and **Alternative 4** both include open and closed framework procedures; however, **Alternative 3** proposes a broader framework procedure while **Alternative 4** proposes a narrower framework procedure than that included in **Preferred Alternative 2**.

**Alternative 1**. No action. In the St. Croix FMP, retain the framework procedures presently included under the Reef Fish, Spiny Lobster, Queen Conch, and Corals and Reef Associated Plants and Invertebrates FMPs (Table 2.7.1).

**Preferred Alternative 2**. Adopt the Framework Procedure listed in Table 2.7.2.

**Alternative 3**. Adopt the broader Framework Procedure listed in Table 2.7.3.

**Alternative 4**. Adopt the narrower Framework Procedure listed in Table 2.7.4.

**Table 2.7.1**. Framework measures in the Reef Fish, Spiny Lobster, Queen Conch, and Coral FMPs under Alternative 1, Action 7.

| Framework Measures in the Reef Fish, Spiny Lobster, Queen Conch, and Coral FMPs |
| --- |
| a) Quota Requirements<br>b) Seasonal Closures<br>c) Area Closures<br>d) Fishing Year<br>e) Trip/Bag Limit<br>f) Size Limits<br>g) Gear Restrictions or Prohibitions<br>h) Fishery Management Unit (FMU)<br>i) Total Allowable Catch (TAC)<br>j) Annual Catch Limits (ACLs)<br>k) Accountability Measures (AMs)<br>l) Annual Catch Targets (ACTs)<br>m) Maximum Sustainable Yield (MSY)<br>n) Optimum Yield (OY)<br>o) Minimum Stock Size Threshold (MSST)<br>p) Maximum Fishing Mortality Threshold (MFMT)<br>q) Overfishing Limit (OFL)<br>r) Acceptable Biological Catch (ABC) control rules<br>s) Actions to Minimize the Interaction of Fishing Gear with Endangered Species or Marine Mammals |
| Establish an assessment group and adjustments:<br>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.<br><br>1. When the Council determines that management measures require modification, the Council would appoint an advisory panel (Group) that would assess the condition of species in the management units (including periodic economic and sociological assessments as needed). The Group would present a report of its recommendations to the Council.<br><br>2. The Council would consider the report and recommendations of the Group and may 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 would make decisions on the need for change.<br><br>3. If changes to management regulations are needed, the Council would 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. |

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4. The RA would 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 would recommend that the Secretary take appropriate regulatory action for the fisheries on such date as may be agreed upon with the Council.

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

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

a. Specification of MSY or MSY proxy and subsequent adjustment where this information is available;

b. Specification of an 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 ACLs and Annual Catch Targets (ACTs), and subsequent adjustment;

e. Specification of AMs and subsequent adjustment;

f. Specification of 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 OFL and subsequent adjustment;

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

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

k. Adjustments to the composition of Fishery Management Units (FMUs).

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 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' 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.

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**Table 2.7.2**. Base framework procedure under Preferred Alternative 2 in Action 7.

| **OPEN FRAMEWORK** | |
|---|---|
| 1. Situations under which this open framework procedure can be used:<br>A. A new stock assessment or other information indicates changes should be made to: MSY, OFL, ABC, or other related management reference points and status determination criteria (SDC). | |
| B. New information or circumstances indicates management measures should be changed.<br>- The Council would, as part of a proposed framework action, identify the new information and provide rationale as to why this new information indicates that management measures should be changed. | |
| C. Changes are required to comply with applicable laws such as MSA, ESA, MMPA, or are required as a result of a court order.<br>- In such instances, the RA would notify the Council in writing of the issue and the action that is required. If there is a legal deadline for taking action, the deadline would be included in the notification. | |
| 2. Types of Open Frameworks: | |
| <u>Abbreviated Framework</u> | <u>Standard Framework</u> |
| Can be used for routine or insignificant changes | Regulatory changes that do not qualify as routine or insignificant. |
| Request is made with letter or memo from the Council to the RA with supporting analyses (biological, social, economic).<br>If RA concurs and approves action, it would be implemented through publication of FR Notice. | Requires a completed framework document with supporting analyses. |
| **Actions that can be taken under each Framework** | |
| <u>Abbreviated Framework</u> | <u>Standard Framework</u> |
| i. Gear marking requirements<br>ii. Vessel marking requirements<br>iii. Restrictions related to maintaining fish in a specific condition (whole condition, filleting, use as bait, etc.)<br>iv. Recreational bag and possession limit changes of not more than 1 fish per boat<br>v. Size limit changes of not more than one inch of the prior size limit for reef fish.<br>vi. Commercial vessel trip limit changes of not more than 10% of the prior trip limit<br>vii. Changes to the length of an established closed season by no more than 1 day of the existing season. | In addition to making changes specified under Abbreviated Framework (left column) that exceed the established thresholds, the following actions can be completed via a standard framework:<br>i. Re-specify ABC<br>ii. Re-specify MSY and OY, and SDC<br>iii. Re-specify SYL<br>iv. Re-specify ACLs<br>v. Rebuilding plans and revisions to approved rebuilding plans<br>vi. Revise accountability measures (e.g., change AM triggers and AM timing)<br>vii. Modify reporting and monitoring requirements |

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| | |
|---|---|
| viii. Minor changes to gear modifications to address conservation issues including to respond to interactions with listed species. | viii. Modify seasonal or year-round closures and closure procedures<br>ix. Modify area closures and closure procedures |
| **3.** The Council would initiate the open framework process to inform the public of the issues and develop potential alternatives to address the issues. The framework process would include the development of documentation and public discussion during at least one council meeting. | |
| **4.** Prior to taking final action on the proposed framework action, the Council may convene its Scientific and Statistical Committee (SSC) or applicable Advisory Panel (AP), as appropriate, to provide recommendations on the proposed actions. | |
| **5.** For all framework actions, the Council would provide the letter, memo, or the completed framework document along with proposed regulations to the Regional Administrator in a timely manner following final action by the Council. | |
| **6.** For all framework action requests, the Regional Administrator would review the Council's recommendations and supporting information and notify the Council of the determinations, in accordance with the MSA and other applicable law. | |
| **CLOSED FRAMEWORK** | |
| Consistent with existing requirements in the FMP and implementing regulations, the RA is authorized to conduct the following closed framework actions through appropriate notification in the Federal Register:<br>a. Reopen any sector of the fishery that had been prematurely closed.<br>b. Implement AMs, either in-season or post-season. Implement an in-season AM for a sector that has reached or is projected to reach, or is approaching or is projected to approach its ACL, or implement a post-season AM for a sector that exceeded its ACL according to the process established in the FMP, or any other established AM. | |

**Table 2.7.3**. Broad framework procedure under Alternative 3 in Action 7.

| **OPEN FRAMEWORK** |
|---|
| **1.** The Council may utilize this open framework procedure to implement management changes in response to any additional information or changed circumstances.<br>a. The Council would, as part of a proposed open framework action, identify any new information and provide rationale as to why this new information requires that management measures be adjusted.<br>**2.** Open framework actions may be implemented at any time based on information supporting the need for adjustment of management measures or management parameters:<br>Actions that can be taken under this Open Framework |

| |
|---|
| i. Re-specify ABC<br>ii. Re-specify MSY and OY, and SDC<br>iii. Re-specify SYL<br>iv. Re-specify ACLs<br>v. Rebuilding plans and revisions to approved rebuilding plans<br>vi. Revise accountability measures (e.g., change AM triggers and AM timing)<br>vii. Modify reporting and monitoring requirements<br>viii. Modify seasonal or year-round closures and closure procedures<br>ix. Modify area closures and closure procedures<br>x. Modify recreational bag and possession limits<br>xi. Modify commercial trip limits<br>xii. Modify size limits<br>xiii. Modify gear restrictions (ranging from altering current regulations to a complete prohibition, including to respond to interactions with listed species)<br>xiv. Other adjustment to management measures within the scope and criteria established by the FMP and implementing regulations deemed appropriate by the Council |
| **3.** The Council would initiate the open framework process to inform the public of the issues and develop potential alternatives to address the issue. The framework process would include the development of documentation and public discussion during one council meeting. |
| **4.** For all framework actions, the Council would provide the letter, memo, or the completed framework document along with proposed regulations to the Regional Administrator in a timely manner following final action by the Council. |
| **5.** For all framework action requests, the Regional Administrator would review the Council's recommendations and supporting information and notify the Council of the determinations, in accordance with the Magnuson-Stevens Act and other applicable law. |
| **CLOSED FRAMEWORK** |
| Consistent with existing requirements in the FMP and implementing regulations, the RA is authorized to conduct the following closed framework actions through appropriate notification in the Federal Register:<br>a. Reopen any sector of the fishery that had been prematurely closed.<br>b. Implement AMs, either in-season or post-season. Implement an in-season AM for a sector that has reached or is projected to reach, or is approaching or is projected to approach its ACL, or implement a post-season AM for a sector that exceeded its ACL according to the process established in the FMP, or any other established AM.<br>c. Take any other immediate action specified in the FMP and implementing regulations. |

**Table 2.7.4**. Narrow framework procedure under Alternative 4 in Action 7.

| **OPEN FRAMEWORK** |
|---|

| |
|---|
| A. A new stock assessment or other information indicates changes should be made to: MSY, OFL, ABC, or other related management reference points and status determination criteria (SDC).<br><br>B. New information or circumstances indicates management measures below should be changed. |
| Open Framework actions may be implemented only in response to the above conditions. Actions that may be implemented via the framework include only the following: |
| i. Re-specify ABC<br>ii. Re-specify ACLs<br>iii. Re-specify MSY and OY, and SDC<br>iv. Re-specify SYL<br>v. Modify recreational bag and possession limits<br>vi. Modify size limits<br>vii. Modify seasonal or year-round closures and closure procedures<br>viii. Modify reporting and monitoring requirements |
| The Council would initiate the open framework process to inform the public of the issues and develop potential alternatives to address the issue. The framework process would include the development of documentation and public discussion during at least three council meetings, and shall be discussed at separate public hearings within the areas most affected by the proposed measures. |
| Prior to taking final action on the proposed framework action, the Council shall convene its SSC and AP to provide recommendations on the proposed actions. |
| For all framework actions, the Council would provide the letter, memo, or the completed framework document and all supporting analyses, along with proposed regulations to the Regional Administrator in a timely manner following final action by the Council. |
| For all framework action requests, the Regional Administrator would review the Council's recommendations and supporting information and notify the Council of the determinations, in accordance with the MSA and other applicable law. The RA would provide the Council weekly updates on the status of the proposed measures. |
| **CLOSED FRAMEWORK** |
| Consistent with existing requirements in the FMP and implementing regulations, the RA is authorized to conduct the following closed framework actions through appropriate notification in the Federal Register:<br>a. Reopen any sector of the fishery that had been prematurely closed.<br>c. Implement AMs, either in-season or post-season. Implement an in-season AM for a sector that has reached or is projected to reach, or is approaching or is projected to approach its ACL, or implement a post-season AM for a sector that exceeded its ACL according to the process established in the FMP, or any other established AM. |

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### 2.7.2 Discussion of Action 7 Alternatives

A framework procedure is a mechanism that can be included in an FMP to allow the Council to address recurrent, routine, or foreseeable actions in an expedited manner. Under the framework procedures, certain management actions can be adjusted via an expedited process. This differs from revising the management program via an FMP amendment, which contains additional procedural steps. The alternatives in Action 6 describe the management measures that would be appropriate to revise via the framework procedures. If the action cannot be completed via framework, then the FMP must be amended. The purpose of establishing framework procedures is to make it possible to manage fisheries more responsively under conditions requiring "real time" management (EPA 2005).

The use of framework procedures is not intended to circumvent standard FMP/amendment and rulemaking procedures under the Magnuson-Stevens Act, and must be done consistent with requirements of the Magnuson-Stevens Act, as well as other applicable law such as the Administrative Procedure Act, the Endangered Species Act, the National Environmental Policy Act, among others. To the extent that statutory requirements can be addressed up front when establishing the framework mechanism, this may result in less analysis and process being needed when individual actions are executed under that mechanism. The analyses and processes required for each individual action would depend on the specific facts and circumstances of that action (NMFS 2015). Every measure adjusted via framework must be analyzed under applicable law and be available to the public for comment at some time prior to implementation. The analysis may be provided at the same time the measure is added to the FMP, or it may be provided subsequently when the action is taken under the framework procedures in the FMP and/or its implementing regulations. The extent of analysis and notification and comment required would depend on the specificity and analysis when the framework was established (NMFS 1997).

**Types of Framework Procedures**

*Open framework procedures* allow the Council to apply discretion to adjust certain management measures. Under an open framework procedure, the Council can select among various management options to address an identified management issue, such as changing a size limit to reduce discards. An example of a past Caribbean action done through an open framework procedure was Regulatory Amendment 3 to the Reef Fish FMP, completed in 2010, which modified management in the Bajo de Sico seasonal area closures in western Puerto Rico by increasing the closure from a 3-month closure to a 6-month closure, prohibited fishing for and possession of Caribbean reef fish in or from the EEZ portion of Bajo de Sico during the closure, and prohibited anchoring in the EEZ portion of Bajo de Sico year-round (CFMC 2010).

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An open framework is used to clarify Council intent or to interpret broad terms contained in approved FMPs; it may be used to implement a portion of an approved FMP/amendment that was reserved and the Council now desires NMFS to implement. Open frameworks can be used when a Council believes a specific problem may occur in the fishery that would require addition to or amendment of the original regulations, but the exact nature of the event or the remedial action cannot be foreseen at the time the FMP is being prepared. There are different types of open frameworks, namely abbreviated and standard frameworks. **Preferred Alternative 2** proposes the use of both types of open frameworks, while **Alternatives 1, 3**, and **4** would only allow the use of the open standard framework. The two types of open frameworks are discussed below.

*Closed framework procedures* allow for adjustment of management measures in specific factual circumstances. In this case, the FMP and implementing regulations identify a specific action to be taken in the event of specific facts occurring, such as closing a sector of a fishery after their quota has been harvested (NMFS 1997). Thus, the action occurs without application of discretion. The action's ecological, economic, and social impacts have already been described in the analyses prepared when the framework measure was adopted. Examples of actions that can be taken through closed frameworks are in-season adjustments such as the closure of a fishery based on a projection of attainment of a quota, adjustment of trip limits or hours of fishing, based on actual effort, or adjustment of quotas, based on computational errors or late reporting (NMFS 1997).

All alternatives in Action 6 propose a framework procedure that includes both open and closed frameworks. However, the actions that can be taken under each of the open and closed frameworks vary among the alternatives. These are listed in Tables 2.7.1, 2.7.2, 2.7.3, and 2.7.4.

**Alternative 1** is the no action alternative and would retain without modification the existing framework procedure for implementing management measures in the St. Croix FMP. The existing framework measures were those included in the Council's Reef Fish, Spiny Lobster, Queen Conch, and Coral FMPs. These framework procedures were developed in the 2005 Caribbean Sustainable Fisheries Amendment (CFMC 2005) for stocks in the Reef Fish, Queen Conch, and Coral FMPs and further modified in the 2010 and 2011 Caribbean ACL Amendments. Framework measures for the Spiny Lobster FMP were established in the 2011 Caribbean ACL Amendment. Table 2.7.1 lists the framework measures under these FMPs. **Alternative 1** would not allow for the inclusion of new and more specific framework measures that could be taken in a relatively shorter time, such as those that can be taken through an abbreviated framework proposed in **Preferred Alternative 2**. In **Alternative 1**, some of the framework measures listed need to be updated to comport with how management is been structured under the St. Croix FMP under development. For example, a framework measure in

**Alternative 1** allows for the adjustment of annual catch targets, which have never been used to manage Caribbean resources in the Council's FMPs.

**Preferred Alternative 2** proposes a framework procedure that includes open and closed frameworks. Under **Preferred Alternative 2**, instances under which the open framework procedure may be used to implement management changes include: (A) A new stock assessment or other information indicates changes should be made to the MSY, OFL, ABC, or other related management reference points and status determination criteria (SDC); (B) New information or circumstances exist. In that instance, the Council would, as part of a proposed framework action, identify the new information and provide rationale as to why this new information indicates that management measures should be changed; (C) Changes are required to comply with applicable laws such as the Magnuson-Stevens Act, ESA, Marine Mammal Protection Act (MMPA), or are required as a result of a court order. In such instances, the Regional Administrator (RA) would notify the Council in writing of the issue and that action is required. If there is a legal deadline for taking action, the deadline would be included in the notification.

In contrast to **Alternatives 1, 3**, and **4**, actions under an open framework in **Preferred Alternative 2** can be implemented either by an abbreviated framework or by a standard framework. An abbreviated open framework can be used for routine or for insignificant changes. An abbreviated framework combines the attributes of closed frameworks (prior notice of the action, short timetable, and additional analysis likely unnecessary) and those of open frameworks (flexibility and Council input), allowing the action to be implemented quicker than a regular FMP amendment or than under a standard open framework. Examples of the type of actions that are routine or that constitute insignificant changes under **Preferred Alternative 2** are listed in Table 2.7.2, and include recreational bag and possession limit changes of no more than one fish per boat and size limit changes of no more than an inch, among others. In an abbreviated framework, a request is made with letter or memo from the Council to the RA containing the proposed action with supporting analyses (biological, social, economic). If multiple actions are proposed, a finding that the actions are also routine or insignificant must also be included. If the RA concurs and approves action, the action would be implemented through publication of notice in the Federal Register.

Changes that do not qualify as routine or insignificant would be addressed under a standard open framework, whose process is similar as that described for **Alternative 1** above. A standard open framework under **Preferred Alternative 2** requires a completed framework document with supporting analyses. Actions that can be taken through a standard open framework are listed in Table 2.7.2, and include, among others, making changes specified under the abbreviated framework that exceed the established thresholds; specification or re-specification of ABC and ABC control rule (CR); re-specification of MSY and OY, and SDC; re-specification of SYL.

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**Preferred Alternative 2** requires opportunity for public comment in at least one Council meeting, and specifies that the Council may convene the Scientific and Statistical Committee (SSC) or a district advisory panel (DAP) as appropriate.

The actions that can be taken through a closed framework under **Preferred Alternative 2** include: reopening any sector of the fishery that had been prematurely closed and implementing accountability measures, either in-season or post-season (implement an in-season AM for a sector that has reached or is projected to reach, or is approaching or is projected to approach its ACL, or implement a post-season AM for a sector that exceeded its ACL according to the procedures established in the FMP).

**Alternative 3** also proposes a framework procedure that includes the option for using open or closed frameworks. **Alternative 3** proposes a procedure that is broader than those included in **Preferred Alternative 2** and **Alternative 4**. Under **Alternative 3**, the Council may utilize this framework procedure to implement management changes in response to any additional information or changed circumstances. Under **Alternative 3**, the Council would, as part of a proposed framework action, identify any new information and provide rationale as to why this new information requires that management measures be adjusted. Open framework actions may be implemented at any time based on information supporting the need for adjustment of management measures or management parameters. These conditions make **Alternative 3** different than **Preferred Alternative 2** and **Alternative 4**, as **Preferred Alternative 2** and **Alternative 4** list specific conditions for when the open framework can be used. Actions that can be taken under **Alternative 3** are listed in Table 2.7.3.

Actions that can be taken under a standard open framework in **Alternative 3** are similar to those proposed in **Preferred Alternative 2**, with the difference that **Alternative 3** also allows to use the procedure for any other measures deemed appropriate by the Council. **Alternative 3** requires public discussion in one Council meeting and similar to **Preferred Alternative 2**, does not require convening the SSC or DAPs to prior to final action.

Actions that can be taken through a closed framework under **Alternative 3** are similar to those proposed under **Preferred Alternative 2** with the difference that **Alternative 3** also allows to take any other immediate action specified in the regulations and **Preferred Alternative 2** does not provide for that.

**Alternative 4** also proposes a framework procedure that includes open and closed frameworks, but, when compared to **Alternatives 1, 2**, and **3**, would not encompass as comprehensive a list of management measures that may be implemented through a framework procedure (Table 2.7.5). An open standard framework in **Alternative 4** can only be used when a new stock assessment or

other information indicates changes should be made to the MSY, OFL, ABC, or other related management reference points or when new information or circumstances indicates management measures listed in Table 2.7.5 should be changed. Such a narrow list of measures and conditions for use makes **Alternative 4** less efficient than the other alternatives proposed as it would not allow for a rapid adjustment of additional management measures that otherwise could be streamlined through the framework procedure.

Different than **Preferred Alternative 2** and **Alternative 3**, **Alternative 4** requires public discussion in at least three Council meetings and discussion at separate public hearings. Also, the Council shall convene its SSC and/or DAPs to provide recommendations on the proposed actions. These requirements may make the framework process for some actions longer than they could be under **Alternatives 1, 2**, and **3**.

Actions that can be taken through a closed framework in **Alternative 4** are similar to those proposed in **Preferred Alternative 2** but differ from **Alternative 3** in that **Alternative 3** also allows the Council to take any other immediate action specified in the FMP and implementing regulations.

**Table 2.7.5**. Differences among the action alternatives in Action 7.

| **Description** | **Preferred Alternative 2 (base)** | **Alternative 3 (broad)** | **Alternative 4 (narrow)** |
|---|---|---|---|
| Types of Framework (FMW) Procedures | - Open abbreviated (Abbv.)<br>- Open Standard<br>- Closed | - Open Standard<br>- Closed | - Open Standard<br>- Closed |
| When can open framework be used | - New stock assessment or other information indicates changes should be made to MSY, OFL, ABC or other related management reference points and SDC<br>- New information or circumstances<br>- When changes are required to comply with applicable law or court order.<br>*Abbreviated Framework can be used for minor or insignificant changes.<br>*Standard framework for all other allowed changes. | In response to any additional information or changed circumstances. | - New stock assessment or other information indicates changes should be made to MSY, OFL, ABC or other related management reference points and SDC<br>- New information or circumstances |

| Description | Preferred Alternative 2 (base) | Alternative 3 (broad) | Alternative 4 (narrow) |
|---|---|---|---|
| Actions that can be taken | - Abbreviated Open FMW can be used for actions that are considered minor and insignificant<br>- Standard Open FMW. Used for all others. List of actions that can be taken under Abbv. And Standard Open FMW are given.<br>- Closed FMW can be used for a specific list of actions. | - Open FMW can be used for a representative list of actions, plus other measures deemed appropriate by the Council.<br>- Closed FMW can be used for a specific list of actions, plus any other immediate actions specified in the FMP and implementing regulations. | - Open FMW can only be used for specific listed actions.<br>- Closed FMW can be used for a specific list of actions. |
| Public Input | Requires public discussion in at least one Council meeting. | Requires public discussion at one Council meeting | Requires public discussion during at least three Council meetings, and discussion at separate public hearings within the areas most affected by the proposed measures. |
| APs/SSC participation | The Council may convene its SSC or an AP(s), as appropriate | Convening the SSC or an AP(s) prior to final action is not required. | The Council shall convene its SSC and an AP(s). |
| How is a request of action made | - Abbv. requires a letter or memo from the Council with supporting analyses<br>- Standard requires a completed FMW document with supporting analyses. | Via letter, memo, or the completed FMW document with supporting analyses. | Via letter, memo, or the completed FMW document with supporting analyses. |

**<u>Comparison of Action 7 Alternatives and Summary of Effects</u>**

Modifying the framework procedure in Action 7 is not expected to have direct effects on the physical or biological/ecological environments. However, if the level of fishing effort or the use

of certain gear types is affected by the management strategies modified by the framework, the physical environment could be affected by changing the interactions between gear and the habitat. The biological/ecological environment could also be indirectly affected by those framework actions that modify fishing effort to protect the biological integrity of the managed resources and decrease the risk of overfishing those resources.

Indirect effects to the physical and biological/ecological environments would be expected from those framework measures that result in a faster protection of the habitat from gear/habitat interactions (physical effects) or a faster protection to the biology of the stocks (biological effects) than if the measure was changed through a regular FMP amendment, such as the specification or modification of gear restrictions, including those that minimize the interaction of fishing gear with endangered species such as listed habitat-forming corals (e.g., *Orbicella annularis*, *Orbicella franski*) found in **Alternatives 1, 2** (Preferred), and **3**, and those actions that close/open areas to fishing, adjust harvest, and regulate fishing effort (e.g., adjustment of trip limits, bag limits, size limits, ABCs, ACLs), among others, which are included in all alternatives proposed but with varied limitations.

The potential indirect physical and biological benefits from **Alternative 3** are expected to be slightly larger than those from **Alternatives 1, 2** (Preferred), and **4**, given that **Alternative 3** allows for a broader spectrum of measures that can be rapidly implemented through framework. **Alternative 4** would be the least beneficial to the physical and biological/ecological environments because the range of actions that could be taken more expeditiously through framework is more limited than the other alternatives. Administratively, by allowing the use of both abbreviated and standard frameworks and the inclusion of a comprehensive list of actions, **Preferred Alternative 2** would provide the best balance between the actions allowed to be implemented under the framework and the procedure required to take these actions. Also when compared to **Alternatives 1, 3**, and **4**, **Preferred Alternative 2** provides the opportunity for sufficient public review and involvement in the process, while still accommodating the ability for more streamlined implementation.

From an economic perspective, the alternatives listed in Action 5 represent administrative actions. Hence, none of the alternatives would have a direct economic impact on the economic environment. Framework procedures that reduce the amount of time needed to change a management measure, however, could provide benefits in the nature of stock/stock complex protection or rebuilding. In addition, regulations that may be forthcoming in response to a change in framework procedures could indirectly result in a change in the economic environment via a change in effort and/or fishing techniques.

In terms of social effects, timing and public input become the parameters that are most constrained or alleviated by the various alternatives for a framework procedure. **Alternative 1** does not allow new framework procedures that may be tailored specifically to St. Croix which may incur some indirect negative social effects. The framework procedure in **Preferred Alternative 2** provides the most flexibility compared to **Alternatives, 1, 3**, and **4** and would likely have the most beneficial social effects. The proposed framework actions in **Alternative 3** are likely to have slightly fewer beneficial social effects as it does not require as much public input under certain procedures, whereas **Alternative 4** requires the most extensive input from the public, DAP and SSC with three Council meetings which could extend the process unnecessarily when expedited action is needed.

DRAFT

# Chapter 3. Affected Environment – Description of the St. Croix Management Area

## 3.1 Introduction

Chapter 2 describes the environment and resources included within the St. Croix management area. The affected environment is divided into five major components. The physical, biological and ecological, economic, social, and administrative environments of the St. Croix exclusive economic zone (EEZ) have been described in detail in the 2010 and 2011 Caribbean Annual Catch Limit (ACL) Amendments (CFMC 2011a, b) and associated environmental impact statements (EIS). Information from these documents is incorporated herein by reference. These amendments can be found on the National Marine Fisheries Service (NMFS) Sustainable Fisheries, Caribbean Branch website.

## 3.2 Physical/Habitat Environment

The physical environment of the U.S. Caribbean, including St. Croix, were described in detail in the Generic Essential Fish Habitat (EFH) Amendment to FMPs of the U.S. Caribbean, the EFH Final Environmental Impact Statement (EFH-FEIS) (CFMC 1998, 2004), the Five-Year review of EFH in the U.S. Caribbean, Vols.1 and 2 (CFMC 2011c), and Regulatory Amendment 2 to the Queen Conch FMP (CFMC 2013a). These documents are incorporated herein by reference and are summarized below.

### 3.2.1 Geography and Geology

The U.S. Caribbean is located in the eastern portion of the Caribbean archipelago, about 1,100 miles (mi) (1,770 km) east-southeast of Miami, Florida (Olcott 1999). The region is composed of the Commonwealth of Puerto Rico in the Greater Antilles and the Territory of the USVI in the Lesser Antilles island chains (Figure 2.2.1), both of which separate the Caribbean Sea from the western central Atlantic Ocean. The U.S. Caribbean EEZ covers an area of approximately 196,029 square kilometers ($km^2$) (75,687 square miles [$mi^2$]).

The USVI are part of the Virgin Islands chain, which lies in the northeastern Caribbean about 80 km (50 miles) east of Puerto Rico's main island. The USVI consist of four major islands, including St. Thomas, St. John, St. Croix, and Water Island, and about 50 cays (DPNR 2005). Together, the USVI constitutes approximately 347 $km^2$ (134 $mi^2$) of land area (Catanzaro et al. 2002).

The island of St. Croix is located about 74 km (46 mi) south of St. Thomas and St. John (CFMC 2004). Covering about 207 $km^2$ (80 $mi^2$), St. Croix is entirely surrounded by the Caribbean Sea. The island of St. Croix lies on a different geological platform than the islands of St. Thomas and St. John, and is separated from those islands by a 4 km (2.5 mi) deep trench (CFMC 2004). The St. Croix shelf is much narrower and shallower than that of the northern islands (Goenaga and Boulon 1992), extending only 4 km ( 2.2 nm) wide in the south, less than 0.2 km (0.1 nm) wide on the northwest, and up to several nautical miles wide in the northeast and on Lang Bank (CFMC 2004; CFMC 2011a). In total, the St. Croix shelf has an area of approximately 99 $nm^2$ (343 $km^2$) (references in Gordon 2010). Most of the shelf area is less than 80 ft (24.4 m) deep (Kojis and Quinn 2012).

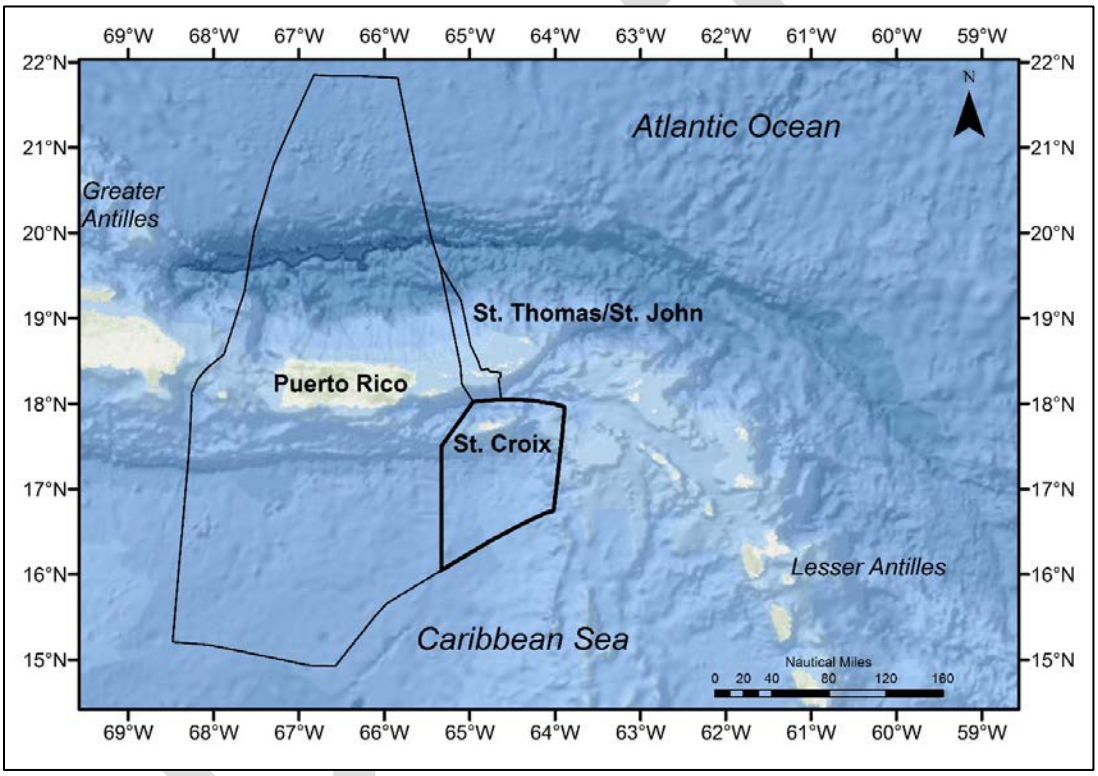


**Figure 3.2.1**. Boundaries of the U.S. Caribbean EEZ with St. Croix EEZ outlined in bold.

Puerto Rico shares the same shelf platform as St. Thomas and St. John, and that shelf also extends east to include the British Virgin Islands. 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 (Figure 2.2.2). Section 3 of the EFH-FEIS (CFMC 2004) summarizes the available information on the geology of the U.S. Caribbean.

St. Croix is 84 square miles in size, 22 miles long and the widest point is a little more than 6 miles. The terrain on the east end of the island is rocky and arid with short grassy hillsides and many cactus clusters. The west end of the island is lush with large fruit trees and ferns gracing the mountains. In the middle of the island are miles of beaches and rolling pasture lands. St. Croix's highest peak, Mount Eagle, is 1,088 feet high. The land slopes to flat-lands on the southern side of the island. There are a few natural harbors and protected bays. St. Croix is about 40 miles away from St. Thomas.

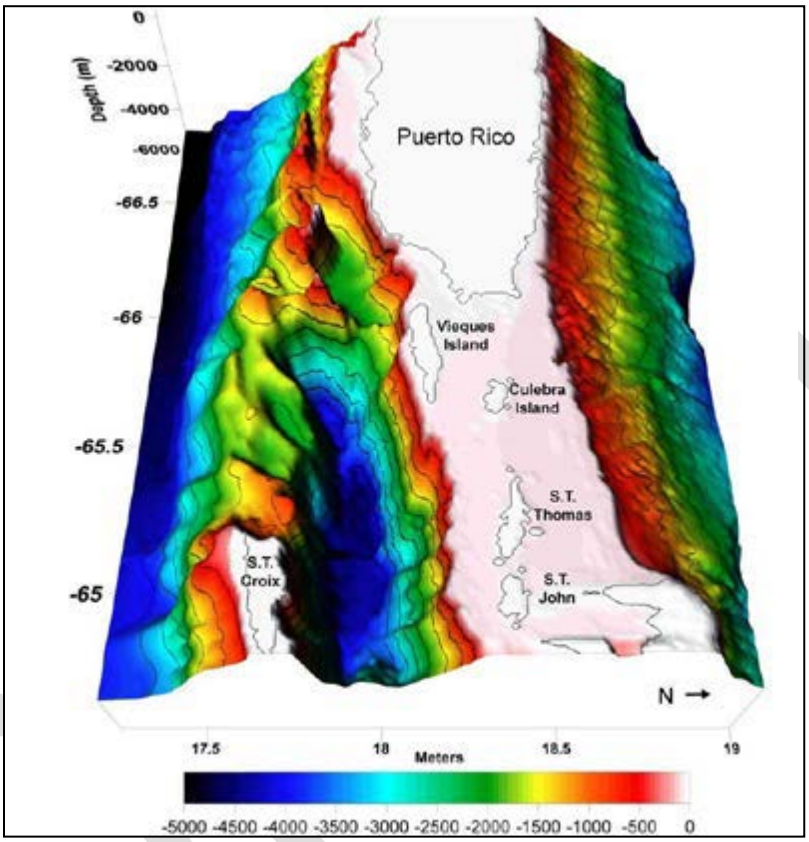


**Figure 3.2.2.** Shared platform between the east coast of Puerto Rico and St. Thomas/St. John. The deep trough between the Puerto Rico/St. Thomas/St. John platform and St. Croix is clearly seen in this graphic representation of depth.
(Source: García-Sais et al. 2005)

## 3.2.2 Oceanography and Climatology

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. 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 62 mi (100 km) south of the U.S. Caribbean islands at an average speed of 0.5 to 1 knots (CFMC 2004). The current is characterized by large cyclonic and anticyclonic gyres. Its strength is influenced by changes in the position of the inter-tropical convergence zone (ITCZ). 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, generally in the late winter to spring. The wet season occurs when the ITCZ is at its most northerly position in the Caribbean, generally in the late summer into late fall (CFMC 2011a and references therein).

Surface water salinity changes along with the seasonal change in precipitation and the position of the ITCZ. Discharge from the Amazon, Orinoco, and Magdalena rivers is the main contributor to buoyancy in the Caribbean Sea, increasing silica concentrations, decreasing salinity (Yoshioka et al. 1985) and increasing chlorophyll and pigments, as well as increasing the input of terrestrial materials (Kjerfve 1981). These parameters vary with changes in the outflow from these South American rivers, dependent on rainfall in the areas supplying water to these rivers and the ITCZ-driven currents transporting those discharges.

Sea surface temperature ranges from a minimum of 25 degrees Celsius (ºC) in February-March to a maximum of about 28.5ºC in August-September. Tidal regimes differ between the north and south coasts. The fluctuations range from a diurnal tide of about 3.9 in (10 cm) on the south coast to a semi-diurnal regime of between 24-39 in (60 to 100 cm) along the north coast, where waves are larger (CFMC 2004). But the astronomical tidal range is slight (8 to 12 in [20 to 30 cm]) (Kjerfve 1981).

Detailed information about the oceanography and climate of Puerto Rico and USVI can be found in Section 5.1.2 of the 2010 Caribbean Annual Catch Limit (ACL) Amendment and is incorporated herein by reference. No effects to the oceanography or to the climate are expected from this action. More information on the effects of climate change is included in the Cumulative Effects Analysis (Chapter 9).

### 3.2.3 Coastal and Marine Habitats

The fisheries of the U.S. Caribbean rely on healthy coastal and marine environments and habitats. While the islands of the U.S. Caribbean share physical and biological similarities, they exhibit unique differences. For instance, mangroves, seagrasses, coral reefs, and estuaries are

found throughout the islands of the U.S. Caribbean. Yet, the distribution and magnitude of these environments vary, and those variations are reflected in the distribution and abundance of fish species that support the fisheries pursued on each island.

The island of St. Croix has a variety of man-made structures, including a pier, docks/marinas, a boardwalk and a jetty, and many natural shoreline types, ranging from sandy beaches to sheer cliffs.
The St. Croix fishery constitutes an important part of the ecosystems in the U.S. Caribbean. NMFS defines ecosystem as a geographically specified system of organisms, involving complex connections between fishery resources, humans, their environments, and the processes that control their dynamics.

A description of the major habitat types in the U.S. Caribbean EEZ, along with information on their ecological functions and condition, can be obtained in Section 3.2 of the EFH-FEIS (CFMC 2004) and in Section 5.1.3 of the Caribbean Sustainable Fisheries Act (SFA) Amendment (CFMC 2005), are incorporated herein by reference, and are summarized below. A description of the major habitat types of St. Croix can be found in the USVI Marine Resources and Fisheries Strategic and Comprehensive Conservation Plan, prepared by the Department of Planning and Natural Resources (DPNR) of the USVI (DPNR 2005) and is incorporated herein by reference.

The coastal marine environments of the USVI and Puerto Rico are characterized by a wide variety of habitat types. Kendall et al. (2001) delineated 21 distinct benthic habitats types. The EFH-FEIS (CFMC 2004) summarized the percent distribution for all habitats in the U.S. Caribbean from the 5,494 $km^2$ (2,121 $mi^2$) of total bottom area mapped from aerial photographs. This total included both Puerto Rico (5,009 $km^2$ [1,934 $mi^2$]) and the USVI (485 $km^2$ [187 $mi^2$]), and covered from the shore line to about 20 m (66 ft) depth.

In the USVI, 24 $km^2$ (9 $mi^2$) of unconsolidated sediment, 161 $km^2$ (62 $mi^2$) of SAV, 2 $km^2$ (0.8 $mi^2$) of mangroves, and 300 $km^2$ (116 $mi^2$) of coral reef and hard bottom were mapped over an area of 485 $km^2$ (187 $mi^2$)(CFMC 2013).

#### 3.2.3.1 Essential Fish Habitat

Essential fish habitat is defined in the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) as “those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity” (16 U.S. C. 1802(10)). Specific categories of EFH identified in state and federal waters of St. Croix, which are utilized by federally managed fish and invertebrate species, include both estuarine/inshore and marine/offshore areas. Specifically, estuarine/inshore EFH includes estuarine emergent and mangrove wetlands, submerged aquatic vegetation, intertidal flats, palustrine emergent and forested systems, and the estuarine water

column. Additionally, marine/offshore EFH includes live/hard bottom habitats, coral and coral reefs, seagrass and algal plains, sand and shell substrate, and the marine water column. Essential fish habitat includes the spawning area in the water column above the adult habitat. EFH utilized by fish and invertebrate species in this region includes coral reefs, live/hard bottom, and submerged aquatic vegetation.

#### 3.2.3.1.1 Habitat Areas of Particular Concern (HAPC)

The Caribbean SFA amendment designated HAPCs in the Reef Fish and Coral FMPs based on confirmed spawning locations and areas or sites identified as having particular ecological importance to managed species.

#### 3.2.3.1.2 Effects of Fishing on Essential Fish Habitat

The effects of fishing on EFH were thoroughly described in the 2004 EFH-EIS. Specifically, 'Section 3.5.1.2 Determination of identifiable adverse fishing effects' describes the impacts by gears including all gears currently in use for harvesting the new species proposed for management (e.g., hook and line; spear). All prohibited gear such as trawls and explosives are also discussed. The following is a summary of the information contained in the 2004 EFH-EIS.

The impacts of fishing gears on fish habitat in the southeastern U.S. and the U.S. Caribbean have been described in Hamilton (2000) and Barnette (2001). In most cases, limited data preclude definitive conclusions on the impacts of fishing gears on specific habitats in the Caribbean. However, these papers indicate the types of habitat most likely to suffer damage from each gear. Based on the analysis of the effects of fishing on EFH described in Section 2.1.5 of the 2004 EFH-EIS, the actions taken to limit the impact of fishing on EFH included modifications to anchoring techniques; 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.

As part of an effort to identify fishing impacts on fish habitat from the gears used in the Gulf of Mexico, South Atlantic, and Caribbean Regions, Rester (2000a; 2000b) completed an annotated bibliography that compiled a listing of papers and reports that addressed fishery-related habitat impacts. The bibliography included scientific literature, technical reports, state and federal agency reports, college theses, conference and meeting proceedings, popular articles, memoranda, and other forms of nonscientific literature, but did not include studies that pertained to the ecosystem effects of fishing (e.g. changes in the biological community structure). While recognizing that fishing may have many varying impacts on EFH, the bibliography focused on the physical impacts of fishing activities on habitat.

Hamilton (2000) summarized a December 1999 workshop concerning gear impacts on EFH attended by NOAA Fisheries scientists and managers. The workshop participants examined existing studies on gear impacts, and examined which factors made gear impact studies relevant to the Southeast region. The criteria included whether the specified gear was utilized in the Southeast Region, whether it was utilized in the same manner (similar fisheries), and whether the habitat was similar. This review recognized that in many instances numerous epifaunal and infaunal species are an integral part of benthic habitat. Such species act as ecosystem engineers and modify the habitats they occupy through burrowing activities (Coleman and Williams 2002). Therefore, studies that document impacts (*i.e.*, reduction in biomass or species diversity) to benthic communities have been included in this section. Recommendations were made concerning future research needs, and a table of the relative impacts of various fishing gears on different habitats was developed.

Barnette (2001) used the over 600 papers compiled by Rester (2000a, 2000b, 2001) to examine fishing impacts in the Southeast Region. The following section is largely excerpted from Barnette (2001). Barnette found a paucity of readily available information on the numerous types of gear utilized within the Caribbean, South Atlantic, and Gulf of Mexico. While there have been hundreds of studies published on gear impacts worldwide, the majority of these focus on mobile gear such as dredges and trawls. Furthermore, in addition to the approved gears within the various FMPs, there are other gears utilized within state and territorial waters that also needed to be evaluated because EFH may extend into coastal and estuarine waters. However, there are few, if any, habitat impact studies that have been conducted on many of these gear types.

Johnson (2002) also reviewed literature (through May 2002) dealing with the effects of fishing gears on benthic habitats. The document focused on mobile gears, such as trawls and dredges, which are not typically used in Caribbean fisheries, but also contained some information on traps, pots, longlines, and gill nets.

Morgan and Chuenpagdee (2003) reviewed literature on gear impacts, summarized these findings and presented them to an expert panel of fishers, scientists, and managers who then ranked habitat impacts for 10 fishing gears commonly used in U.S. fisheries. In this instance, gear impacts considered physical habitat damage, bycatch, and potential ghost fishing together. Based on the results of the panel workshop, a questionnaire was developed to assess fishing impacts, which was circulated among a broad range of marine fisheries experts. Results from the questionnaires were analyzed to rank fishing gear impacts and categorize gears as having high, medium, or low impacts. The report states that bottom trawls, bottom gillnets, dredges, and midwater gillnets have relatively high impacts; pots/traps, pelagic longlines, and bottom longlines have medium impacts; while midwater trawls, purse seines, and hook and line have

relatively low impacts. Based on the Morgan and Chuenpagdee (2003) report, the gear impacts for gears used in Caribbean fisheries from high to low would be: bottom gillnets (high); pots/traps, bottom longlines, pelagic longlines (medium); hook and line (low).

The Council prohibited explosives and poisons due to the documented habitat damage associated with those methods, but the methods are briefly reviewed because of their historical use. While trawls are not used within the region, they are allowed for non-FMP fisheries (50 CFR 600.725).

The nature and magnitude of the effects of fishing activities depend heavily upon the physical and biological characteristics of a specific area in question. There are strict limitations on the degree to which probable local effects can be inferred from the studies of fishing practices conducted elsewhere (North Carolina Division of Marine Fisheries 1999). The extreme variability that occurs within marine habitats confounds the ability to easily evaluate habitat impacts on a regional basis. Obviously, observed impacts at coastal or nearshore sites should not be extrapolated to offshore fishing areas because of the major differences in water depth, sediment type, energy levels, and biological communities (Prena et al. 1999).

Of the gears used in the U.S. Caribbean (state and federal waters) pots and traps, longline, vertical gear, and gillnets and trammel nets have the highest individual impact and the greatest potential for adverse damage to fish habitat. Hand harvest of coral and live/hard bottom, if it were allowed, could also cause substantial habitat damage. Of the habitat types considered in the U.S. Caribbean, coral has the greatest vulnerability to fishing impacts, followed by hard bottom and SAV. Barnette (2001) noted that several gears have negligible or minimal impacts on fish habitat, but that this conclusion was based on limited information. For the Caribbean region, specifically, less information is available than in other regions. Reduction of coral and reef heterogeneity due to damage or removal of physical structure can seriously impact available shelter for juvenile fishes and post-settlement larvae, and there is likely a correlation between topographic relief and fish abundance (Luckhurst and Luckhurst 1978). However, conclusions drawn on impacts, or lack of impacts, should be made cautiously.

A “Symposium on Impacts from Fishery Activities to Benthic Habitats” was held in Tampa, Florida on November 11-15, 2002. The following is a summary of the meeting prepared by SSC member R. Boulon for the Council.

The driving force for this symposium was the question of the relationship of EFH and impacts to benthic habitats by fishing activities. This requirement was instrumental in the development of three questions that were defined as the goals for this symposium: 1. What have we learned about fishery impacts? 2. What more do we need to know? 3. What do we know enough about to act on right now?

However, the greatest need (and where very little information exists beyond nearshore, shallow water areas) is accurate mapping of benthic habitats. Without knowing what exists and where it is, management measures to protect or conserve benthic habitat cannot be developed. The next step is identifying the level and distribution of fishing activities relative to our benthic habitats. Once mapped, habitats can be classified based on their availability (how much there is), their vulnerability (which is based on frequency of natural disturbance) and their risk (measured by frequency of disturbance from fishing activities).

NOAA's R/V Nancy Foster, Okeanos Explorer and others have contributed to the efforts of mapping the marine habitats by producing high resolution bathymetry, side scan sonar imagery and documenting the species and associated habitat at depth. However, to date we are still lacking a comprehensive map of the habitats in the area.
DeAlteris et al. (1999) stated that fishery-related impacts to fish habitat need to be compared to natural causes, both in magnitude and frequency of disturbance. Fishing can be adjusted or eliminated to complement particular habitats, whereas natural conditions continue unabated.

#### 3.2.3.1.3 Non-Fishing Impacts Threats to the Coastal and Marine Environments and Essential Fish Habitat

Hurricanes Irma and Maria clearly demonstrated the extent to which coastal and marine environments and essential fish habitat can be altered by non-fishing impacts, the hurricanes themselves. Assessment of the impact to coral reefs, many monitored over the past 20 years by PRDNER/NOAA, is currently under way. These coral reef areas are found in shallower depths to about 30 m. Mesophotic reefs are also currently being assessed to determine impacts to habitats at depths between 30 and 50 m (CRCP FY 18) caused by the hurricanes.

The passage of storms and hurricanes through mangroves and seagrasses can cause uprooting, mechanical defoliation, and deposition of sediment and other materials. This stress can eliminate vegetation from some areas. For mangroves, following the acute stress, there is a rapid reestablishment of new seedlings on suitable habitats, and the system restores itself. Seagrasses also may recover quickly, if damage is slight and the substrate has not been severely altered. Some storms may have beneficial effects on mangroves such as removing accumulations of materials choking drainage ways, and reopening salt ponds to the sea. Such tropical disturbances are important agents that redistribute materials along the coast. Storms passing within +/- 2° of Puerto Rico have increased in number and intensity since 1990.

Damage to coral reefs in Puerto Rico and the USVI due to natural phenomena has been well documented. A large portion of the U.S. Caribbean lies within the hurricane belt and therefore reefs are frequently exposed to severe hurricane related impacts. Hurricanes can modify

substantial portions of shallow reefs. Two tropical storms in 1979 (David and Frederic) caused extensive damage on the outer east coast and southern coastal reefs, especially in the shallow *Acropora palmata* zone, off the eastern point of Vieques and off St. Croix (Goenaga and Cintrón 1979, Rogers 1982). Changes to the shape of emergent reefs, and to the flora in these reefs, were documented in La Parguera after these hurricanes (Armstrong 1980, Matta 1982). Hurricane Hugo caused a significant reduction in total living scleractinian cover on reefs on the south side of St. John (Rogers et al 1991). It devastated portions of coral reefs and seagrass beds off St. Croix (Rogers et al 1991). Rogers et al (1991) were able to study the effect of Hurricane Hugo that hit the USVI in 1989. Analysis of quantitative data collected before and after the storm allowed documentation of the effects of this powerful storm on coral community structure. The total living cover by scleractinians, including the dominant species, *Montastrea annularis*, decreased significantly. The amount of substrate available for colonization increased. Cover by macroscopic algae increased dramatically after the storm, later decreased, and then rose again one year later. It appears that the level of herbivory by urchins and fishes is too low to keep the macroalgae in check, and algae are inhibiting coral settlement and growth (Rogers et al. 1997). In spite of the reduction in live coral cover by the dominant coral species, neither diversity nor evenness increased. Hurricane Georges in 1998 was the worst hurricane since San Ciprián in 1932, with sustained winds of 185 km/hour. Hurricane Maria might be significantly more devastating than any previous storm that had impacted Puerto Rico. Testimony from fishers at the Council meeting immediately after Maria provided evidence of the changes to the seascape.

The non-fishing impacts to EFH were also thoroughly discussed in Section 3.5.2 of the 2004 EFH-EIS, the EFH 5-year Review (2011) and are incorporated herein by reference. Currently there are two on-going efforts to expand on the information on non-fishing impacts, the second 5-year EFH Review and the development of a Fishery Ecosystem Plan.

#### 3.2.3.2 Fishable Habitat

In the Caribbean SFA Amendment (CFMC 2005), fishable habitat was defined as those waters less than or equal to 100 fathoms (fms) (600 ft; 183 m). The majority of fishing activity for Council-managed species occurs in that area, except for fishing for deep-water snappers, which occurs primarily in the EEZ at depths greater than 100 fms (600 ft; 183 m) (CFMC 2005). The total area of fishable habitat (less or equal to 100 fms) in the U.S. Caribbean is estimated to be approximately 2,214.1 square nautical miles ($nm^2$) (7,594 $km^2$) (Table 3.13.1), with only 13.8% of that area within the U.S. Caribbean EEZ. The total area of fishable habitat in the St. Croix management area is 109.3 $nm^2$ (375 $km^2$), of which 18.1% occurs in the EEZ.

**Table 3.2.1**. Estimates of fishable habitat areas in the U.S. Caribbean.

| Region | Total Fishable Habitat Area | Fishable Habitat in EEZ Waters | Fishable Habitat in Territorial Waters |
|---|---|---|---|
| U.S. Caribbean (EEZ and Territorial Waters combined) | 7594 $km^2$ (2214.1 $nm^2$) | 1045 $km^2$ (304.7 $nm^2$) | 6549 $km^2$ (1909.4 $nm^2$) |
| USVI (total) | 1771 $km^2$ (516 $nm^2$) | 635 $km^2$ (185 $nm^2$) | 1136 $km^2$ (331 $nm^2$) |
| St. Croix | 375 $km^2$ (109.3 $nm^2$) | 68 $km^2$ (19.8 $nm^2$) | 307 $km^2$ (89.5 $nm^2$) |

Source: NMFS-SERO 2015

## 3.3 Biological and Ecological Characteristics

St. Croix waters support hundreds of fish species and invertebrates including corals and organisms associated to coral reefs. Of those, 81 species of reef fish, 58 species of aquarium trade fish, spiny lobster (one species), queen conch (one species), 94 species or species groups of corals, and 63 species or genera of aquarium trade invertebrates were previously managed by the Council under their Reef Fish, Spiny Lobster, Queen Conch, and Coral FMPs. Most of those species would be retained in the St. Croix FMP, resulting from Preferred Alternative 2 of Action 1. Many of these species are harvested by commercial, recreational, and/or subsistence fishermen in the St. Croix fishery, while others are species that provide an important ecological function, such as shallow and deep-water corals and several species of herbivorous fish and invertebrates.

### 3.3.1 Stock Management

Stocks in the fishery can be grouped into stock complexes as appropriate. Target stocks are stocks or stock complexes that fishermen seek to catch for sale or personal use, including such fish that are discarded for economic or regulatory reasons as defined under the Magnuson-Stevens Act. The non-target species and non-target stocks are fish caught incidentally during the pursuit of target stocks in a fishery. Non-target stocks may require conservation and management and, if so, must be included in an FMP and be identified at the stock or stock complex level. If non-target species are not in need of conservation and management, they may be identified in an FMP as EC species.

The Council, with input from the Council's Scientific and Statistical Committee (SSC) and District Advisory Panels (DAP), established a process for determining which stocks would be included in the new St. Croix FMP. For those species for which landings data are available, the Council followed a stepwise application of a set of criteria to determine if a species should be managed under the St. Croix FMP. Section 2.2 of this document contains a description of each criterion and the list of species included in or excluded from the St. Croix FMP.

Species identified for inclusion in the St. Croix FMP, would compose those that the Council believes are the most important to fishermen in federal waters off St. Croix. Under Action 2, Preferred Alternative 2, a total of 43 finfish would be managed under the St. Croix FMP along with spiny lobster, queen conch, and all species of sea urchins, sea cucumbers, and corals within the St. Croix EEZ (see Table 3.3.1 below).

Stock Complexes

Once species are assigned as targeted or non-targeted stocks, the Council has the option to group stocks into "stock complexes". A stock complex is a group of stocks that are sufficiently similar in geographic distribution, life history characteristics, and vulnerability to the fishery (see box) such that the impact of management actions on the stocks is similar. National Standard 3 of the Magnuson-Stevens Act requires that, to the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination (50 CFR 600.320).

***Definitions***

**Productivity** – the capacity of the stock to produce maximum sustainable yield and to recover if the population is depleted.

**Susceptibility** – the potential for the stock to be impacted by the fishery, which includes direct captures, as well as indirect impacts to the fishery (e.g., loss of habitat quality).

**Vulnerability** – the combination of a stock's productivity, which depends upon its life history characteristics, and its susceptibility to the fishery.

Stocks may be grouped into complexes for various reasons, for example, where stocks in a multispecies fishery cannot be targeted independent of one another; where there is insufficient data to measure a stock's status relative to SDC; or when it is not feasible for fishermen to distinguish individual stocks among their catch. The vulnerability of individual stocks should be considered when determining if a particular stock complex should be established or reorganized, or if a particular stock should be included in a complex. The FMP should provide, to the extent practicable, a full and explicit description of the proportional composition of each stock in the stock complex, at the time the stock complex is established.

The species resulting from the selection process in Action 2 were either grouped as stock complexes or managed as individual stocks based on scientific analysis, biological/life history similarities and vulnerability; or, expert opinion from the scientific and fishing communities. Species included in the St. Croix FMP would be managed as 13 individual stocks and 13 stock complexes (see Table 3.3.1 below).

Indicator Stocks

The Magnuson-Stevens Act NS1 Guidelines define an indicator stock as a stock with measurable and objective SDC that can be used to help manage and evaluate the more poorly known stocks that are in a stock complex[22]. Where practicable, stock complexes should include one or more indicator stocks (each of which has SDC and ACLs). Otherwise, stock complexes may be comprised of: several stocks without an indicator stock (with SDC and an ACL for the complex as a whole), or one or more indicator stocks (each of which has SDC and management objectives) with an ACL for the complex as a whole. Councils should review the available quantitative or qualitative information (e.g., catch trends, changes in vulnerability, fish health indices, etc.) of stocks within a complex on a regular basis to determine if they are being sustainably managed.

If an indicator stock is used to evaluate the status of a complex, it should be representative of the typical vulnerability of stocks with the complex (see box above). If the stocks within a stock complex have a wide range of vulnerabilities, they should be reorganized into different stock complexes according to similar vulnerabilities; otherwise the indicator stock should be chosen to represent the more vulnerable stocks within the complex. In instances where an indicator stock is less vulnerable than other members of the complex, management measures should be more conservative so the more vulnerable members of the complex are not at risk from the fishery.

More than one indicator stock can be selected to provide a broader base of information about the status of the complex. When indicator stocks are used, the stock complex's MSY could be listed as “unknown,” while noting that the complex is managed on the basis of one or more indicator stocks that do have known stock-specific MSYs, or suitable proxies.

For the St. Croix FMP, an indicator stock is one where the status of the indicator stock is extrapolated to represent that of other stocks in a multi-species stock complex. The Council’s SSC recommended indicator stocks with the intent that the indicator stock was representative of the typical vulnerability of stocks with the complex. An indicator stock(s) was assigned to a complex based on the following criteria: percent of the catch, targeted, habitat co-occurrence, life history/vulnerability, catch co-occurrence, data availability, and market value. Stocks in the stock complex would be subject to AMs based on the indicator stock ACL.

[22] https://www.govinfo.gov/content/pkg/FR-2016-10-18/pdf/2016-24500.pdf

In the St. Croix FMP, six indicator stocks were selected (Table 3.3.1), with two indicators selected for each of the Snapper 1 and Parrotfish 2 stock complexes. If no indicator stocks were identified, for stock complexes for which harvest is allowed, species in the complex would be subject to AMs as a group based on the aggregate ACL.

**Table 3.3.1.** Stocks and stock complexes included in the St. Croix FMP. Where applicable, indicator stocks are in bold text. Species new to management are marked with a plus sign+.

| Family or Class | Stock/Stock Complexes | Species Name | Common Name |
|---|---|---|---|
| Strombidae -- True conchs | Queen Conch | *Lobatus (Strombus) gigas* | Queen conch |
| Palinuridae -- Spiny lobster | Spiny Lobster | *Panulirus argus* | Caribbean spiny lobster |
| Lutjanidae -- Snappers | Snapper 1 | *Apsilus dentatus* | Black snapper |
| | | ***Lutjanus buccanella*** | **Blackfin snapper** |
| | | ***Lutjanus vivanus*** | **Silk snapper** |
| | | *Rhomboplites aurorubens* | Vermilion snapper |
| | Snapper 2 | *Etelis oculatus* | Queen snapper |
| | Snapper 3 | *Lutjanus griseus* | Gray snapper |
| | | *Lutjanus synagris* | Lane snapper |
| | Snapper 4 | *Lutjanus analis* | Mutton snapper |
| | Snapper 5 | *Lutjanus apodus* | Schoolmaster |
| | Snapper 6 | *Ocyurus chrysurus* | Yellowtail snapper |
| Serranidae -- Groupers | Grouper 1 | *Epinephelus striatus* | Nassau Grouper |
| | Grouper 2 | *Epinephelus itajara* | Goliath grouper |
| | Grouper 3 | ***Cephalopholis fulva*** | **Coney** |
| | | *Cephalopholis cruentata* | Graysby |
| | Grouper 4 | *Epinephelus adscensionis* | Rock hind |
| | | ***Epinephelus guttatus*** | **Red hind** |
| | Grouper 5 | *Mycteroperca bonaci* | Black grouper |
| | | *Epinephelus morio* | Red grouper |
| | | *Mycteroperca tigris* | Tiger grouper |
| | | *Mycteroperca venenosa* | Yellowfin grouper |
| | Grouper 6 | *Hyporthodus mystacinus* | Misty grouper |
| Scaridae -- Parrotfish | Parrotfish 1 | *Scarus coeruleus* | Blue parrotfish |
| | | *Scarus coelestinus* | Midnight parrotfish |
| | | *Scarus guacamaia* | Rainbow parrotfish |
| | Parrotfish 2 | *Scarus vetula* | Queen parrotfish |
| | | *Scarus taeniopterus* | Princess parrotfish |
| | | ***Sparisoma chrysopterum*** | **Redtail parrotfish** |
| | | ***Sparisoma viride*** | **Stoplight parrotfish** |
| | | *Sparisoma aurofrenatum* | Redband parrotfish |
| | | *Sparisoma rubripinne* | Redfin parrotfish |
| | | *Scarus iseri* | Striped parrotfish |

| Family or Class | Stock/Stock Complexes | Species Name | Common Name |
|---|---|---|---|
| Acanthuridae -- Surgeonfish | Surgeonfish | *Acanthurus coeruleus* | Blue tang |
| | | *Acanthurus tractus* | Ocean surgeonfish |
| | | *Acanthurus chirurgus* | Doctorfish |
| Pomacanthidae -- Angelfish | Angelfish | *Holacanthus ciliaris* | Queen angelfish |
| | | *Pomacanthus arcuatus* | Gray angelfish |
| | | *Pomacanthus paru* | French angelfish |
| Haemulidae -- Grunts | Grunts | *Haemulon sciurus* | Bluestriped grunt |
| | | *Haemulon plumierii* | White grunt |
| Holocentridae -- Squirrelfish | Squirrelfish | *Holocentrus rufus* | Longspine squirrelfish |
| Balistidae -- Triggerfish | Triggerfish | *Balistes vetula* | Queen triggerfish |
| Coryphaenidae -- Dolphinfish | Dolphin | *Coryphaena hippurus*+ | Dolphin+ |
| Scombridae -- Mackerels and Tunas | Wahoo | *Acanthocybium solandri*+ | Wahoo+ |
| Class Holothuroidea -- Sea Cucumbers | Sea Cucumbers | All species | Sea Cucumbers |
| Class Echinoidea -- Sea Urchins | Sea Urchins | All species | Sea Urchins |
| All Corals | Corals | All species | Corals |

*Description of the Stocks Managed under the St. Croix FMP*

Appendix F contains specific information about the distribution and habitat, life history, diet, reproduction and spawning characteristics for all species in the St. Croix FMP.

### 3.3.2 Protected Species and Critical Habitat

Within the U.S. Caribbean, some species and their habitats are protected under the Marine Mammal Protection Act (MMPA), the Endangered Species Act (ESA), or both. At least 17 species of whales and dolphins have been reported in or near U.S. waters in the northeastern Caribbean (Mignucci-Giannoni 1998). All 17 species are protected under the MMPA. Three of these species (*i.e.*, sperm, sei, and fin whales) are also listed as endangered under the ESA.[23] In addition to these three marine mammals, 16 other species that are known to occur in the U.S. Caribbean are also protected under the ESA (Table 3.3.2), and include sea turtles, corals, and fish species. ESA designated critical habitat for leatherback sea turtles (Figure 3.3.1) and *Acropora* corals (Figure 3.3.2) also occur within the St. Croix management area.

**Table 3.3.2.** ESA-listed species that occur in U.S. Caribbean federal waters.

[23] Five DPSs of humpback whales are listed under the ESA; however, the West Indies DPS, which is the only DPS present in the U.S. Caribbean, is not listed as endangered or threatened (81 FR 62259).

| Common Name | Scientific Name | Status |
|---|---|---|
| Sei whale | *Balaenoptera borealis* | Endangered |
| Sperm whale | *Physeter macrocephalus* | Endangered |
| Fin whale | *Balaenoptera physalus* | Endangered |
| Green turtle (North Atlantic Distinct Population Segment [DPS]) | *Chelonia mydas* | Threatened |
| Green turtle (South Atlantic DPS) | *Chelonia mydas* | Threatened |
| Hawksbill sea turtle | *Eretmochelys imbricata* | Endangered |
| Leatherback sea turtle | *Dermochelys coriacea* | Endangered |
| Loggerhead sea turtle (Northwest Atlantic DPS) | *Caretta caretta* | Threatened |
| Elkhorn coral | *Acropora palmata* | Threatened |
| Staghorn coral | *Acropora cervicornis* | Threatened |
| Rough cactus coral | *Mycetophyllia ferox* | Threatened |
| Pillar coral | *Dendrogyra cylindrus* | Threatened |
| Lobed star coral | *Orbicella annularis* | Threatened |
| Mountainous star coral | *Orbicella faveolata* | Threatened |
| Boulder star coral | *Orbicella franksi* | Threatened |
| Scalloped hammerhead shark (Central and Southwest Atlantic DPS) | *Sphyrna lewini* | Threatened |
| Nassau grouper | *Epinephelus striatus* | Threatened |
| Oceanic whitetip shark | *Carcharhinus longimanus* | Threatened |
| Giant Manta Ray | *Manta birostris* | Threatened |

Background information on the life history, habitat, diet, growth patterns, or other species-specific information for each of the ESA-listed species occurring in that action area are described below for reference.

#### 3.3.2.1 Marine Mammals

The sei whale occurs in all ocean basins of the world, primarily in temperate to subpolar latitudes. Sei whales in the North Atlantic reportedly feed primarily on calanoid copepods, with a secondary preference for euphausiids (Hjort and Ruud 1929; Mitchell 1975a; Mitchell et al. 1986; Christensen et al. 1992). Throughout their range, sei whales occur predominantly in deep water. They are most common over the continental slope (Mitchell 1975b; Cetacean and Turtle Assessment Program 1982; Martin 1983; Olsen et al. 2009), shelf breaks (Committee on the Status of Endangered Wildlife in Canada 2003), and deep ocean basins situated between banks (Sutcliffe and Brodie 1977). Studies in various ocean basins indicate that sei whales are associated with ocean fronts and eddies (Nasu 1966; Nemoto and Kawamura 1977; Skov et al. 2008; Bost et al. 2009). Direct hunting was the main cause of initial depletion of sei whales. Loss of prey base due to climate and ecosystem change presents an unknown, but potentially high impact to recovery.

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The sperm whale occurs in all oceans of the world. Sperm whales are distributed throughout most oceanic areas, but are found in deeper waters seaward of the continental shelf. The primary cause of the population decline that precipitated ESA listing was commercial whaling for ambergris and spermaceti in the eighteenth, nineteenth, and twentieth centuries. Cephalopods (*i.e.*, squid, octopi, cuttlefishes, and nautili) are the main component of sperm whale diets. Current threats to sperm whales include ship strikes and entanglements in fishing gear. Other threats to sperm whales include disturbance by man-made noise, for example from seismic surveys, and this threat is heightened in areas of oil and gas activities or where shipping activity is high. NMFS' Recovery Plan for Sperm Whales (NMFS 2010) identified four main categories of threats to the recovery of sperm whales in the Atlantic Ocean: (1) vessel interactions, (2) incidental capture in fishing gear, (3) habitat degradation, and (4) military operations.

The fin whale is found throughout the world in deep, offshore waters of all major oceans, primarily in temperate to polar latitudes. They are less common in the tropics. They occur year-round in a wide range of locations, but the density of individuals in any one area changes seasonally. Fin whales feed on krill, small schooling fish (including herring, capelin, and sand lance), and squid. Fin whales can become entangled in fishing gear, either swimming off with the gear attached or becoming anchored. They can become entangled in many different gear types, including traps, pots, or gillnets. Underwater noise also threatens whale populations, interrupting their normal behavior and driving them away from areas important to their survival. Increasing evidence suggests that exposure to intense underwater sound in some settings may cause some whales to strand and ultimately die.

#### 2.3.2.2 Sea Turtles

After emerging from the nest, green sea turtle hatchlings swim to offshore areas and go through a post-hatchling pelagic stage where they are believed to live for several years. During this life stage, green sea turtles feed close to the surface on a variety of marine algae and other life associated with drift lines and debris. This early oceanic phase remains one of the most poorly understood aspects of green sea turtle life history (NMFS and USFWS 2007). At approximately 8-10 inches (20-25 cm) carapace length, juveniles leave the pelagic environment and enter nearshore developmental habitats such as protected lagoons and open coastal areas rich in sea grass and marine algae. Within the developmental habitats, juveniles begin the switch to a more herbivorous diet, and by adulthood feed almost exclusively on seagrasses and algae (Rebel 1974), although some populations are known to also feed heavily on invertebrates (Carballo et al. 2002). The diving abilities of all sea turtles species vary by their life stages. The maximum diving range of green sea turtles is estimated at 360 ft (110 m) (Frick 1976), but they most frequently make dives of less than 65 ft (20 m) (Walker 1994). The time of these dives also varies by life stage. The maximum dive length is estimated at 66 minutes with most dives lasting

from 9 to 23 minutes (Walker 1994). Green sea turtles face threats including destruction of nesting habitat from storm events, oceanic events such as cold-stunning, pollution (e.g., plastics, petroleum products, petrochemicals), ecosystem alterations (e.g., nesting beach development, beach nourishment and shoreline stabilization, vegetation changes), poaching, global climate change, fisheries interactions, natural predation, and disease.

Hawksbill sea turtles nest on sandy beaches throughout the tropics and subtropics. The most significant nesting within the United States occurs in Puerto Rico and the U.S. Virgin Islands, specifically on Mona Island and Buck Island Reef National Monument, respectively. Post-hatchlings (oceanic stage juveniles) are believed to live in the open ocean, taking shelter in floating algal mats and drift lines of flotsam and jetsam in the Atlantic ocean (Musick and Limpus 1997) before returning to more coastal foraging grounds. In the Caribbean, hawksbill sea turtles are known to almost exclusively feed on sponges (Meylan 1988; Van Dam and Diez 1997), although at times they have been seen foraging on other food items, notably corallimorphs and zooanthids (León and Diez 2000; Mayor et al. 1998; Van Dam and Diez 1997). Adult foraging typically occurs over coral reefs, although other hard-bottom communities and mangrove-fringed areas are occupied occasionally. NMFS believes it is probable that much of the Caribbean, down to 328 ft (100 m) or more, provides a foraging habitat for the adult turtles, particularly since sponges grow to this depth.Hawksbill sea turtles are currently subjected to the same suite of threats on both nesting beaches and in the marine environment that affect other sea turtles (e.g., interaction with federal and state fisheries, coastal construction, oil spills, climate change affecting sex ratios). Due to their preference to feed on sponges associated with coral reefs, hawksbill sea turtles are particularly sensitive to losses of coral reef communities. Because continued loss of coral reef communities (especially in the greater Caribbean region) is expected to impact hawksbill foraging, it represents a major threat to the recovery of the species.

Leatherback sea turtles are the most pelagic of all ESA-listed sea turtles and spend most of their time in the open ocean. Although, they will enter coastal waters and are seen over the continental shelf on a seasonal basis to feed in areas where jellyfish are concentrated. Leatherback sea turtles feed primarily on cnidarians (medusae, siphonophores) and tunicates. Unlike other sea turtles, leatherbacks' diets do not shift during their life cycles. Leatherback sea turtles are the deepest diving of all sea turtles, with recorded depths in excess of a half-mile (Eckert et al. 1989), but they may also come into shallow waters to locate prey items. Dive times range from a maximum of 37 minutes to more routines dives of 4 to 14.5 minutes (Standora et al. 1984; Eckert et al. 1986; Eckert et al. 1989; Keinath and Musick 1993). Leatherback sea turtles may spend 74% to 91% of their time submerged (Standora et al. 1984). Leatherback sea turtles face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, oceanic events such as cold-stunning, pollution (plastics, petroleum products, petrochemicals, etc.), ecosystem alterations (nesting beach development, beach nourishment and

shoreline stabilization, vegetation changes, etc.), poaching, global climate change, fisheries interactions, natural predation, and disease. Of all sea turtle species, leatherbacks seem to be the most vulnerable to entanglement in fishing gear, especially gillnet and pot/trap lines.

Critical habitat for the leatherback sea turtle has been designated in the waters adjacent to Sandy Point St. Croix, USVI, up to and inclusive of the waters from the 100-fathom curve shoreward to the level of mean high tide with boundaries at 17°42′12”N and 64°50′00″W (Figure 3.3.1).

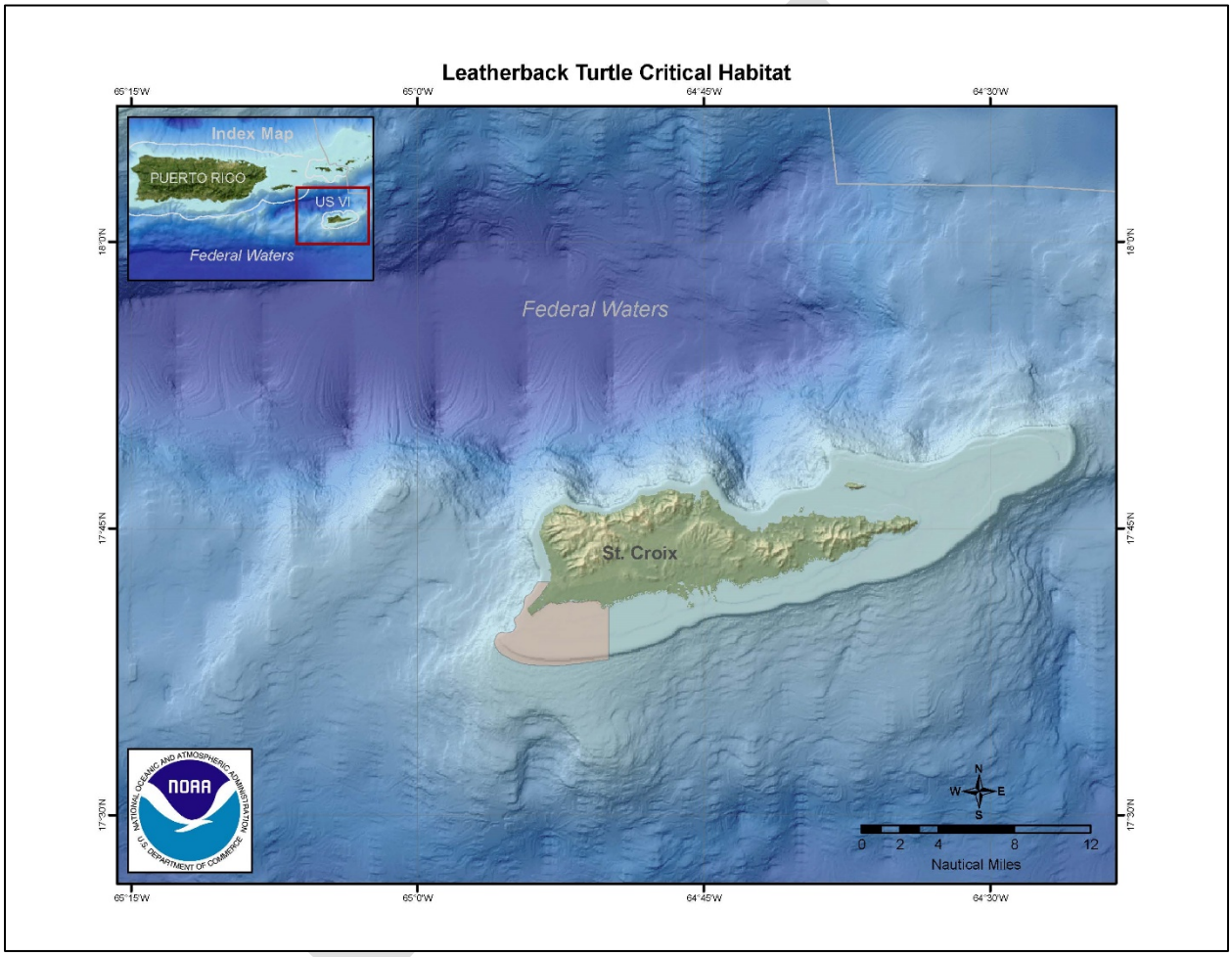


**Figure 3.3.1**. Area (southwest corner of St. Croix) designated as leatherback sea turtle critical habitat.

### 3.3.2.3 Corals

*Acropora cervicornis* and *Acropora palmata*, the only two species of acroporids in the Caribbean, are two of the major reef-building corals in the wider Caribbean. Elkhorn colonies form flattened to near-round branches that typically radiate outward from a central trunk that is

firmly attached to the sea floor. Staghorn colonies are stag antler-like, with cylindrical, straight, or slightly curved branches. The branching morphology of these species provides important habitat for other reef organisms. Historically, both acroporid species formed dense thickets at shallow (16 ft [<5 m]) and intermediate (33 to 49 ft [10 to 15 m]) depths in many reef systems, including locations in the Florida Keys, western Caribbean (e.g., Jamaica, Cayman Islands, Caribbean Mexico, Belize), and eastern Caribbean. In the 1960s and 1970s in the USVI, elkhorn coral was the main reef-building coral at depths less than 33 ft (10 m) (Rogers et al. 2002). Elkhorn coral grew in nearly monospecific stands on the reef crest and in the upper and lower forereef zones of well-developed fringing and bank barrier reefs, as well as on isolated patch reefs (Rogers et al. 2002). Elkhorn coral commonly grows in turbulent water on the fore-reef, reef crest, and shallow spur-and-groove zone (Cairns 1982; Miller et al. 2008; Rogers et al. 1982; Shinn 1963) in water ranging from approximately 3-15 ft (1-5 m) depth, and up to 40 ft (12 m). The preferred habitat of elkhorn coral is the seaward face of a reef (turbulent shallow water), including the reef crest, and shallow spur-and-groove zone (Shinn 1963; Cairns 1982; Rogers et al. 1982). Historically, staghorn coral was reported from depths ranging from <3.28 to 197 ft (<1 to 60 m) (Goreau and Goreau 1973). It is suspected that 197 ft (60 m) is an extreme situation and that the coral is relatively rare below 66 ft (20 m) depth. The common depth range at which staghorn coral is currently observed is 16 to 56 ft (5 to 17 m). In the USVI, this species was abundant, but not often found in dense thickets or well-defined zones (Rogers et al. 2002); unlike in areas in the western Caribbean where this species was historically the primary constructor of mid-depth (33 to 49 ft [10 to 15 m]) reef terraces (Adey 1978).

Pillar coral (*Dendrogyra cylindrus*) forms cylindrical columns on top of encrusting bases. Colonies are generally grey-brown in color and may reach circa 10 ft (3 m) in height. Polyp tentacles remain extended during the day, giving columns a furry appearance. Pillar coral inhabits most reef environments in water depths ranging from ~3-75 ft (1-25 m), but it is most common between ~15-45 ft (5-15 m) depths (Acosta and Acevedo 2006; Cairns 1982; Goreau and Wells 1967). Pillar coral is a gonochoric (separate sexes) broadcast spawning species with relatively low annual egg production for its size. Sexual recruitment of this species is low, and reported juvenile colonies in the Caribbean are lacking. Pillar coral can reproduce by fragmentation following storms or other physical disturbance. Average growth rates of 0.7-0.8 inches (in) (1.8-2.0 centimeters [cm]) per year in linear extension have been reported in the Florida Keys compared to 0.31 in (0.8 cm) per year in Colombia and Curaçao. Feeding rates (removal of suspended particles in seawater) are low relative to most other Caribbean corals, indicating it is primarily a tentacle feeder rather than a suspension feeder. However, pillar coral has a relatively high photosynthetic rate, and it receives substantial amounts of energy from its symbiotic algae. Pillar coral is uncommon but conspicuous with scattered, isolated colonies. In monitoring studies, cover is generally less than 1%. At permanent monitoring stations in the

USVI, pillar coral has been observed in low abundance at 10 of 33 sites and, where present, ranged in cover from less than 0.05-0.22% (Smith 2013). It is rarely found in aggregations.

Rough cactus coral (*Mycetophyllia ferox*) forms a thin, encrusting plate that is weakly attached. Maximum colony size is ~20 in (50 cm) in diameter. It has been reported in reef environments in water depths of ~15 to 300 ft (5 to 90 m), including shallow and mesophotic habitats. Rough cactus coral is a hermaphroditic (simultaneously both sexes) brooding (fertilization occurs within the parent colony and grows for a period of time before release) species. Colony size at first reproduction is greater than 15 $in^2$ (100 $cm^2$). Recruitment of rough cactus coral appears to be very low, even in studies from the 1970s. Rough cactus coral has a lower fecundity compared to other species in its genus (Morales Tirado 2006). Over a 10 year period, no colonies of rough cactus coral were observed to recruit to an anchor-damaged site in the USVI although adults were observed on the adjacent reef (Rogers and Garrison 2001). Rough cactus coral is usually uncommon or rare, constituting less than 0.1% of all coral species at generally less than 1% of the benthic cover. Benthic cover of rough cactus coral in the Red Hind Marine Conservation District off St. Thomas, USVI, which includes mesophotic coral reefs, was 0.003 ± 0.004% in 2007, accounting for 0.02% of coral cover, and ranking 20$^{th}$ highest in cover out of 21 coral species (Nemeth et al. 2008; Smith et al. 2010). In the USVI between 2001 and 2012, cover of rough cactus coral appeared in 12 of 33 survey sites and accounted for 0.01% of the bottom, and 0.07% of the coral cover, ranking as 13$^{th}$ most common (Smith 2013).

Boulder star coral (*Orbicella franksi*) is one of the three species in the *Orbicella annularis* complex (mountainous star coral [*Orbicella faveolata*] and lobed star coral [*Orbicella annularis*] are the other two). These three species were formerly in the genus *Montastraea*; however, recent work has reclassified the three species in the *annularis* complex to the genus *Orbicella* (Budd et al. 2012). Boulder star coral is distinguished by large, unevenly arrayed polyps that give the colony its characteristic irregular surface. Colony form is variable, and the skeleton is dense with poorly developed annual bands. Colony diameter can reach up to 16 ft (5 m) with a height of up to 6.5 ft (2 m). Boulder star coral tends to have a deeper distribution than the other two species in the *Orbicella* species complex. It occupies most reef environments and has been reported from water depths ranging from ~16-165 ft (5 to 50 m), with the species complex reported to 250 ft (90 m). *Orbicella* species are a common, often dominant, component of Caribbean mesophotic reefs, suggesting the potential for deep refugia for boulder star coral. Boulder star coral is hermaphroditic (simultaneously having both sexes) broadcast spawners, with spawning concentrated on 6 to 8 nights following the full moon in late August, September, or early October. Boulder star coral spawning is reported to be about one to two hours earlier than lobed star coral and mountainous star coral. Fertilization success measured in the field was generally below 15% for all three species being closely linked to the number of colonies concurrently spawning. In Puerto Rico, minimum size at reproduction for the star coral species

complex was 13 $in^2$ (83 $cm^2$). Boulder star coral is reported as common. In the USVI, boulder star coral is the second most abundant species by percent cover at permanent monitoring stations. However, because the species complex, which is the most abundant by cover, was included as a category when individual *Orbicella* species could not be identified with certainty, it is likely that boulder star coral is the most abundant. Population estimates of boulder star coral in the ~19 square mile (49 $km^2$) Red Hind Marine Conservation District are at least 34 million colonies (Smith 2013). Abundance was stable between 1998-2008 at nine sites off Mona and Desecheo Islands, Puerto Rico. In 1998, 4% of all corals at six sites surveyed off Mona Island were boulder star coral colonies in 1998 and approximately 5% in 2008; at Desecheo Island, about 2% of all coral colonies were boulder star coral in both 2000 and 2008 (Bruckner and Hill 2009).

Lobed star coral (*Orbicella annularis*) colonies grow in columns that exhibit rapid and regular upward growth. Unlike the other two star coral species, margins on the sides of columns are typically dead. Live colony surfaces usually lack ridges or bumps. Lobed star coral is reported from most reef environments in depths of ~1.5-66 ft (0.5-20 m). The star coral species complex is a common, often dominant component of Caribbean mesophotic (deeper than ~100 ft) reefs, suggesting the potential for deep refuge across a broader depth range, but lobed star coral is generally described with a shallower distribution. Asexual fission and partial mortality can lead to multiple clones of the same colony. The percentage of unique genotypes is variable by location and is reported to range between 18% and 86% (14-82% are clones). Colonies in areas with higher disturbance from hurricanes tend to have more clonality. Although lobed star coral is still abundant, it may exhibit high clonality in some locations. Like the other species in the complex, lobed star coral is a hermaphroditic broadcast spawners, with spawning concentrated on 6-8 nights following the full moon in late August, September, or early October. Lobed star coral is reported to have slightly smaller egg size and potentially smaller size/age at first reproduction that the other two species of the *Orbicella* genus. In Puerto Rico, minimum size at reproduction for the star coral species complex was 12 $in^2$ (83 $cm^2$). Lobed star coral has been described as common overall. Demographic data collected in Puerto Rico over nine years straddling the 2005 bleaching event showed that population growth rates were stable in the pre-bleaching period (2001–2005) but declined one year after the bleaching event. Population growth rates declined even further two years after the bleaching event, but they returned to stasis the following year. Lobed star coral is the third most abundant coral by percent cover in permanent monitoring stations in the USVI. A decline of 60% was observed between 2001 and 2012 primarily due to bleaching in 2005. However, most of the mortality was partial mortality, and colony density in monitoring stations did not change (Smith 2013). At nine sites off Mona and Desecheo Islands, Puerto Rico, no species extirpations were noted at any site over 10 years of monitoring between 1995 and 2008. In 1998, 8% of all corals at six sites surveyed off Mona Island were lobed star coral colonies, dipping to approximately 6% in 2008. At Desecheo Island,

14% of all coral colonies were lobed star coral in 2000 while 13% were in 2008 (Bruckner and Hill 2009).

Mountainous star coral (*Orbicella faveolata*) grows in heads or sheets, the surface of which may be smooth or have keels or bumps. The skeleton is much less dense than in the other two star coral species. Colony diameter can reach up to 33 ft (10 m) with heights of 13-16 ft (4-5 m). Mountainous star coral has been reported in most reef habitats and is often the most abundant coral at 33-66 ft (10-20 m) in fore-reef environments. The depth range of mountainous star coral has been reported as ~1.5-132 ft (0.5-40 m), though the species complex has been reported to depths of 295 ft (90 m), indicating mountainous star coral's depth distribution is likely deeper than 132 ft (40 m). Like the other species in the complex mountainous star coral is a hermaphroditic broadcast spawner with spawning concentrated on 6 to 8 nights following the full moon in late August, September, or early October. Fertilization success measured in the field was generally below 15% for all three species being closely linked to the number of colonies concurrently spawning. In Puerto Rico, minimum size at reproduction for the star coral species complex was 12 $in^2$ (83 $cm^2$). In many life history characteristics, including growth rates, tissue regeneration, and egg size, mountainous star coral is considered intermediate between lobed star coral and boulder star coral. Reported growth rates of mountainous star coral range between 0.12 and 0.64 in (0.3-1.6 cm) per year (Cruz-Piñón et al. 2003; Tomascik 1990; Villinski 2003; Waddell 2005). Szmant and Miller (2005) reported low post-settlement survivorship for mountainous star coral transplanted to the field with only 3-15% remaining alive after 30 days. Mountainous star coral is the sixth most abundant species by percent cover in permanent monitoring stations in the USVI. Population estimates in the 19-square-mile (49 kilometers squared) Red Hind Marine Conservation District are at least 16 million colonies (Smith 2013). At nine sites off Mona and Desecheo Islands, Puerto Rico, no species extirpations were noted at any site over 10 years of monitoring between 1998 and 2008 (Bruckner and Hill 2009). Both mountainous star coral and lobed star coral sustained large losses during the period. The number of colonies of mountainous star coral decreased by 36% and 48% at Mona and Desecheo Islands, respectively (Bruckner and Hill 2009). In 1998, 27% of all corals at six sites surveyed off Mona Island were mountainous star coral colonies, but decreased to approximately 11% in 2008 (Bruckner and Hill 2009). At Desecheo Island, 12% of all coral colonies were mountainous star coral in 2000 compared to 7% in 2008.

On November 26, 2008, a final rule designating *Acropora* critical habitat was published in the *Federal Register* and defined the physical or biological features essential to the conservation of the species (also known as essential feature). The essential features to the conservation of *Acropora* species is substrate of suitable quality and availability, in water depths from the mean high water line to 98 ft (30 m), to support successful larval settlement, recruitment, and reattachment of fragments. Substrate of suitable quality and availability means consolidated

hard bottom or dead coral skeletons free from fleshy macroalgae or turf algae and sediment cover. Areas containing these features have been identified in St. Croix (Figure 3.3.2).

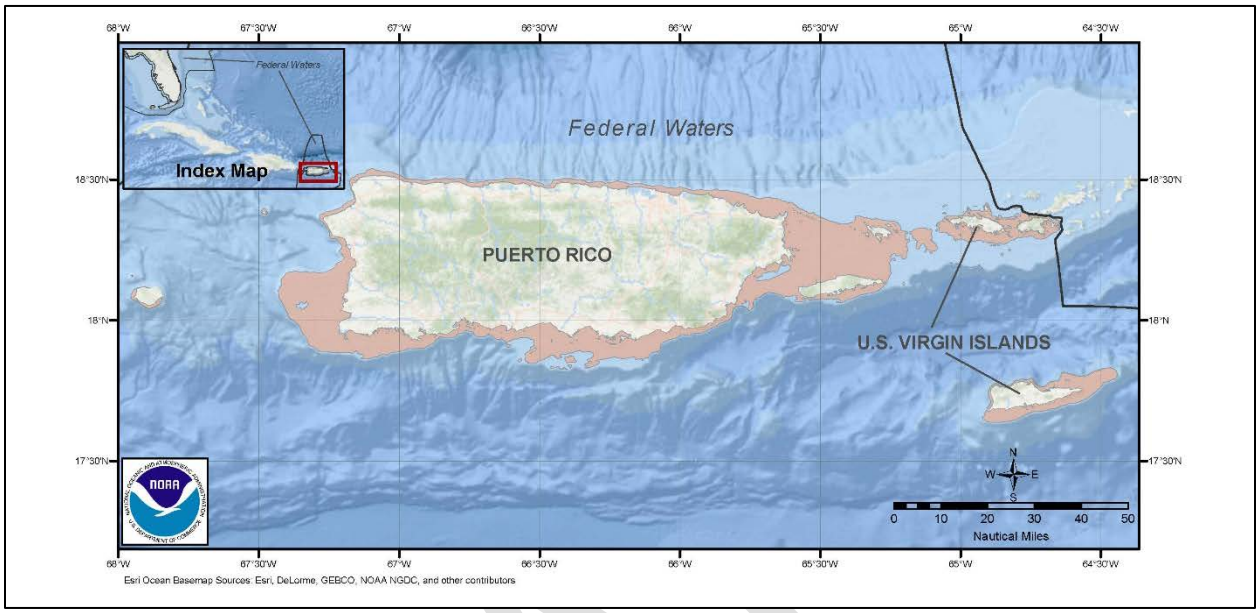


**Figure 3.3.2**. Area designated as *Acropora* critical habitat in U.S. Caribbean federal waters.

### 3.3.2.4 Fish

The Nassau grouper is primarily a shallow-water, insular species that has long been valued as a major fishery resource throughout the wider Caribbean, South Florida, Bermuda and the Bahamas (Carter et al. 1994). Nassau grouper are slow-growing and long-lived, with estimates up to 29 years (Bush et al. 1996). The Nassau grouper is considered a reef fish, but it transitions through a series of ontogenetic shifts of both habitat and diet. As larvae they are planktonic. As juveniles, they are found in nearshore shallow waters in macroalgal and seagrass habitats. They shift progressively deeper with increasing size and maturation into predominantly reef habitat (e.g., forereef and reef crest). Adult Nassau grouper tend to be relatively sedentary and are found most abundantly on high relief coral reefs or rocky substrate in clear waters (Sadovy and Eklund 1999), although they can be found from the shoreline to about 328-427 ft (100-130 m). Larger adults tend to occupy deeper, more rugose, reef areas (Semmens et al. 2007). Both adults and juveniles would use either natural or artificial reefs (Smith 1971, Beets and Hixon 1994, Colin et al. 1997). As a top predator in reef ecosystems, the Nassau grouper serves ecological functions that are still being clarified (Mumby et al. 2006). Its presence maintains grazers and grazing pressure on reef alga providing an important benefit to stony corals (Mumby at al. 2006). As with most large marine reef fish, Nassau grouper demonstrate a bi-partite life cycle with demersal juveniles and adults but pelagic eggs and larvae. Reproduction is only known to occur

during annual aggregations, in which large numbers of Nassau grouper, ranging from dozens to tens of thousands, collectively spawn (Smith 1972, Olsen and LaPlace 1979, Colin et al. 1987, Fine 1990, Fine 1992, Colin 1992).

The scalloped hammerhead shark is a circumglobal species that lives in coastal warm temperate and tropical seas. It occurs over continental and insular shelves, as well as adjacent deep waters, but is seldom found in waters cooler than 22° C (Compagno 1984, Schulze-Haugen et al. 2003). It ranges from the intertidal and surface to depths of up to 1479-1680 ft (450-512 m) (Sanches 1991, Klimley 1993), with occasional dives to even deeper waters (Jorgensen et al. 2009), and has been documented entering enclosed bays and estuaries (Compagno 1984). Both juveniles and adult scalloped hammerhead sharks occur as solitary individuals, pairs, or in schools. The scalloped hammerhead shark is viviparous (*i.e.*, gives birth to live young), with a gestation period of 9-12 months (Branstetter 1987, Stevens and Lyle 1989), which may be followed by a one-year resting period (Liu and Chen 1999). Females attain maturity around 6.5-8.2 ft (200-250 cm) total length (TL) while males reach maturity at smaller sizes (range 4.2-6.6 ft [128 – 200 cm] TL); however, the age at maturity differs by region. Data from the northwest Atlantic and Gulf of Mexico indicate the von Bertalanffy growth parameters are: $L_\infty$= 9.2 ft (279 cm) TL, k = 0.13 year−1, t0 = -1.62 years for males and $L_\infty$= 9.9 ft (303 cm) TL, k=0.09 year−1, t0=−2.22 years for females (Piercy et al. 2007). Maximum size observed was 10.3 ft (313 cm) TL for a female and 10.0 ft (304 cm) TL for a male, corresponding to an age of 30.5 years.

The oceanic whitetip is considered the only truly oceanic (*i.e.*, pelagic) shark of its genus (Bonfil et al. 2008). They are distributed worldwide in epipelagic tropical and subtropical waters, usually found far offshore between 30° North latitude and 35° South latitude (Baum et al. 2006). It has a clear preference for open ocean waters and is most abundant between 10° South latitude and 10° North latitude (Backus et al. 1956; Strasburg 1958; Compagno 1984; Bonfil et al. 2008). In the western Atlantic, oceanic whitetips occur from Maine to Argentina, including the Caribbean and Gulf of Mexico. The oceanic whitetip shark is a highly migratory species that is usually found offshore in the open ocean, on the outer continental shelf, or around oceanic islands in deep water, occurring from the surface to at least 499 ft (152 m) depth. The species can be found in water temperatures between 15°C and 28°C, but it exhibits a strong preference for the surface mixed layer in water with temperatures above 20°C, and is considered a surface-dwelling shark. Little is known about the movement or possible migration paths of the oceanic whitetip shark. Although the species is considered highly migratory and capable of making long distance movements, tagging data provides evidence that this species also exhibits a high degree of philopatry (*i.e.*, site fidelity) in some locations. The oceanic whitetip has an estimated maximum age of 17 years, with confirmed maximum ages of 12 and 13 years in the North Pacific and South Atlantic, respectively (Seki et al. 1998; Lessa et al. 1999). Other information from the South Atlantic suggests the species likely lives up to 20 years based on observed

vertebral ring counts (Rodrigues et al. 2015). Sexual maturity is estimated to occur at an age of 6-7 years and the gestation period is 10-12 months. The number of pups in a litter ranges from 1-14 (mean=6) (Compagno 1984; Seki et al. 1998; Bonfil et al. 2008; IOTC 2015). When compared to other shark species, the oceanic whitetip is relatively productive, with an intrinsic rate of population increase (r) of 0.121 per year (Cortés et al. 2012). Oceanic whitetips are ranked among the highest in productivity when compared with other pelagic sharks in terms of pup production, rebound potential, potential for population increase, and growth rate (Chapple and Botsford 2013). However, although the oceanic whitetip shark has a relatively high productivity rate relative to other sharks, it is still considered low for a fish species (r <0.14), making them generally vulnerable to depletion and potentially slow to recover from overexploitation (Young et al. 2016).

The giant manta ray can be found in all ocean basins, but within this broad distribution, individual populations are scattered and highly fragmented (CITES 2013). In terms of range, the species has been documented as far north as New Jersey on the United States east coast (Gudger 1922; Kashiwagi et al. 2010; Moore 2012; CITES 2013). Clark (2010) suggests that giant manta rays may forage in less productive pelagic waters and conduct seasonal migrations following their prey. Tracking studies using pop-up satellite archival tags registered movements of the giant manta ray from the Yucatan region of Mexico into the northern Gulf of Mexico (Marshall et al. 2011a). Despite this large range, sightings are often sporadic. The timing of these sightings also varies by region and seems to correspond with the movement of zooplankton, circulation and tidal patterns, seawater temperature, and possibly mating behavior (Couturier et al. 2012; De Boer et al. 2015; Armstrong et al. 2016). Within its range, the giant manta ray inhabits tropical, subtropical, and temperate bodies of water and is commonly found offshore, in oceanic waters, and near productive coastlines (Marshall et al. 2009; Kashiwagi et al. 2011). As such, giant manta rays can be found in cooler water, as low as 19°C, although temperature preference appears to vary by region (Duffy and Abbott 2003; Marshall et al. 2009; Freedman and Roy 2012; Graham et al. 2012). Additionally, giant manta rays exhibit a high degree of plasticity in terms of their use of depths within their habitat. Tagging studies show the species conducting nightly descents from the surface to 656-1,476 ft (200-450 m) (Rubin et al. 2008; Stewart et al. 2016b), and that they are capable of diving to depths exceeding 3,281 ft (1,000 m) (A. Marshall et al. unpublished data cited in Marshall et al. 2011). Although manta rays have been reported to live for at least 40 years (Marshall and Bennett 2010; Marshall et al. 2011b; Kitchen-Wheeler 2013) with low rates of natural mortality (Couturier et al. 2012), the time needed to grow to maturity and the low reproductive rates mean that a female would be able to produce only 5-15 pups in her lifetime (CITES 2013). Generation time (based on M. alfredi life history parameters) is estimated to be 25 years (Marshall et al. 2011a; Marshall et al. 2011b). In the Atlantic, very little information on M. birostris populations is available, but there is a known, protected population within the Flower Garden Banks National Marine Sanctuary in the Gulf of

Mexico. However, researchers are still trying to determine whether the manta rays in this area are only giant manta ray individuals or potentially also comprise individuals of a new, undescribed species (Marshall et al. 2009; Hinojosa-Alvarez et al. 2016). With populations potentially ranging from around 100 to 1,500 individuals (see Table 4 in Miller and Klimovich 2016), coupled with their life history traits and productivity estimates and particularly their low reproductive output and sensitivity to changes in adult survival rates, giant manta ray populations are inherently vulnerable to depletions, with low likelihood of recovery.

## 3.4 Description of the Socioeconomic Characteristics of the St. Croix Management Area

For a comprehensive description of the fisheries of St. Croix, including its economic significance, please see the Environmental Assessment for the Island-Based FMP for St. Croix (NMFS 2014). That description is incorporated by reference.

On February 9, 2018, Secretary of Commerce Wilbur Ross determined catastrophic fishery disasters occurred in the USVI because of impacts from Hurricanes Irma and Maria that made landfall in August and September of 2017, respectively. In addition to damages to fishing vessels and dockside facilities caused by winds and storm surge, fishing from many St. Croix beaches has continued to be adversely impacted by both erosion and sewage overflows caused by Hurricane Maria (https://viconsortium.com/virgin-islands-2/two-beaches-not-safe-twelve-could-not-be-tested-d-p-n-r-warns/).

With exception for 2011, the USVI does not export fresh, chilled, or frozen finfish (North American Industry Classification System [NAICS] code 114111) or shellfish (NAICS code 114112). The USVI is a net importer of seafood and most of those imports are shellfish, although finfish imports exceeded shellfish imports from 2008 through 2010 (Table 3.4.1).

**Table 3.4.1**. Value (in dollars) of USVI finfish and shellfish imports and exports, 2008 - 2017.

| Year | Imports by NAICS code | | | Exports by NAICS Code | | | Net Export |
|---|---|---|---|---|---|---|---|
| | 114111 | 114112 | Total | 114111 | 114112 | Total | |
| 2008 | $320,746 | $65,508 | $386,254 | $0 | $0 | $0 | -$386,254 |
| 2009 | $206,403 | $70,647 | $277,050 | $0 | $0 | $0 | -$277,050 |
| 2010 | $76,042 | $45,300 | $121,342 | $0 | $0 | $0 | -$121,342 |
| 2011 | $0 | $54,380 | $54,380 | $0 | $8,711 | $8,711 | -$45,669 |
| 2012 | $6,529 | $63,893 | $70,422 | $0 | $0 | $0 | -$70,422 |
| 2013 | $6,528 | $50,050 | $56,578 | $0 | $0 | $0 | -$56,578 |
| 2014 | $20,658 | $63,700 | $84,358 | $0 | $0 | $0 | -$84,358 |

| Year | Imports by NAICS code | | | Exports by NAICS Code | | | Net Export |
|---|---|---|---|---|---|---|---|
| | 114111 | 114112 | Total | 114111 | 114112 | Total | |
| 2015 | $0 | $72,785 | $72,785 | $0 | $0 | $0 | -$72,785 |
| 2016 | - | $63,680 | $63,680 | $0 | $0 | $0 | -$63,680 |
| 2017 | $18,070 | $82,086 | $100,156 | $0 | $0 | $0 | -$100,156 |

Source: https://usatrade.census.gov, August 9, 2018.

Often the USVI is characterized as having a tourism-driven economy with imagined estimates of the travel and tourism sector accounting for most of the territory's Gross Domestic Product (GDP). However, the USVI economy is more diverse than that. Instead of accounting for over half of GDP, the travel and tourism sector generated 30.4% of USVI GDP in 2011, 29.9% in 2014, 31.8% in 2016, and 28% in 2017 (World Travel and Tourism Council 2015, 2017, 2018).

Certainly, the travel and tourism sector is a primary contributor to the USVI economy, and the accommodation and food services industries are key aspects of that sector. However, while those industries accounted for an average of 12.2% of GDP from 2011 through 2015, the USVI's goods-producing industries accounted for an average of 17.4% of GDP (Table 3.4.2).

Service-producing industries that include, but are not limited to, tourism-related industries (wholesale and retail trade, accommodation and food services, and other services) account for more than half of the USVI's GDP. From 2011 through 2015, for example, the services-producing industries accounted for 57% to 65% of GDP Table 3.4.2).

**Table 3.4.2.** Percentage of USVI GDP by sector, 2011 – 2015.

| Sector | | | Percentage of GDP | | | | |
|---|---|---|---|---|---|---|---|
| | | | 2011 | 2012 | 2013 | 2014 | 2015 |
| Private | Goods-producing industries | | 23% | 20% | 16% | 14% | 14% |
| | Services-producing industries | Wholesale & retail trade | 10% | 10% | 11% | 11% | 10% |
| | | Accommodation & food services | 10% | 11% | 12% | 14% | 14% |
| | | Other services, except government | 37% | 40% | 41% | 40% | 41% |
| | | *Total* | *57%* | *61%* | *64%* | *65%* | *65%* |
| | Total Private | | 80% | 81% | 80% | 79% | 79% |
| Public | Federal government | | 3% | 4% | 4% | 4% | 4% |
| | Territorial government | | 17% | 15% | 16% | 17% | 17% |
| | Total Public | | 20% | 19% | 20% | 21% | 21% |
| Total | | | 100% | 100% | 100% | 100% | 100% |

Source: U.S. Department of Commerce Bureau of Economic Analysis.

The goods-producing industries include agriculture and manufacturing, and St. Croix has been the agricultural and manufacturing center of the USVI. In 2007 60% of the employer establishments in the manufacturing sector were located in St. Croix and in 2012, that share was down to 58% (U.S. Census Bureau Economic Census of the Islands, 2007 and 2012). In both 2002 and 2007, approximately 95% of farmed acres and 73% of the USVI's farms were located in St. Croix (Table 3.4.3).

St. Croix's agricultural advantages are its flatter terrain, where cultivation is substantially easier than on the much steeper islands of St. Thomas and St. John, and its larger size; St. Croix is the largest of the USVI islands and three times the size of St. Thomas.

**Table 3.4.3**. Numbers of farms, acres, and farms with harvested crops and sales, 2002 and 2007.

| Farms and Acres | Number in 2002 | | | Number in 2007 | | |
|---|---|---|---|---|---|---|
| | St. Croix | USVI | Percent St. Croix | St. Croix | USVI | Percent St. Croix |
| All Farms | 139 | 191 | 72.8% | 160 | 219 | 73.1% |
| Acres | 8,708 | 9,168 | 95.0% | 5,574 | 5,881 | 94.8% |
| Average Acres per Farm | 62.6 | 48.0 | - | 34.8 | 26.9 | - |
| Farms with Harvested Crops | 91 | 129 | 70.5% | 105 | 145 | 72.4% |
| Farms with Sales | 139 | 191 | 72.8% | 160 | 219 | 73.1% |
| Average Sales per Farm | $19,225 | $15,805 | - | $10,718 | $9,457 | - |

Source: USDA Census of Agriculture 2007.

Although the number of farms in St. Croix increased from 2002 to 2007, the number of acres farmed and average size of a farm decreased (Table 3.4.3). In part that is because multiple droughts have hit the island's agricultural sector hard since 2005. Droughts in the USVI occur frequently and tend to be severe due to a lack of perennial streams and a limited ground water supplier (Zack and Larsen, 1994). Christiansted experienced its second driest month on record (1951-2015) in 2015, with only 0.77 inch of precipitation (NOAA National Centers for Environmental Information, August 2015). The entire island endured over three months without significant rainfall and crops were damaged and livestock were weakened and died. The island was declared a primary natural disaster area by USDA in August 2015 after a severe drought affected the island starting in April that year (The Virgin Islands Consortium, August 27, 2015). With that designation, farm operators were eligible to apply for assistance from the Farm Service Agency that included emergency loans.

St. Croix's smallholder farmers largely produce crops for local consumption, such as cucumbers, tomatoes, eggplant, peppers, yams, and sweet potatoes, and livestock products, such as chicken, pork and beef. In 2007, there was one commercial tilapia farm in St. Croix, but whether it

presently remains is unknown (USDA Census of Agriculture 2007). In 2014, the agricultural sector accounted for approximately 2% of USVI's gross domestic product (GDP). (https://theodora.com/wfbcurrent/virgin_islands/virgin_islands_economy.html).

Despite local food production, the USVI imports the bulk of its food. According to USVI Department of Agriculture Commissioner Denis Robles, the USVI has typically imported over 97% of its food (The Virgin Islands Consortium March 29, 2017). That figure is consistent with the United Nations Food and Agriculture Organization (FAO) estimate. That makes St. Croix vulnerable to food shortages.

Hurricane Maria hit the island on September 20, 2017. A peak sustained wind of 93 knot (kt) (107 mph) with a gust to 119 kt (137 mph) was reported at St. Croix near the northeast edge of Hurricane Maria's eyewall (Pasch et al. April 2018). Wind damage was evident across the entire island with many fallen trees, downed signs, roof damage and complete destruction of many wooden houses. Excessive rainfall generated significant flooding and mud slides across the island. Weather stations on St. Croix recorded 5 and 10 inches of rain from the hurricane. Almost a month after the hurricane, only 1.6% of people on the island had electricity. Eight months after Hurricane Maria, 100% of power had been restored to the USVI (Travel Weekly, May 24, 2018).

After Hurricane Maria, there was a serious food shortage across the island. Farmers lost crops, bees and livestock, and the USVI had to rely on food imports for all of its food (Robles in the St. Croix Source, February 26, 2018). The number of agricultural employees fell from 10 in December 2016 to 8 in December 2017 (USVI Labor Market Basket, 4$^{th}$ Quarter, 2016-2017).

Manufacturing has largely been based on oil and rum production, but St. Croix's manufacturing history can be divided into before and after the closing of the HOVENSA petroleum refinery in May 2012. HOVENSA was a joint venture between Hess Corporation and a Venezuelan state-owned oil company that had been the largest refinery in North American and one of the world's largest oil refineries. It was St. Croix's largest tax payer and also the USVI's largest employer up through the first quarter of 2012. The refinery's closure caused a loss of more than $580 million in direct gross economic output that accounted for 13% of USVI's Gross Territory Product (GTP) (USVI BER, 2012). However, there had been costs associated with that output, such as air pollution and its adverse impacts. The refinery had been in violation of the Clear Air Act, and in January 2011 agreed to pay a $5.375 million civil penalty and spend more than $700 million in new pollution controls because of its violations (U.S. Department of Justice, January 6, 2011).

With the refinery's closure there were substantial losses of manufacturing jobs (Figure 3.4.1). Unemployment spiked as shown in Figure 3.4.2. USVI's Real GDP declined by 15% in 2012 (Figure 3.4.3).

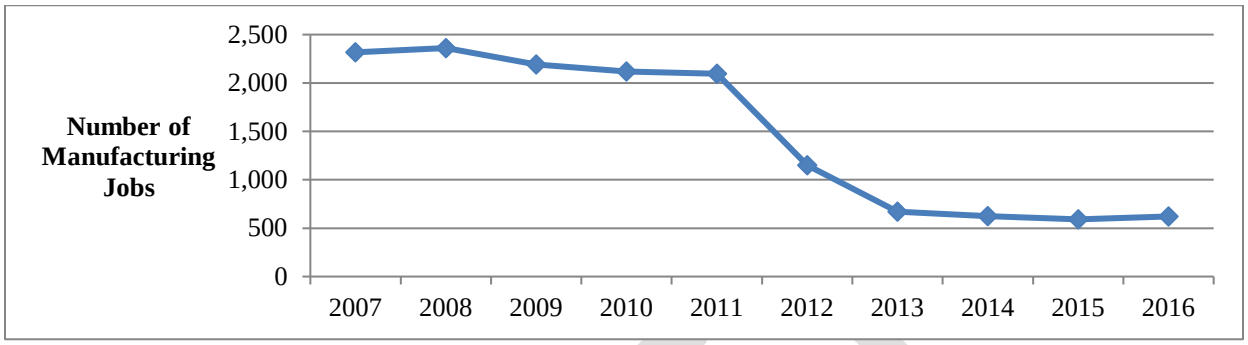


**Figure 3.4.1.** Number of manufacturing jobs, 2007 – 2016.
(Source: USVI BER 2018)

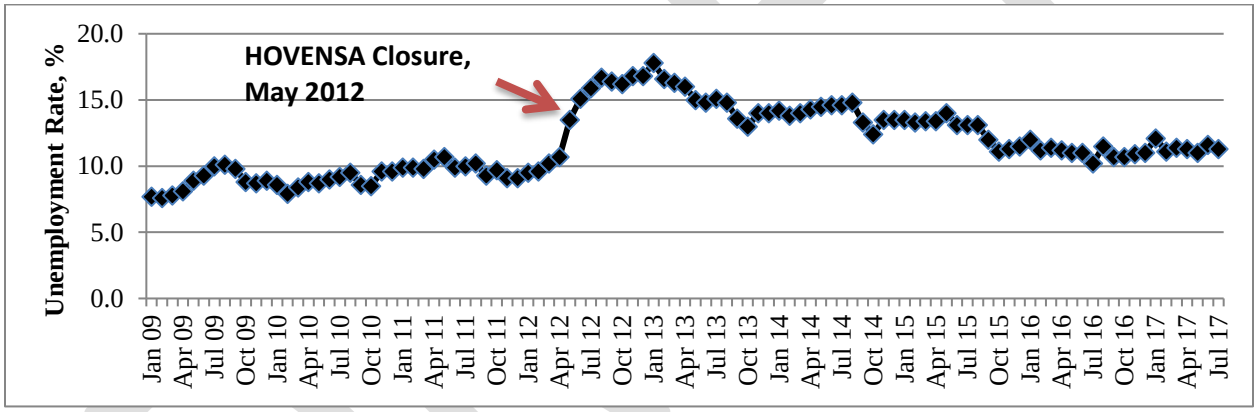


**Figure 3.4.2.** St. Croix unemployment rate, January 2009 – July 2017.
(Source: USVI BER 2018)

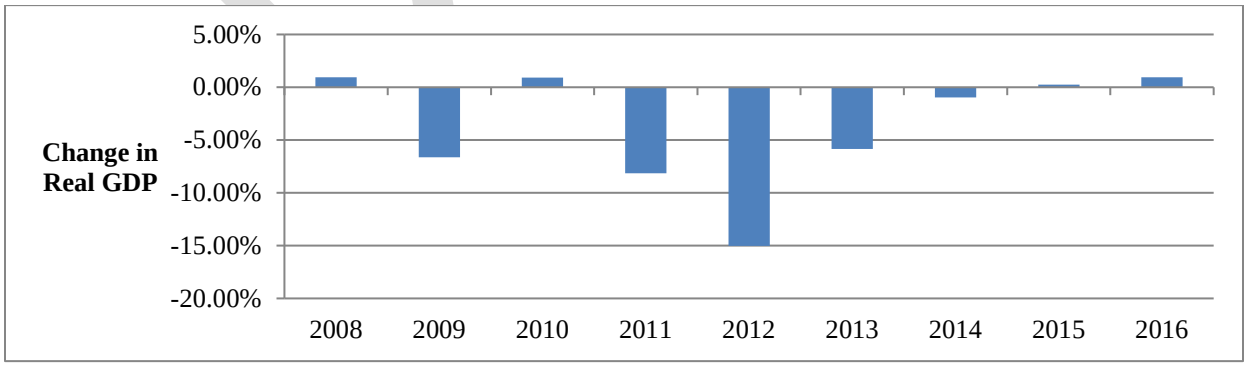


**Figure 3.4.3.** Percent change in USVI Real GDP (2009 $), 2008 - 2016.
(Source: U.S. Department of Commerce (DOC) BEA, December 1, 2017)

The refinery's closure affected other sectors and employment across the island. As shown in Figure 3.4.4, the number of workers employed in St. Croix has been considerably lower since 2012. The two largest percentage declines occurred in 2012 and 2013.

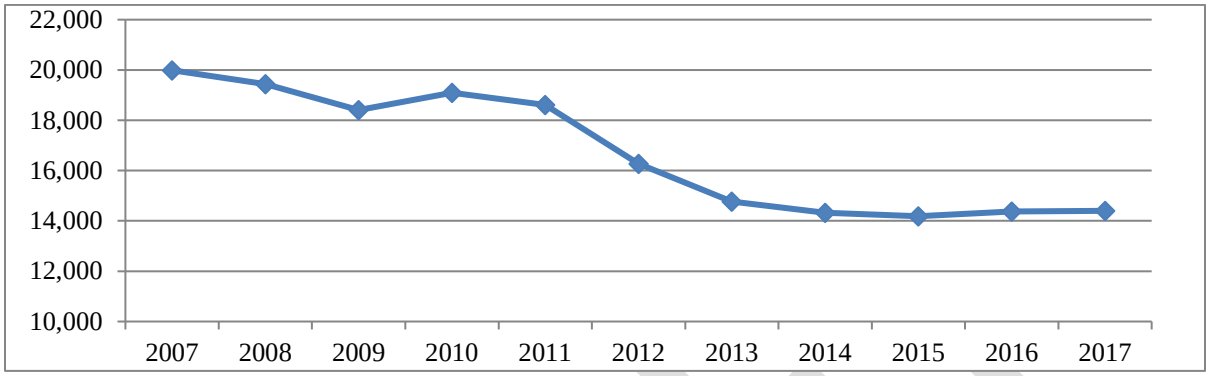


**Figure 3.4.4**. Employment, all industries, St. Croix, 2007 – 2017.
(Source: https://data.bls.gov/timeseries/ENU7801010010)

In addition to the manufacturing sector that lost 78.3% of its employees from 2010 through 2013 in St. Croix, agriculture lost 82.9% of its employees, mining lost 66.7%, construction 27.6%, and education services 37.7% of its employees (Table 3.4.4). Nonetheless, there were significant increases in some sectors, such as utilities (80.0% ↑) and wholesale trade (40.1% ↑). In 2012, the U.S. Department of Labor (DOL) awarded a $7.8 million National Emergency Grant to the USVI to assist the more than 1,200 workers who lost their jobs due to HOVENSA's closing (DOL May 15, 2012).

**Table 3.4.4**. Employees by sector in St. Croix, December 2010 – December 2013.

| Industry | Employment in St. Croix | | | | |
|---|---|---|---|---|---|
| | 2010 | 2011 | 2012 | 2013 | Percent Change |
| Agriculture | 41 | 10 | 9 | 7 | -82.9% |
| Mining | 42 | 37 | 13 | 14 | -66.7% |
| Utilities | 15 | 14 | 27 | 27 | 80.0% |
| Construction | 1,124 | 1,321 | 1,003 | 814 | -27.6% |
| Manufacturing | 1,896 | 1,674 | 578 | 411 | -78.3% |
| Wholesale Trade | 272 | 257 | 268 | 381 | 40.1% |
| Retail Trade | 2,032 | 2,144 | 2,100 | 1,941 | -4.5% |
| Transportation & Communication | 600 | 585 | 518 | 579 | -3.5% |

| Industry | Employment in St. Croix | | | | |
|---|---|---|---|---|---|
| | 2010 | 2011 | 2012 | 2013 | Percent Change |
| Information | 249 | 290 | 284 | 256 | 2.8% |
| Finance & Insurance | 456 | 453 | 402 | 430 | -5.7% |
| Real Estate, Rental & Leasing | 410 | 411 | 372 | 362 | -11.7% |
| Prof., Sci., & Technical Services | 504 | 482 | 498 | 503 | -0.2% |
| Management of Companies | 16 | 17 | 19 | 18 | 12.5% |
| Admin. Supp. & Waste Mgt & Remed. Serv. | 858 | 778 | 777 | 738 | -14.0% |
| Education Services | 488 | 460 | 370 | 304 | -37.7% |
| Health Care & Welfare Services | 790 | 735 | 759 | 747 | -5.4% |
| Arts, Entertainment & Recreation | 357 | 346 | 308 | 294 | -17.6% |
| Accommodation & Food Services | 1,579 | 1,632 | 1,474 | 1,255 | -20.5% |
| Other Services | 1,739 | 1,286 | 878 | 616 | -64.6% |
| *Private Sector Total* | *13,468* | *12,932* | *10,657* | *9,697* | *-28.0%* |
| *Government Sector Total* | *5,322* | *4,938* | *4,598* | *4,437* | -16.6% |
| *Federal Sector Total* | *336* | *315* | *317* | *318* | -5.4% |
| Grand Total | 19,126 | 18,185 | 15,572 | 14,452 | -24.4% |

Source: USVI Department of Labor, Labor Market Basket, Quarterly Census of Employment and Wages by County/Island and Industry, Second Quarter.

Before the closure of the refinery, USVI exported billions of dollars in refined petroleum. It was the primary export. From 2008 through 2011, for example, the USVI exported an average of $1.86 billion of refined petroleum annually (Figure 3.4.5) and most of that was sent to the U.S. mainland. In 2008, approximately 84% of the USVI's exports went to the U.S. mainland, and that fell to approximately 61% in 2012 and 47% by 2016 (USVI BER, May 22, 2018).

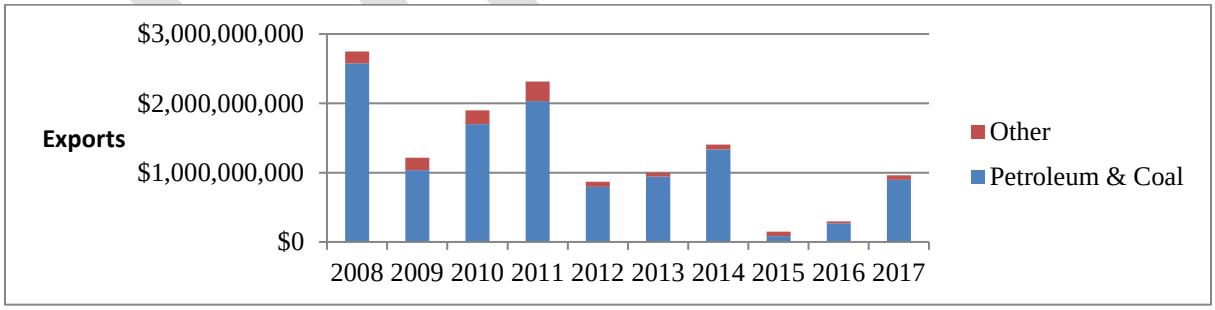


**Figure 3.4.5.** Value of exports (all commodities), 2008 – 2017.
(Source: International Trade Administration, August 2018)

Oil and gas were not just the primary export, but they were also the primary import. However, as shown in Figure 3.4.6, that has changed considerably. Approximately two-thirds of the

USVI's petroleum imports go into electricity and water production, and the remaining third into transportation (cars, trucks, vessels, and planes). After the HOVENSA oil refinery closed in 2012, USVI's Water and Power Authority (WAPA) utilized expensive, polluting diesel generators for electricity (Gould et al. 2015).

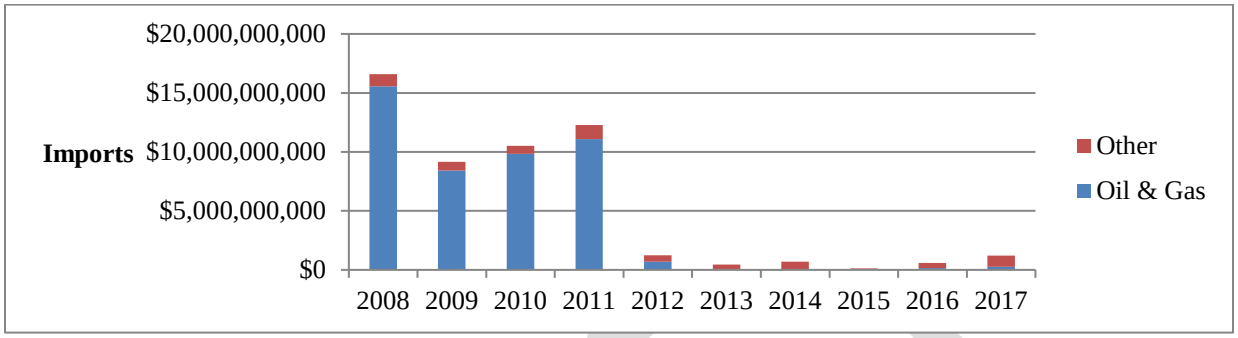


**Figure 3.4.6**. Value of imports (all commodities), 2008 – 2017.
(Source: usatrade.census.gov, August 2018)

The USVI was already mired in the after effects of two recessions in the 2000s before the refinery closed. First, there was the recession from 2002-2003, which was created by the collapse of the speculative dot-com bubble, a fall in business investments and expenditures, and the September 11 attacks in 2001. After that was the 2007-2009 recession created by the subprime mortgage crisis. The unemployment rate in St. Croix rose from 8.2% in 2001 to 11.5% in 2002 and 12.5% in 2003 (Table 3.4.5). The effects of the second recession on employment can be seen in the dip in employment in 2009.

**Table 3.4.5**. Unemployment rate, 1997-2006.

| Unemployment Rate, St. Croix | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **1997** | **1998** | **1999** | **2000** | **2001** | **2002** | **2003** | **2004** | **2005** | **2006** |
| 6.7% | 7.6% | 8.3% | 7.9% | 8.2% | 11.5% | 12.5% | 9.4% | 8.6% | 7.3% |

Source: VI Bureau of Labor Statistics, US Bureau of Labor Statistics.

Impacts of the 2008-2009 global recession and the HOVENSA closure are also evidenced in the total number of private sector employer establishments in St. Croix that fell from 2008 to 2012 and again from 2012 to 2016 (Table 3.4.6). Nonetheless, there were increases in the number of employer establishments in some sectors, such as health care & social assistance and finance & insurance from 2008 to 2016.

**Table 3.4.6**. Number of private sector employer establishments in St. Croix, 2008, 2012, 2016.

| Sector | Number of Employer Establishments | | | |
|---|---|---|---|---|
| | 2008 | 2012 | 2016 | Change 2008-2016 |
| Agriculture, forestry, fishing & hunting | 1 | 1 | 1 | 0 |
| Mining, quarrying, & oil & gas extraction | 2 | 3 | 3 | 1 |
| Utilities | 3 | - | 1 | -2 |
| Construction | 109 | 74 | 56 | -53 |
| Manufacturing | 41 | 36 | 28 | -13 |
| Wholesale trade | 22 | 25 | 14 | -8 |
| Retail trade | 198 | 194 | 159 | -39 |
| Transportation & warehousing | 44 | 38 | 35 | -9 |
| Information | 15 | 16 | 17 | 2 |
| Finance & insurance | 42 | 54 | 47 | 5 |
| Real estate & rental & leasing | 74 | 61 | 58 | -16 |
| Professional, scientific, & technical services | 117 | 102 | 88 | -29 |
| Management of companies & enterprises | 2 | 3 | 2 | 0 |
| Administrative & support & waste management & remediation services | 63 | 57 | 52 | -11 |
| Educational services | 29 | 23 | 18 | -11 |
| Health care & social assistance | 106 | 123 | 122 | 16 |
| Arts, entertainment, & recreation | 15 | 16 | 14 | -1 |
| Accommodation & food services | 110 | 118 | 97 | -13 |
| Other services (except public administration) | 108 | 92 | 96 | -12 |
| Industries not classified | 6 | 4 | 11 | 5 |
| Total | 1,107 | 1,040 | 919 | -188 |

Source: DOC Census County Business Patterns 2008, 2012, 2016.

There have been more recent gains in employment in some sectors. From 2014 through 2016, for example, the largest gains in the private sector were in the other services (358 ↑) and accommodation & food services (133 ↑) industries. Employment in the USVI public sector also increased: government (65 ↑) (Table 3.4.7).

**Table 3.4.7**. St. Croix employment in December, 2011 – 2016.

| Industry | Change in Employment | |
|---|---|---|
| | From 2011 to 2013 | From 2014 to 2016 |
| Agriculture | -3 | 1 |
| Mining | -23 | 37 |
| Utilities | 13 | -1 |
| Construction | -507 | -251 |
| Manufacturing | -1,263 | -43 |

| Industry | Change in Employment | |
|---|---|---|
| | From 2011 to 2013 | From 2014 to 2016 |
| Wholesale Trade | 124 | -70 |
| Retail Trade | -203 | 3 |
| Transportation & Communication | -6 | -51 |
| Information | -34 | -44 |
| Finance & Insurance | -23 | -5 |
| Real Estate, Rental & Leasing | -49 | -21 |
| Prof., Sci., & Technical Services | 21 | 20 |
| Management of Companies | 1 | 16 |
| Admin. Support & Waste Mgt & Remed. Serv. | -40 | -19 |
| Education Services | -156 | -29 |
| Health Care & Welfare Services | 12 | 54 |
| Arts, Entertainment & Recreation | -52 | 18 |
| Accommodation & Food Services | -377 | 133 |
| Other Services | -670 | 358 |
| Unclassified | 0 | 0 |
| *Private Sector Total* | -3,235 | 106 |
| *Government Sector Total* | -501 | 65 |
| *Federal Government Sector Total* | 3 | -9 |
| Grand Total | -3,733 | 162 |

Source: USVI Labor Market Basket, Quarterly Census of Employment and Wages.

Declines in the manufacturing sector were lessened by increasing production of rum. After 2011, rum exports from the USVI to the mainland increased from previous levels (Figure 3.4.7). There was a slight decline in rum exports after FY2013, which is attributed to Cruzan losing market share to Puerto Rico rum distilleries (Virgin Islands Daily News, April 28, 2014).

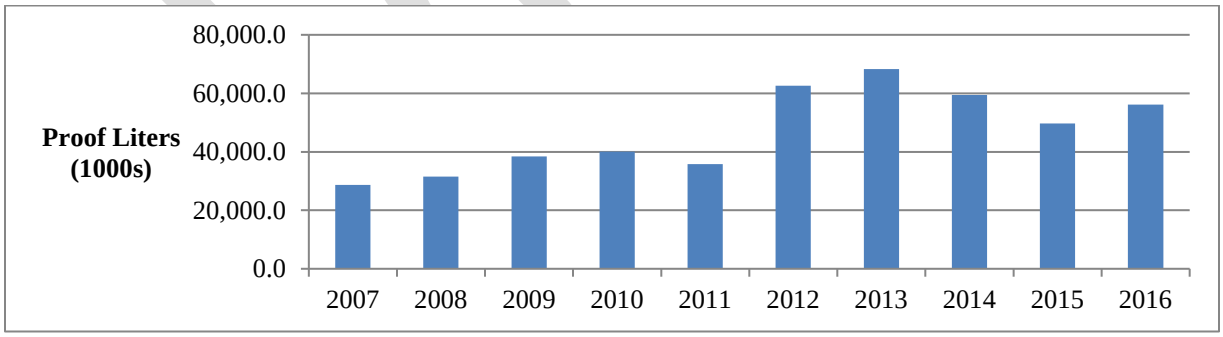


**Figure 3.4.7.** Proof liters of rum exported to mainland, FY2007 - 2016.
(Source: USVI Bureau of Economic Research (BER), 2018)

There are two distilleries in St. Croix: Cruzan Rum and Captain Morgan. In 2012, Diageo, the world's largest producer of beer, wine and spirits, moved production of its Captain Morgan Rum from Puerto Rico to St. Croix. As part of its agreement with the USVI, Diageo's St. Croix distillery would supply all of the Captain Morgan and Diageo's other branded rum products to the United States for 30 years. The agreement also requires at least 80% of Diageo's hired employees to be residents of the island. The Diageo distillery has the capacity to produce 20 million proof-gallons annually, which is approximately 29 million gallons (assuming 35% alcohol).

The Cruzan Rum Distillery, which is owned by Beam Suntory, exports Cruzan, Old St. Croix and bulk rum to the mainland. The USVI government also negotiated with Cruzan Rum producer, Cruzan VIRIL, Ltd., at the same time to obtain a similar agreement that guaranteed exclusive production of Cruzan Rum on St. Croix for 30 years (National Council for Public-Private Partnerships). Cruzan rum is shipped in bulk to Florida where it is bottled. The USVI, including St. Croix, benefits from the $13.50 excise tax that the U.S. government collects on every gallon of Virgin Islands-produced rum sold in the United States because the territory receives a portion of that tax (Virgin Islands Daily News, December 19, 2015).

The number of visitors (tourists and excursionists) to St. Croix increased significantly after 2008 with the rise of cruise passenger arrivals (Figure 3.4.8). However, cruise ship passenger arrivals and ship calls peaked in 2011 and show a cyclical pattern (Table 3.4.8). A general reduction may reflect the preferences of cruise passengers, who according to the Virgin Islands Daily News (July 21, 2015), indicated in a survey that they prefer St. Thomas over St. Croix.

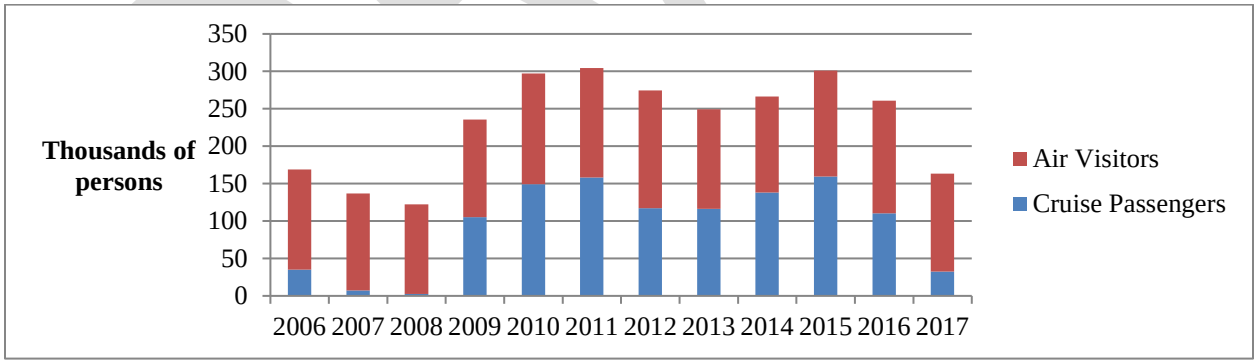


**Figure 3.4.8**. Visitor arrivals in St. Croix, 2006 – 2016.
(Source: U.S. Virgin Islands Bureau of Economic Research, Annual Tourism Indicators)

**Table 3.4.8.** Cruise passenger arrivals and cruise ship calls in St. Croix, 2006-2017.

| Year | Cruise Ships | Cruise Passengers (thousands) |
|---|---|---|
| 2006 | 25 | 35.2 |

| Year | Cruise Ships | Cruise Passengers (thousands) |
|---|---|---|
| 2007 | 6 | 7.1 |
| 2008 | 2 | 2.5 |
| 2009 | 48 | 105.1 |
| 2010 | 67 | 149.4 |
| 2011 | 72 | 158.2 |
| 2012 | 54 | 117.2 |
| 2013 | 49 | 116.4 |
| 2014 | 54 | 138.1 |
| 2015 | 58 | 142.7 |
| 2016 | 45 | 117.1 |
| 2017 | 17 | 32.6 |

Source: U.S. Virgin Islands Bureau of Economic Research, Annual Tourism Indicators.

The above declines of cruise passenger arrivals and cruise ship calls in 2017 cannot be simply explained as the result of Hurricane Maria. When January through April 2016 is compared to January through April 2017, there are considerable declines of both arrivals and ship calls as shown in Table 3.4.9. Those figures rebounded in 2018. That is not intended to suggest that the hurricane did not affect cruise ship calls or passenger arrivals. It did, but Hurricane Maria had a larger impact on air passenger travel to St. Croix. Figure 3.4.9 compares air passenger arrivals from September through December from 2013 through 2017 to illustrate the effects of Hurricane Maria on air passenger arrivals to St. Croix.

**Table 3.4.9.** Cruise passenger arrivals and cruise ship calls in St. Croix, January – April 2016, 2017, 2018.

| Month | Cruise Passengers Arrivals | | | Cruise Ship Calls | | |
|---|---|---|---|---|---|---|
| | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 |
| Jan | 27,282 | 7,299 | 22,155 | 12 | 4 | 12 |
| Feb | 22,404 | 4,595 | 5,510 | 8 | 2 | 3 |
| Mar | 11,629 | 5,835 | 3,826 | 6 | 3 | 4 |
| Apr | 14,821 | 7,013 | 14,493 | 5 | 3 | 6 |

Source: U.S. Virgin Islands Bureau of Economic Research, Annual Tourism Indicators.

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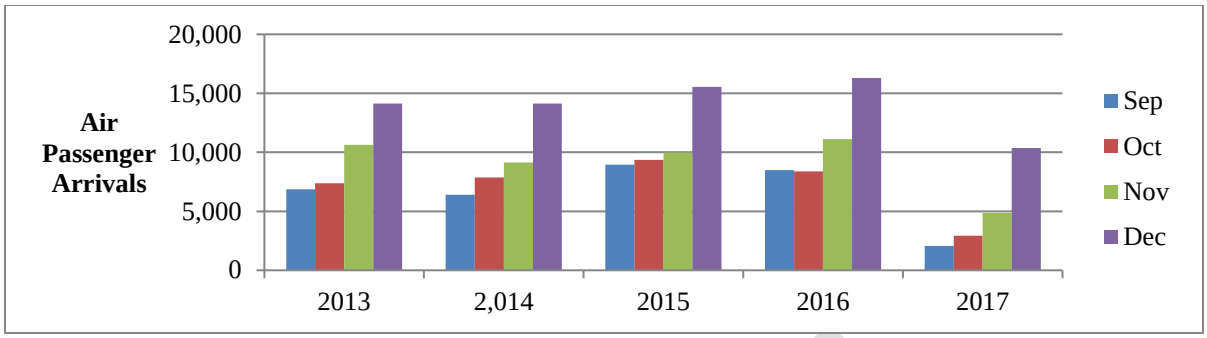


**Figure 3.4.9.** Air passenger arrivals in St. Croix, September through December, 2013-2017. (Source: U.S. Virgin Islands Bureau of Economic Research, Annual Tourism Indicators)

St. Croix's two largest hotels, the 200-room Divi Carina Bay All-Inclusive Resort & Casino on the east end, which was originally scheduled to reopen sometime in 2018, is now closed until June 2019 (Travel Weekly March 29, 2018). The 150-room Renaissance St. Croix Carambola Beach Resort & Spa on the north shore is not reopening until the fourth quarter of 2018. Caravelle Hotel & Casino in Christiansted, which accommodated relief workers, closed on April 30 to repair damage and would reopen on September 1, 2018; however, its casino and restaurant remained open throughout the repairs. The 138-room Buccaneer had minimal damage and played host to relief workers for two months before reopening to guests (Travel Weekly February 12, 2018). The Fred Hotel, a new boutique hotel in Frederiksted, opened in December 2017.

Hurricane Maria damaged St. Croix's airport and ports. The terminal at Henry E. Rohlsen Airport on St. Croix was damaged and closed to commercial flights until October 5, 2017. The island's only large cruise ship port, the Ann E. Abramson Marine Facility in Frederiksted, sustained extensive damage to the catwalk mooring extension. The first cruise ship to stop at the facility after the hurricane did not occur until November 15, 2017 (Virgin Islands Port Authority, February 20, 2018). A warehouse at the Wilfred Bomba Allick Port (also known as "The Containerport") was damaged. According to the Virgin Islands Daily News (September 27, 2017), hurricane-force winds picked up shipping containers from the port and landed them on the Molasses Pier, and Ruth Island, each at least a half mile from the end of The Container port pier. Empty 40-foot and 20-foot shipping containers weigh about four tons and two tons, respectively.

Hurricane Maria's more immediate impact on employment is illustrated in Figure 3.4.10. From January through August 2017, the average monthly unemployment rate in St Croix was 11.4%. After Hurricane Maria, it rose to 14.9% in October; however, it declined thereafter to a low of 8.4% in February 2018, but then jumped to 13.0% in March 2018 before declining again. In March 2018 the number employed actually increased by 130, but the workforce increased from 17,129 to 18,176 by 1,047.

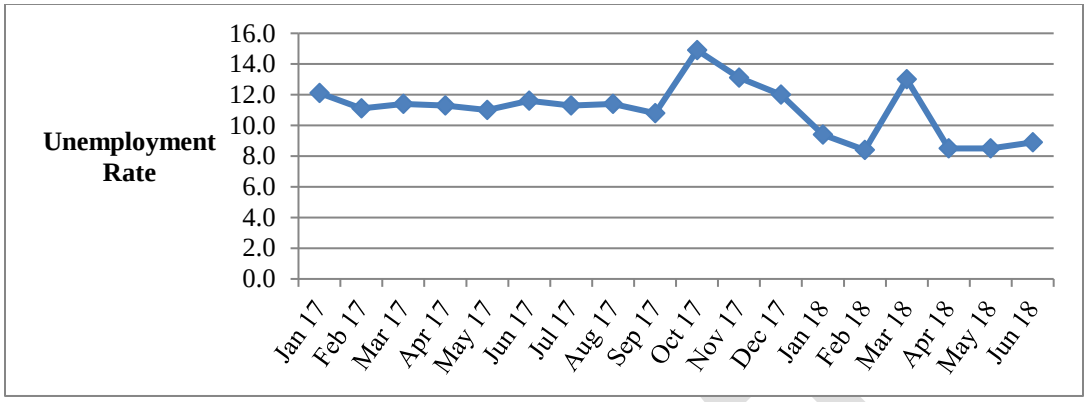


**Figure 3.4.10.** St. Croix unemployment rate, January 2017 – March 2018.
(Source: USVI Bureau of Labor Statistics June 2018)

The Captain Morgan Distillery had minimal damages caused by Hurricane Maria; however, Cruzan Rum had to suspend rum production for approximately three weeks in 2017, after Hurricane Maria (www.cruzanrum.com). Those impacts are reflected in the 9.6% decline in employment in the beverage & tobacco products industry in the fourth quarter of 2017 from the same quarter in the previous year (Table 3.4.10). Employment was down in several tourism-related industries, such as accommodation and food services. However, there was a substantial increase in employment and number of establishments in the heavy and civil engineering construction industry as many parts of St. Croix's infrastructure needed to be rebuilt. Employment rose by 725% (Table 3.4.10), and the number of employer establishments in the heavy and civil engineering construction industry increased 50%.

**Table 3.4.10**. Employment in various private sector industries, fourth quarter 2016, 2017.

| Industry, Non-Government | Employment, Fourth Quarter | | Percent Change |
|---|---|---|---|
| | 2016 | 2017 | |
| Accommodation | 724 | 628 | -13.3% |
| Food Services & Drinking Places | 766 | 548 | -28.5% |
| Amusement, Gambling & Recreation | 258 | 187 | -27.5% |
| Museums, Parks & Historical Places | 35 | 32 | -8.6% |
| Beverage & Tobacco Products | 187 | 169 | -9.6% |
| Construction of Buildings | 332 | 362 | 9.0% |
| Heavy and Civil Engineering Construction | 64 | 528 | 725.0% |
| Specialty Trade Contractors | 231 | 187 | -19.0% |
| All Industries | 9,635 | 8,828 | -8.4% |

Source: USVI Department of Labor Quarterly Census of Employment and Wages, 2018.

The U.S. Virgin Island's economy is known to be nearly six times more energy-intensive than the economy in the 50 states (EIA September 21, 2017). As of February 2017, the average price of electricity paid by USVI consumers was greater than 32 cents per kilowatt hour (Kwh), which was about three times the average in the 50 states (U.S. Department of Energy, Energy Information Administration [EIA] September 21, 2017). The St. Croix electrical system, with about 100 megawatts of capacity, is separated from the St. Thomas system by 40 miles of deep ocean waters, so each system serves its own grid.

According to the EIA, USVI's energy efficiency has been low because of water desalination requirements, the predominance of small simple-cycle generators, and operational constraints and power losses on the islands' isolated electric grids. As part of the U.S. pilot project for the international Energy Development in Island Nations (EDIN) program, the USVI government pledged to cut petroleum use by 60% between 2008 and 2025, using efficiency and renewable energy. More than half of the reductions are planned to come from energy efficiency, particularly in generation, transmission, street lighting, and desalination, with the balance coming from wind, solar, and biomass technologies, including waste-to-energy and landfill gas. By the end of 2013, the USVI had cut petroleum imports by 20% (EIA September 21, 2017). According to EIA, the USVI has commercial wind energy, waste-to-energy, landfill gas, and biomass energy potential. WAPA is converting most petroleum-fired electric generators to cleaner-burning propane and adding substantial solar resources. Solar water heaters are required in all new construction and in major renovations.

There is a commercial-scale solar plant in the Estate Spanish Township on St. Croix capable of producing 4 megawatts; however, it was severely damaged during Hurricane Maria. In August 2018, the plant was sold to Virgin Group's BMR Energy, which plans to restore the plant (Business Wire August 7, 2018).

The USVI has potential commercial wind energy resources, but finding the large sites needed for utility-scale projects on the islands has been a challenge. Moreover, the fluctuating output of wind generators complicates their integration into the islands' small grids, and the potential for damage from hurricanes has made financing wind projects difficult. The most promising locations for utility-scale wind projects are on high ridges and exposed capes where wind speeds are suitable for large turbines. In St. Croix, such wind speeds were found at potential sites around Longford.

In December 2015, the USVI government sold the former HOVENSA refinery and the oil and marine storage terminals on the site to ArcLight Capital Partners, a private equity firm based in Boston. According to Reuters (July 2, 2018), the current owners of the former HOVENSA

refinery (ArcLight Capital Partners and Freepoint Commodities) plan to invest $1.4 billion to refurbish and restart a portion of the renamed, Limetree Bay, refinery. ArcLight is a private equity firm that owns 80% of Limetree Bay Terminals, the oil storage and marine terminal on the site. ArcLight expects the refinery would be able to process 200,000 barrels of crude oil per day and deliver fuels by January 2020. It is estimated that restarting the refinery would bring 1,000 construction jobs and 700 permanent jobs to the site as well as increasing jobs at the Terminals by 750 workers. BP Oil is expected to supply the crude oil.

According to the Government Accountability Office (GAO), USVI's total public debt outstanding grew by 84 percent, from $1.4 billion in FY2005 to $2.6 billion in FY2015. The sharpest increase was between FY2008 and FY2010. During this period, total public debt outstanding increased by about $800 million, and almost all of USVI's public debt was in the form of bonds. Bonds issued by USVI's primary government are either backed by: 1) both a general obligation of the government and a gross receipts tax, or 2) an excise tax on rum produced in USVI. Bonds issued by component units are backed by their revenues. Approximately half of USVI's bonded debt is backed by revenues generated from the excise tax placed on rum imports to the U.S. mainland. Both the primary government and component units issued notes and took out loans during this period. Most of USVI's bonded debt outstanding is scheduled to mature in 2027 or afterward.

GAO also estimated that USVI's total public debt outstanding as a percentage of GDP doubled between FY2005 and FY2015, growing from 34% to 72%. The steepest increases were between FY2008 and FY2010, when total public debt outstanding as a percentage of GDP increased by 19%, and between 2011 and 2014, when it increased by 16%. Total public debt outstanding as a share of GDP reached 72% in FY2015. Bonded debt outstanding was 63% of GDP in FY2015. Total public debt outstanding per capita also increased during this period, and ranged from about $13,063 per person in FY2005 to about $25,739 per person in FY2015.

USVI's general revenue showed almost no growth in the 10-year period between FY2005 and FY2015. USVI's general revenue declined from FY2008 to 2009 due to the 2008 recession and operating losses at the Hovensa oil refinery, but rebounded in FY2010 as the economy recovered. General revenue decreased again from FY2010 to FY2011. Between FY2011 and FY2014 revenue increased again. Despite the increase, the FY2015 general revenue of $919.4 million was only about $43 million greater than that collected 10 years prior. In contrast USVI's total revenue (*i.e*. general revenue and program revenue combined) grew slightly by 2 percent on average, per year, between FY2005 and FY2015, from $1.6 billion to $1.9 billion (GAO).

According to territory officials, several factors contributed to USVI's increasing reliance on debt to fund government operations, including the recession of 2008, the 2012 closure of the Hovensa

oil refinery, a decline in USVI's share of worldwide rum sales, and a decline in visits from cruise ship passengers (GAO).

In April 2018, the U.S. Treasury approved the designation of Christiansted and all of the western end of St. Croix as Qualified Opportunity Zones, which are zones in low income communities that give tax breaks to investors that locate in those zones (Virgin Islands Consortium April 9, 2018, and Virgin Islands Free Press April 12, 2018). U.S. investors who invest in qualified property in an Opportunity Zone can defer U.S. capital gains tax on the new investment for up to seven years; reduce the amount of those capital gains by as much as 15 percent; and pay zero federal capital gains tax on any appreciation in value of that new investment.

## 3.5 Description of the St. Croix Fishery

### 3.5.1 Introduction

Today, fish and fishing contribute to the local economy and remain central to the island culture that characterizes the United States Virgin Islands (USVI), including St. Croix. The fisheries include small-scale commercial fishing, recreational fishing, and subsistence fishing. Commercial fishing supplies sustenance and employment, and recreational fishing provides food and leisure activity for local residents, tourists and visitors. Commercial and recreational fishermen target similar species of fish and shellfish, including reef fish, coastal and offshore pelagic fish, lobster, and conch, among others. Subsistence fishing, or fishing for household consumption, characterizes both commercial and recreational fisheries. Sport fishing, or competitive fishing for game fish, represents an aspect of recreational fisheries of significance, and especially of growing interest to St. Croix. This chapter describes the characteristics of the commercial, recreational, and fisheries within the St. Croix management area.

### 3.5.2 Commercial Fishing Activity

Commercial fishermen in St. Croix pursue multiple species, commonly using multiple gear types. These fishermen have been characterized as "artisanal"[24] because their commercial fishing vessels tend to be less than (and commonly much less than) 45 feet (13.7 m) long, have small crews, yield small revenues, and their seafood processors are small-scale producers. Commercial fishermen primarily target benthic, coastal pelagic and deep-water pelagic fish, and two species of shellfish: spiny lobster and queen conch (Kojis et al. 2017). The fishery is operated almost exclusively by men from small boats who return daily with their catch and

[24] The NOAA Fisheries Glossary Revise Edition June 2006 defines artisanal fishery as a fishery based on traditional or small-scale gear and boats.

market the catch themselves. A detailed summary of the history of previous surveys conducted in the USVI, extending back to 1930 (Fiedler and Jarvis, 1932), is found in section 3.10.

Commercial landings for St. Croix peaked in 2006 at 1,339,263 pounds and the 2016 annual landings were approximately one third of that value (Table 3.5.1). Average landings were generally greatest each year in January (4 of the 17 years), although the overall average monthly landings was greatest in March at 78,544 pounds (Table 3.5.1). The number of trips per year have decreased from a high of 13,880 in 2002 to a low of about 2,250 in 2015, but the number of pounds harvested per trip has increased recently, peaking in 2016 (Figure 3.5.1).

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**Table 3.5.1.** Commercial landings in pounds for St. Croix during 2000-2016 by year and month.

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2000 | 62,869 | 67,189 | 61,085 | 62,696 | 64,581 | 48,962 | 60,673 | 78,985 | 89,361 | 69,139 | 74,678 | 66,050 | 806,265 |
| 2001 | 66,168 | 69,114 | 71,913 | 68,660 | 74,337 | 68,869 | 93,586 | 100,789 | 91,171 | 100,916 | 103,452 | 96,287 | 1,005,260 |
| 2002 | 104,410 | 97,896 | 104,020 | 96,022 | 97,039 | 77,643 | 83,401 | 95,161 | 91,653 | 97,175 | 89,379 | 80,735 | 1,114,532 |
| 2003 | 94,821 | 87,832 | 101,609 | 97,083 | 88,974 | 56,611 | 91,303 | 99,297 | 77,438 | 85,877 | 58,074 | 55,924 | 994,843 |
| 2004 | 78,987 | 77,084 | 93,759 | 103,083 | 91,753 | 85,373 | 81,023 | 75,842 | 74,353 | 96,195 | 88,615 | 89,268 | 1,035,333 |
| 2005 | 93,689 | 80,151 | 99,412 | 86,720 | 74,723 | 82,816 | 90,862 | 102,058 | 92,442 | 111,930 | 123,030 | 112,660 | 1,150,490 |
| 2006 | 120,036 | 122,519 | 132,411 | 130,696 | 123,501 | 93,093 | 107,442 | 100,419 | 95,171 | 102,892 | 106,605 | 104,480 | 1,339,263 |
| 2007 | 119,179 | 107,353 | 135,978 | 121,234 | 116,768 | 96,976 | 108,725 | 98,068 | 95,502 | 76,706 | 79,163 | 71,384 | 1,227,034 |
| 2008 | 83,983 | 94,640 | 89,328 | 83,537 | 88,006 | 67,607 | 86,578 | 87,822 | 83,206 | 81,943 | 94,328 | 97,875 | 1,038,850 |
| 2009 | 111,566 | 97,764 | 105,489 | 87,783 | 83,010 | 61,707 | 60,855 | 64,225 | 65,173 | 69,742 | 66,941 | 67,128 | 941,382 |
| 2010 | 68,967 | 60,384 | 66,171 | 60,388 | 51,317 | 38,872 | 65,717 | 49,571 | 47,306 | 61,419 | 74,533 | 76,250 | 720,893 |
| 2011 | 77,851 | 65,170 | 71,787 | 74,683 | 67,899 | 50,394 | 42,100 | 41,719 | 29,212 | 45,828 | 38,316 | 40,065 | 645,020 |
| 2012 | 44,604 | 41,634 | 51,981 | 46,646 | 55,455 | 33,112 | 47,482 | 40,436 | 31,969 | 33,802 | 46,034 | 38,464 | 511,619 |
| 2013 | 50,133 | 41,849 | 42,778 | 46,423 | 41,729 | 32,582 | 38,814 | 32,718 | 25,865 | 42,673 | 43,922 | 30,410 | 469,896 |
| 2014 | 43,529 | 46,502 | 40,212 | 42,163 | 38,905 | 34,124 | 25,655 | 22,515 | 29,591 | 24,264 | 27,580 | 23,816 | 398,856 |
| 2015 | 26,998 | 32,980 | 31,405 | 39,615 | 39,618 | 19,212 | 31,446 | 26,096 | 43,273 | 31,719 | 31,175 | 26,302 | 379,839 |
| 2016 | 28,137 | 34,435 | 35,909 | 31,990 | 27,440 | 34,930 | 22,588 | 37,043 | 40,475 | 46,292 | 44,891 | 49,711 | 433,840 |
| **Average** | **75,054** | **72,029** | **78,544** | **75,260** | **72,062** | **57,816** | **66,956** | **67,810** | **64,892** | **69,324** | **70,042** | **66,283** | **836,071** |

Source: Southeast Fisheries Science Center, Feb 2018

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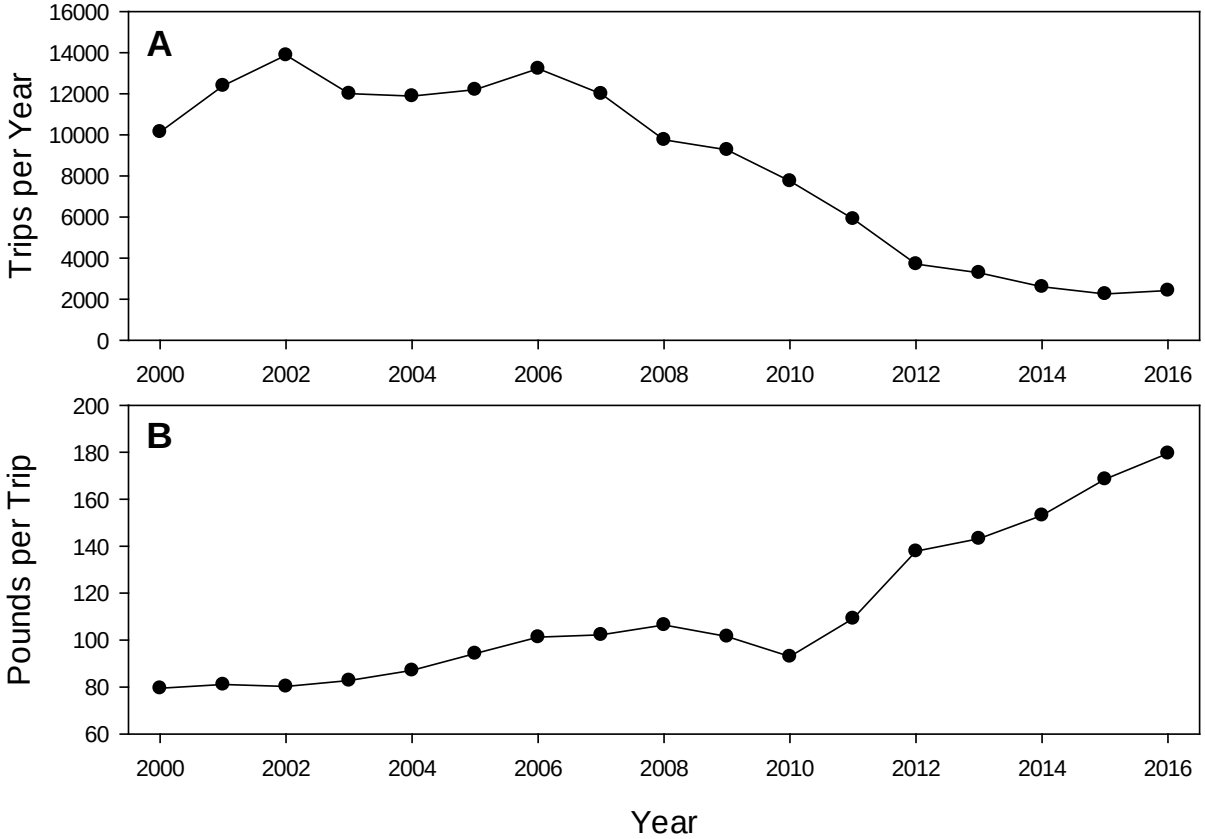


**Figure 3.5.1.** Number of fishing trips conducted each year in St. Croix (A) and the pounds harvested per trip (B).
(Source: Southeast Fisheries Science Center, Feb 2018)

### 3.5.2.1 Commercial Fishermen

The most recent fisher census survey (Kojis et al. 2017) reported 141 commercial fishermen living in St. Croix. That number was estimated using the list of fishermen applying for a fishing license renewal in 2015-2016 and in 2016-2017 as provided by the USVI's Department of Planning and Natural Resources (DPNR). From that universe of fishermen, 122 were able and willing to be interviewed of which only 98 reported that they actively fished. For the purposes of this section, results are presented for all fishermen that participated, regardless of active/inactive status.

Commercial fishermen in St. Croix had an average of 22.2 years experience and about half report that their sole employment comes from fishing (Kojis et al. 2017). Most fishing in St. Croix occurs in territorial waters, with 14.6% of the fishermen interviewed fishing solely in federal

waters. Roughly one fourth of the fishermen reported that they fished equally in federal and territorial waters. Almost all (96.3%) of the fishermen surveyed said that they fish throughout the year. The remaining 3.7% reported that they fished seasonally for queen conch, dolphinfish, and in the summer months when not working. In general, fishermen averaged 11.5 trips per month, at 6.6 hours per trip. The duration of fishing trips reported by fishermen in St. Croix did not exceed 12 hours.

In St. Croix the majority (36.4%) of surveyed fishermen reported that they fish using two different methods (*i.e.*, gear), followed by fishermen that reported only using one method (Kojis et al. 2017). Line fishing[25] was the most common method used by commercial fishermen, followed by SCUBA diving, and then trap fishing. Using multiple methods allows USVI fishermen to target multiple species per trip, which in St. Croix includes reef fish, spiny lobster, and coastal pelagics.

The number of fishermen submitting catch reports from 2000-2016 ranged from a high of 172 in 2002 to a low of 59 in 2015. The catch reports were modified in 2011 to better reflect harvest, and since 2012 the catch per unit effort (CPUE = pounds landed/number of fishermen) had been increasing, (*i.e.*, fewer fishermen are catching the same or more pounds) until 2016 when it decreased slightly (Figure 3.5.2).

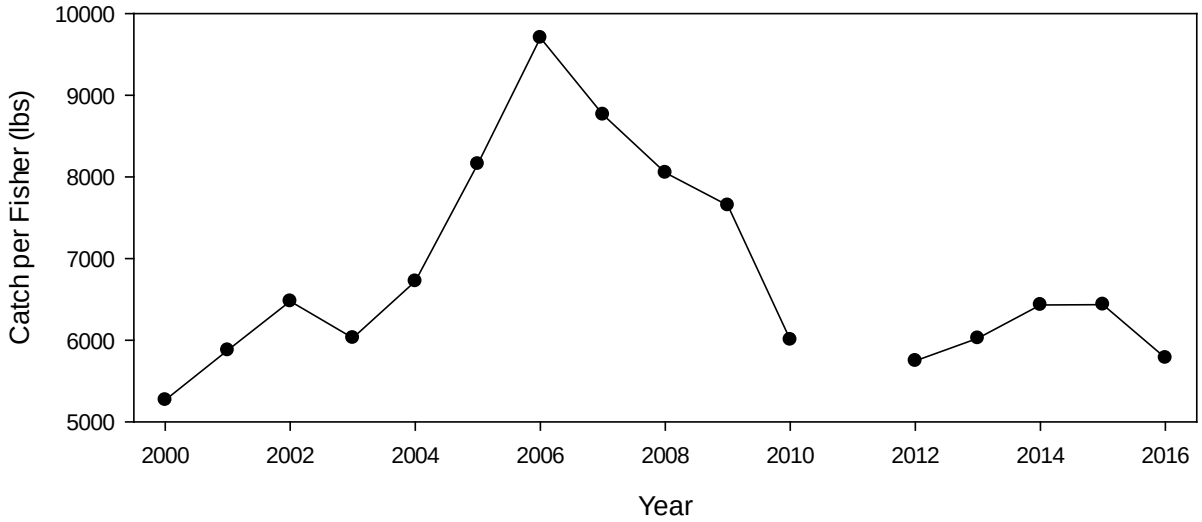


**Figure 3.5.2**. Total landings (pounds) per number of fisher each year in St. Croix. Year 2011 was omitted due to changes in reporting form.
(Source: Southeast Fisheries Science Center, Feb 2018)

[25] Line fishing includes fishing with hand lines, rods and reels, tuna buoys, deep-water snapper fishing, surface and bottom long lines, etc.

#### 3.5.2.2 Commercial Fishing Vessels

According to the 2016 census, there was a total of 129 fishing boats on St. Croix ranging from 12-45 feet in length with a mean length of 21.9 ± 5.6 (Kojis et al. 2017). That number does not include dinghies (generally < 12 feet in length), which fishermen generally use close to shore, when fishing with seine nets, and during calm weather. The St. Croix fleet was comprised of older vessels, the majority of which were built in 1971-1980 and constructed of fiberglass and wood. The majority of fishing vessels have a single gas-powered engine ranging in horsepower from 3.5-300 hp for outboard engines and 15-500 hp for inboard engines. Inboard engines were generally in the 151-300 size range while the majority of outboard engines were 76-100 hp. Most fishermen reported using electronic equipment such as depth finders and GPS, but most relied on cell phones for communication rather than a marine radio or EPIRB.

#### 3.5.2.3 Commercial Fishing Gear

Gear and methods used in the commercial fishery in St. Croix include hook and lines[26], traps, nets, and hand or spear collection via SCUBA or skin diving. The top three methods that fishermen reported using in St. Croix were lines (91.8%), SCUBA/dive (44.5%), and traps (31.8%)(Kojis et al. 2017). In St. Croix, commercial landings reported using dive gear have consistently been greater than landings reported for line, trap, or net gear types (Figure 3.5.3).

Of all the hook and line gear types used by fishermen in St. Croix, yo-yo reels (handlines) were used the most, followed by vertical set lines (multi-hook lines used in deep-water habitats) and rod and reel lines (Kojis et al. 2017). Only one fishermen reported using a bottom longline, and no fishermen reported using a surface long line. The number of hooks per line ranged from 1-40[27] and total hours fished ranged from half an hour to 10 hours, with most gear fished for about six hours per set. With the exception of bottom long line gear, most fishermen deployed two to three lines per set.

Half of the fishermen surveyed in St. Croix reported owning their own SCUBA gear, and almost all reported using snares or spears during diving operations (Kojis et al. 2017). Similarly, snare and spear gear were used by most fishermen while skin diving, and almost all of the skin divers reported using nets while diving. Average dive time reported was 3.7 hours for SCUBA gear and 3.2 hours for skin diving.

Fishermen in St. Croix reported owning 855 traps (96% of which are fish traps) (Kojis et al. 2017). However, studies show that fishermen do not use all of their traps all the time (Sheridan

[26] Hook and line gear means any handline, rod, reel, or any pole to which hook and line are attached, as well as any bob, float, weight, lure, plug, spoon, or standard bait attached thereto, with a total of ten or fewer hooks.
[27] Hook per line data was not available for the bottom longline gear.

et al. 2006; Kojis et al. 2017). During interview with trap fishermen, Sheridan et al. (2006) found that most fishermen in St. Croix used single traps marked with buoys (as opposed to trap lines) and set and hauled traps by hand. When buoys were missing, most fishermen would use dive gear to recover the missing traps (Sheridan et al. 2006). All traps were made of wire materials, but the reported size specifications of the traps varied (Sheridan et al. 2006). Trap lengths ranged from 4-6 ft (122 - 183 cm), trap widths ranged from 3-4 ft (91-122 cm), and all reported trap heights were 1.5 ft (46 cm). Mesh size ranged from 1.5-2.5 in (3.8 - 6.4 cm), which was compatible with regulations for fish traps in both federal and territorial waters (minimum size of 1.5 in [3.8 cm]).

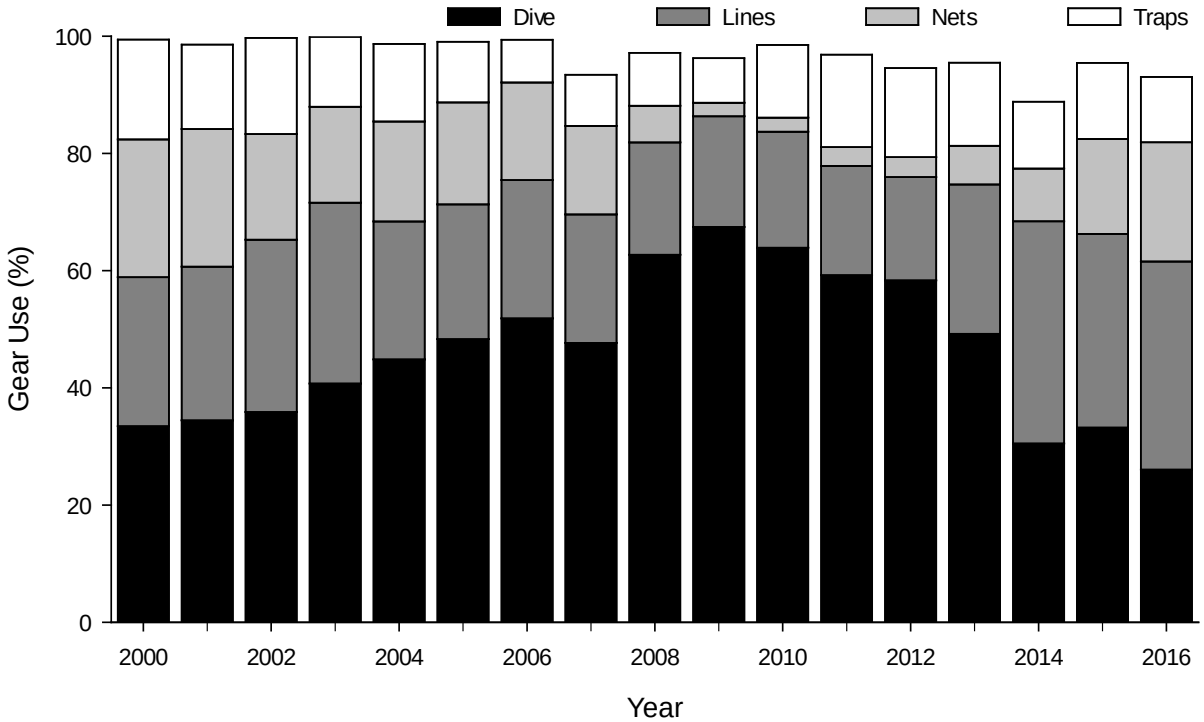


**Figure 3.5.3.** Percent of commercial landings (pounds) by top gear methods used by fishermen in St. Croix.
(Source: Southeast Fisheries Science Center, Feb 2018)

### 3.5.2.4 Targeted Species

Commercial fishermen in St. Croix target a wide variety of species, usually depending on which fish or shellfish they would easily be able to sell or would generate the greatest amount of money. Reef fish are targeted by >80% of the fishermen, which includes several species in the grouper, snapper, triggerfish, parrotfish, grunt, wrasse, surgeonfish, and squirrelfish families

(Kojis et al. 2017). Close to half of the fishermen also reported that they target spiny lobster and coastal pelagic species such as jacks and mackerels. Fishermen also reported targeting dolphinfish, wahoo, and deepwater snappers. Commercial landings corroborated what the fishermen reported as targeted catch groups, with parrotfish, spiny lobster, and snappers dominating the historical landings (2000-2016) (Figure 3.5.4) and spiny lobster, dolphin, and stoplight parrotfish dominating the recent landings (2012-2016) (Figure 3.5.5).

Fishermen reported that they fished seasonally for queen conch from June1 – October 31 each year, and for dolphinfish during November – May (Kojis et al. 2017).

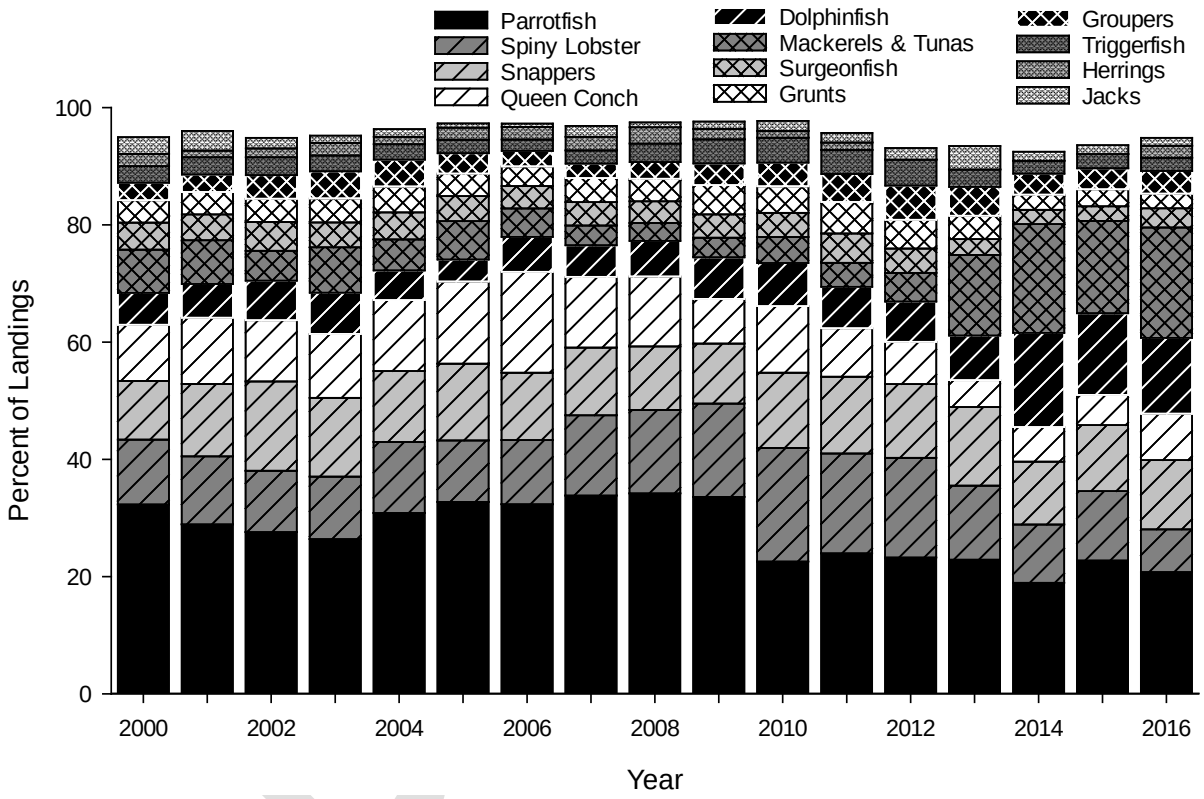


**Figure 3.5.4.** Most targeted (>90% of commercial landings) catch each year in St. Croix.
(Source: Southeast Fisheries Science Center, Feb 2018)

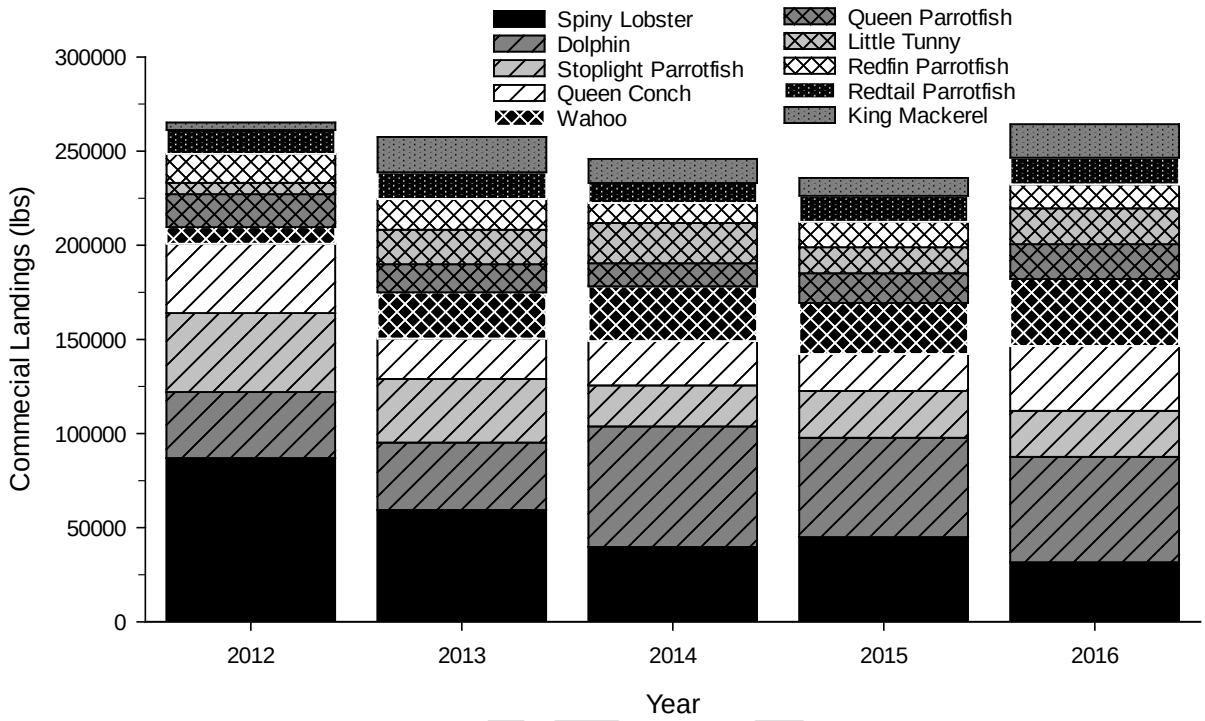


**Figure 3.5.5.** Most targeted (in pounds landed) stocks in 2012-2016 in St. Croix.
(Source: Southeast Fisheries Science Center, Feb 2018)

### 3.5.2.5 Fishing Areas

St. Croix fishing areas include territorial (<3 nm) and federal (3-200 nm) waters and fishermen report their landings by the location code where the fish were caught (Figure 3.5.6). St. Croix fishermen reported landing their catch at 19 different sites on the island (Kojis et al. 2017). The most used landing sites were: Altona Lagoon in Christiansted, Molasses Dock adjacent to the container port on the south side of St. Croix, and Frederiksted fishermen's pier and boat ramps. These three sites were commonly used by both commercial and recreational fishermen.

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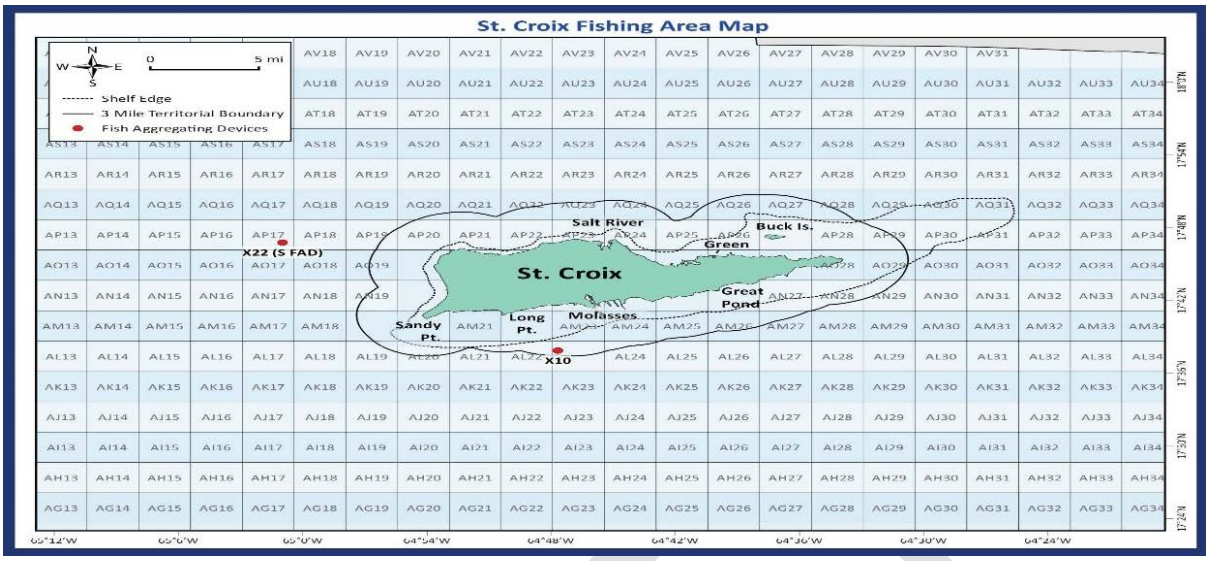


**Figure 3.5.6.** St. Croix commercial fishing area map.

### 3.5.2.6 Licenses, Permits and Fees

Federal Waters

Fishing vessel permits are not required to commercially harvest any Council-managed species in federal waters of the U.S. Caribbean (CFMC 2013c). Also, there are no federal licenses or permits required for the recreational harvest of reef fish, queen conch, spiny lobster, or aquarium trade species in the EEZ of the U.S. Caribbean. However, a federal permit may be issued to take or possess Caribbean prohibited coral only as a scientific research activity, exempted fishing, or exempted education activity. Efforts are underway to evaluate the development of a federal permit system in federal waters. Highly migratory species permits are required for commercial fishermen in the U.S. Caribbean EEZ.

Territorial Waters

The USVI requires commercial fishing licenses for (1) all commercial fishermen, (2) any person who uses a pot, trap, set-net, or haul seine, (3) any person who sells, trades, or barters any part of their catch (including charter boat operators who sell or trade their catch), and (4) commercial fishing helpers who must obtain a helper's permit to assist a licensed commercial fisher (the licensed commercial fisher must be onboard when the helper is fishing) (DPNR 2018). USVI commercial fishermen are required to report their catch (all species) and effort for every trip (CFMC 2010). Commercial Catch Report (CCR) forms must be submitted to the DPNR on a monthly basis, within two weeks after every fishing trip or within two weeks after the close of the month if no fishing took place (DPNR 2018). Commercial fishing licenses are only issued to U.S. citizens who are permanent residents of the USVI for at least one year. No licenses are issued to minors under 17 years old, except with written consent. Commercial fishermen are

exempt from boat registration fees, provided they possess a valid Department of Licensing and Consumer Affairs (DLCA) business license ($1.00 license) and are in compliance with submitting their required CCRs. Fishermen must first have a commercial fishing license before obtaining a DLCA business license to sell their catch.

On August 24, 2001, the DPNR implemented a moratorium on issuance of new commercial fishing licenses, which remains in effect. License renewals are only issued to fishermen who have held a commercial fishing license within three years of June 2001 and have complied with catch reporting requirements.

### 3.5.3 Recreational Fishing

The diverse coastal and marine environment is home to coral reefs, salt ponds, and mangrove forests. Common benthic habitats around St. Croix include coral reef, hard bottom, and seagrass (Kendall et al. 2001). This diversity supports a variety of species including sharks and sea turtles, reef fish, wahoo and tuna, which in turn creates ample fishing and SCUBA diving opportunities. While St. Croix's narrow shelf limits the area available for harvest for reef fish than the surrounding islands, it brings the pelagic fish closer to shore (Feingold 2014).

The island of St. Croix is surrounded by a drop which is 0.5 to 4 miles north or south, makes this management area known for some of the hardiest game fish in the world. St. Croix has a narrow under-water shelf off its shores, making fishing from small boats close to the shoreline more feasible than St. Thomas/St. John. Migrating schools of small fish gather in these areas, which attracts larger pelagics such as billfish, tuna, wahoo and dolphin.

Recreational fishermen also fish from shore (Figure 3.5.7), but there are various marine reserves around St. Croix in which fishing is prohibited, limited, and/or requires a special permit.

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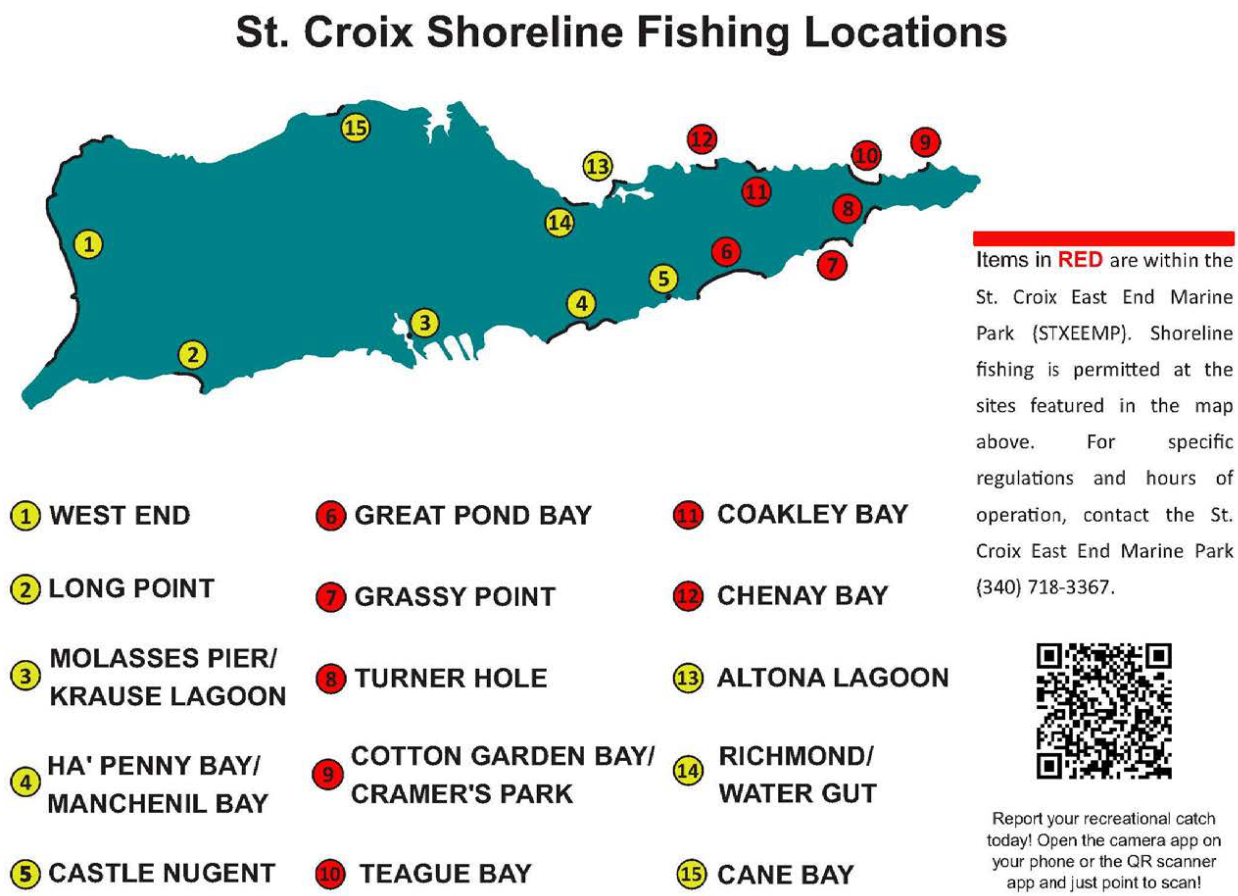


**Figure 3.5.7**. Shoreline fishing locations on St. Croix.
(Source: DPNR DFW 2018)

### 3.5.3.1 Recreational Fishermen

Recreational fishermen are persons who primarily fish to provide food for themselves or their families and those who catch and release fish. Although Marine Recreational Fisheries Statistics Survey recreational data collection program does not operate in St. Croix, the Division of Fish and Wildlife has made available three different ways for recreational fishermen to submit data for recreational fishing activities including traditional catch report forms, sport-fishing logbooks for charter companies or for those that fish often, and through a digital reporting form,[28] which can easily be accessed by scanning a QR code.

To date, the number of recreational (*i.e.*, non-commercial) fishermen on St. Croix has not been quantified (Goedeke et al. 2016). However, one study estimated that 10.8% of St. Croix

[28] https://form.jotform.co/80293727553866

residents fished recreationally, not including charter boat fishermen (Jennings 1992), and a separate household survey conducted from December 1998 to July 1999, (Mateo 2004) estimated the total number of recreational anglers on St. Croix to be 3,294. Approximately 60% of those recreational anglers fished exclusively from the shore (1,976 of 3,294), while an estimated 691 anglers fished from the shore and a boat (Mateo 2004).

#### 3.5.3.2 Recreational Fishing Vessels

Among registered boat owners in USVI, the average recreational boat is nearly 23' in length, with 82% less than 30' and only 5% being 40' or more in length (Eastern Caribbean Center, 2002).

#### 3.5.3.3 Recreational Fishing Gear

In territorial waters, the following gear types are considered commercial gear and may not be used by recreational fishermen: pots, traps, haul seines, and set-nets (a net consisting of a wall of fine mesh held up by a float line and anchored on the sea floor). Two of the most common gear used in the U.S. Caribbean recreational sector are hook-and-line and SCUBA diving equipment (Griffith et al. 2007).

#### 3.5.3.4 Recreationally Targeted Species

The USVI DFW deploys and maintains fish aggregating devices (FAD) in federal waters around the USVI (DPNR DWF 2018). Both surface and submerged buoys are deployed offshore to attract pelagic sport fish species such as dolphinfish, tunas, and wahoo. By attracting pelagic sport fish, FADs reduce the effort, time, and money that anglers spend searching for fish, which enhances recreational fishing opportunities.

Popular offshore game fish targeted by recreational fishermen include blue and white marlin, sailfish, yellowfin tuna, and wahoo. Targeted inshore game fish include barracuda, bonefish, kingfish, mackerel, snook, and tarpon. Seasons and locations vary depending on the species targeted (Table 3.5.2) Methods for inshore fishing include fly rod, top water bait and trolling.

**Table 3.5.2**. Location and season for species targeted by recreational fishermen in St. Croix federal and territorial waters.

| Area | Species | Location | Season |
|---|---|---|---|
| Offshore | Atlantic Blue Marlin | STX 100 Fathom drop off, FADs | All year, best May-October |
| Offshore | White Marlin | STX 100 Fathom drop off, FADs | All year, best April-May |
| Offshore | Sailfish | STX 100 Fathom drop off | October-March |

| Area | Species | Location | Season |
|---|---|---|---|
| Offshore | Yellowfin Tuna | STX 100 Fathom drop off and all shelf areas, FADs | August – February |
| Offshore | Blackfin Tuna | shelf areas, FADs | All Year |
| Offshore | Skipjack Tuna | shelf areas, FADs | All Year |
| Offshore | Dolphinfish (Mahi-Mahi) | shelf areas, FADs | October-January (peak season) May, July |
| Offshore | Wahoo | shelf areas, FADs | All year, best September-May |
| Inshore | Bonito (Little Tunny) | most inshore areas, drop-offs and around schools of bait fish | All year, best January-May |
| Inshore | Barracuda | reef & bank areas | All Year |
| Inshore | Hardnose | most inshore areas and around schools of bait fish and FADs | April-September |
| Inshore | Bar Jack | most inshore areas and around schools of bait fish | All Year |
| Inshore | Crevalle Jack | STX 100 Fathom drop off, most inshore areas and around schools of bait fish | All Year |
| Inshore | Rainbow Runner | reefs & banks, FADs | April – September |
| Inshore | Yellowtail Snapper | near reefs & bank areas | All Year |
| Inshore | Kingfish | reefs, most mid-shelf areas and drop-offs | All year, best February-May |
| Inshore | Cero | Near shore, reefs | All Year |

Source: https://www.vinow.com/general_usvi/fishing-guide/

#### 3.5.3.5 Tournament Fishing

Several fishing tournaments occur in St. Croix throughout the year, many of which are scheduled by local clubs such as the Golden Hook Fishing Club[29]. Some of the fishing tournaments include: Golden Hook Challenge (February), Dolphin Tournament (March), Guy/Gal Reel Challenge (September) and Wahoo Tournament (November).

#### 3.5.3.6 For-Hire/Charter Fishing

Fishing charters in St. Croix include inshore, offshore, and marlin trips. A few charters offer trips starting at 2 hours, however the most common are ½ day trips (4 hours, typically between 8am and noon, or 1 pm and 5 pm); ¾ of a day (6 hours); full day (8 hours); and Marlin trips (10 hours, usually 7:30 am to dusk). Short trips are generally inshore fishing only. Boat capacity of 4 to 6 passengers is common. Rates for fishing charters varies depending on length of trip, size of boat, inclusion of fuel in the rate versus fuel being a surcharge, and differences in services and equipment provided.

[29] https://www.fishstx.com/

#### 3.5.3.7 Licenses, Permits, and Fees

In the USVI, sale, barter, or trade of recreational catch is prohibited. Pots, traps, haul seines, and set-nets are considered commercial gear and may not be used by recreational fishermen. Fishing licenses are not required for recreational anglers in the USVI, but a recreational shrimp fishing permit is required in order to fish in Altona Lagoon and Great Pond, St. Croix.

Additional permits are required in the USVI for HMS and marine life harvested. For billfish, swordfish, tuna, and shark HMS, federal regulations and permit requirements apply in territorial waters. The Commissioner may issue permits to aquarists, collectors, and other persons desiring to collect specimens of marine life forms. Additional information regarding fishery management in territorial or federal waters is found in the USVI's Commercial and Recreational Fisher's Information Handbook, updated in 2018.

Since 2010, all anglers fishing recreationally in U.S. Caribbean federal waters are required to be registered through the National Angler Registry. In addition, there are Highly Migratory Species (HMS) permit requirements that apply to the commercial and the recreational sectors fishing in the U.S. Caribbean EEZ. For HMS regulations in the southeast, please visit the NMFS website for Atlantic HMS Compliance Guides. Federal permits are needed for Atlantic blue marlin, white marlin, sailfish, yellowfin tuna and skipjack tuna.

### 3.5.4 Subsistence Fishing

Fishermen in St. Croix fish for sustenance, to provide food for their family and household. Subsistence fishing characterizes both commercial and recreational fishing in USVI. With unemployment rates of over 14% in St. Croix in 2014 (Virgin Islands Department of Labor, 2014) and many residents living in conditions of poverty, fishing remains important in helping to make ends meet. Schmied and Burgess (1987) observed that in 1979, 50% of recreational anglers in USVI and 85% of anglers in Puerto Rico reported no preferences in species targeted. Lack of selectivity, coupled with large landings, indicated an intermixing between recreational and subsistence fishermen, making it difficult to differentiate the two (Schmied and Burgess, 1987). Subsistence fishing in USVI is not fully understood. More research is needed.

Recreational fishermen contribute to the local economy through purchase of vessels, gear, bait, and other local services. Hinkey et al., (1994) estimated that recreational fishing contributed more than $25 million to the economy of USVI (IAI, 2007).

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### 3.5.5 Foreign Fishing

There is enough capacity within the U.S. Caribbean EEZ to harvest and process the available optimum yield. All management measures apply to the domestic fishermen and there is no portion of the optimum yield allocated by the Council to a foreign fleet.

From the NS1:
(H) Part of the OY may be held as a reserve to allow for factors such as uncertainties in estimates of stock size and domestic annual harvest (DAH). If an OY reserve is established, an adequate mechanism should be included in the FMP to permit timely release of the reserve to domestic or foreign fishermen, if necessary (vi) OY and foreign fishing. Section 201(d) of the Magnuson-Stevens Act provides that fishing by foreign nations is limited to that portion of the OY that would not be harvested by vessels of the United States. The FMP must include an assessment to address the following, as required by section 303(a)(4) of the Magnuson-Stevens Act:

The Secretary must consider the capacity of, and the extent to which, U.S. vessels would harvest the OY on an annual basis. Estimating the amount that U.S. fishing vessels would actually harvest is required to determine the surplus. (B) Domestic annual processing (DAP). Each FMP must assess the capacity of U.S. processors. It must also assess the amount of DAP, which is the sum of two estimates: The estimated amount of U.S. harvest that domestic processors would process, which may be based on historical performance or on surveys of the expressed intention of manufacturers to process, supported by evidence of contracts, plant expansion, or other relevant information; and the estimated amount of fish that would be harvested by domestic vessels, but not processed (e.g., marketed as fresh whole fish, used for private consumption, or used for bait). (C) Joint venture processing (JVP). When DAH exceeds DAP, the surplus is available for JVP.

### 3.5.6 Illegal, Unreported, and Unregulated (IUU) Fishing

Foreign fishing in the EEZ waters surrounding St. Thomas/St. John is allowed as long as fishing vessels meet numerous requirements established in Section 201. Foreign Fishing (16 U.S.C. 1821) of the Magnuson-Stevens Act. For example, a foreign fishing vessel could legally be fishing in the EEZ if it has on board a valid permit issued under a governing international fishery agreement. However, there could be illegal, unreported, and unregulated (IUU) fishing taking place in the U.S. Caribbean EEZ waters. The IUU fishing is a global problem that threatens ocean ecosystems and sustainable fisheries. The IUU products often come from fisheries lacking the strong and effective conservation and management measures to which U.S. fishermen are subject. The IUU fishing most often violates conservation and management measures, such as quotas or bycatch limits, established under international agreements. By adversely impacting fisheries, marine ecosystems, food security and coastal communities around the world, IUU

fishing undermines domestic and international conservation and management efforts. Furthermore, IUU fishing risks the sustainability of a multi-billion-dollar U.S. industry.

## 3.5.7 Tribal Fishing Rights

The Magnuson-Stevens Act requires that FMPs contain a description of the nature and extent of Indian treaty fishing rights (16 U.S.C. 1853 (a)(2)). Historically, the United States has not negotiated any treaties over fishing rights with Native Tribes in the U.S. Caribbean.

## 3.5.8 Economic Characteristics of the St. Croix Fishery

### 3.5.8.1 Commercial Fishing

The St. Croix commercial fishing industry is largely artisanal in nature with about 140 registered and licensed fishermen. These fishermen, with few exceptions, make single day trips and during the course of the year may fish for a large number of species using a multitude of gear types. Given the artisanal nature of the fishery, furthermore, most fishing related activities, including the selling of their catches, are carried out by the fishermen themselves. Depending upon several factors - including size of the vessel, species being sought, and time of year - fishing may occur in territorial waters (<3 nm from shore), federal waters (>3 nm to 200 nm from shore), or both.

Economic information pertaining to the commercial fishing sector in St. Croix is limited; particularly in comparison to many of the larger U.S. mainland fisheries where both statistics and research are plentiful. This section presents a general overview of the St. Thomas/St. John commercial seafood industry based primarily on trip ticket data and the few economic studies pertaining to the islands.

#### 3.5.8.1.1 Trip Ticket Information

<u>Pounds, value, and price</u>
Lacking an established marketing structure – particularly seafood dealers - on the islands, most of the St. Croix commercial fishermen sell their daily catches directly to various outlets (e.g., along the road and restaurants). This complicates the collection of reliable basic statistics - including pounds landed, the value of landings, and trips – which are based on self-reporting by the fishermen via the submission of trip tickets. Thus, industry statistics, representing the aggregation of trip tickets submitted by each of the fishermen, are only as reliable as the information provided by the fishermen.

Given this caveat, reported commercial landings from St. Croix spanning the period from 2000 through 2016 totaled 14.2 million pounds, or approximately 836 thousand pounds per year. As indicated by the information in Table 3.9.1, reported landings prior to 2011, and the

implementation of ACLs, tended to exceed comparable figures after 2011. Specifically, reported annual landings from 2000 through 2010 averaged about 1.0 million pounds, or more than double the 473 thousand pounds annually harvested during the 2011- 2016 timeframe.

The value of the reported commercial harvest during the 2000-2016 timeframe totaled $71.1 million which equates to annual revenues to the fishing fleet of approximately $4.2 million. As with poundage, the dockside value in later years (*i.e.*, post 2010) declined from that reported in earlier years (Table 3.9.1). Specifically, the average annual dockside value in the terminal five-year period of analysis ($2.71 million) was lower than that of the initial five-year period of analysis ($4.15 million) by more than 30%. This difference, furthermore, does not account for the influence of inflation on prices. After removing inflation, the reported value of landings in the terminal five-year period was only about one-half of that in the initial five-year period.

The dockside price for the St. Croix harvested product gradually increased from about $4.20 per pound in the earlier years of analysis to about $6.20 per pound in the later years (Table 3.5.3); an increase of approximately 50%. Much of this increase represents the influence of inflation. Removing this influence indicates a much more modest price increase of less than 20%. Several factors could be contributing to the observed increase in deflated price received by St. Croix commercial fishermen. First, demand for the harvested product may have increased. Second, and as previously discussed, reported annual harvests (*i.e.*, supplies) declined during the 17-year period of analysis which, all other factors being the same, would in theory result in an increase in price.[30] Third, the composition of the harvested product may have changed with higher valued products comprising an increased share of the total.[31]

**Table 3.5.3**. St. Croix reported commercial landings statistics, 2000-2016.

| Year | Pounds (thousands) | Value ($1,000s) | Deflated Value[a] ($1,000s) | Price ($/lb) | Deflated Price[a] ($/lb) | Trips | Pounds Per Trip | Deflated Value Per Trip[a] |
|---|---|---|---|---|---|---|---|---|
| 2000 | 806.3 | 3,288.8 | 4,583.6 | 4.08 | 5.68 | 10144 | 79.5 | 452 |
| 2001 | 1,005.3 | 4,341.6 | 5,883.5 | 4.32 | 5.85 | 12396 | 81.1 | 475 |
| 2002 | 1,114.5 | 4,662.9 | 6,220.7 | 4.18 | 5.58 | 13880 | 80.3 | 448 |
| 2003 | 994.8 | 4,006.4 | 5,225.7 | 4.03 | 5.25 | 12015 | 82.8 | 435 |
| 2004 | 1,035.3 | 4,445.5 | 5,648.1 | 4.29 | 5.46 | 11888 | 87.1 | 475 |
| 2005 | 1,150.5 | 5,121.0 | 6,293.1 | 4.45 | 5.47 | 12202 | 94.3 | 516 |

[30] This statement, of course, is based on the assumption that close substitutes for the harvested product (either imported seafood or non-seafood products) are limited. There is no information regarding how much seafood is imported into St. Croix.
[31] Changes in the trip ticket database over time (primarily changes related to the aggregation of species) impede detailed analysis of the influence of this factor on price.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2006 | 1,339.3 | 7,104.2 | 8,457.4 | 5.30 | 6.31 | 13224 | 101.3 | 640 |
| 2007 | 1,227.0 | 6,476.9 | 7,498.6 | 5.28 | 6.11 | 12000 | 102.3 | 625 |
| 2008 | 1,038.9 | 5,465.3 | 6,092.3 | 5.26 | 5.87 | 9762 | 106.4 | 624 |
| 2009 | 941.4 | 5,000.6 | 5,595.1 | 5.31 | 5.94 | 9273 | 101.5 | 603 |
| 2010 | 720.9 | 3,991.0 | 4,391.7 | 5.54 | 6.09 | 7752 | 93.0 | 567 |
| 2011 | 645.0 | 3,634.4 | 3,878.4 | 5.63 | 6.01 | 5909 | 109.2 | 656 |
| 2012 | 511.6 | 3,099.6 | 3,240.0 | 6.06 | 6.33 | 3710 | 137.9 | 873 |
| 2013 | 469.9 | 2,784.5 | 2,868.2 | 5.93 | 6.10 | 3282 | 143.2 | 874 |
| 2014 | 398.9 | 2,427.6 | 2,461.5 | 6.09 | 6.17 | 2605 | 153.1 | 945 |
| 2015 | 379.7 | 2,496.4 | 2,528.9 | 6.57 | 6.66 | 2254 | 168.5 | 1,122 |
| 2016 | 433.8 | 2,738.0 | 2,738.0 | 6.31 | 6.31 | 2417 | 179.5 | 1,133 |
| [a]Based on the 2016 Consumer Price Index (CPI-U, U.S. Department of Labor) | | | | | | | | |

The changing composition of harvested product can be examined, in part, via the landings statistics for spiny lobster. Spiny lobster represents one of the higher valued species harvested by commercial fishermen in St. Croix and, as indicated by the information presented in Table 3.5.4, the price of the harvested product increased from about $7.00 per pound to $7.50 per pound during the 17-year period of analysis with price in some years equaling $8.00. This represents a 20%-70% premium over the average price of all harvested seafood with the premium appearing to have declined over time. During the early 2000's, as based on the information presented in Tables 3.5.3 and 3.5.4, spiny lobster represented about 20% of the total St. Croix commercial seafood landings by value (with a peak of 25% in 2010). This percentage has fallen in recent years, equaling less than 10% in 2016. Thus, it does not appear that the change in composition, at least in relation to spiny lobster harvests, has been a major contributing factor to the observed increase in deflated prices received by the fishermen.

**Table 3.5.4.** St. Croix reported commercial spiny lobster landings, 2000-2016.

| Year | Pounds (thousands) | Value ($1,000s) | Deflated Value[a] ($1,000s) | Price ($/lb) | Deflated Price[a] ($/lb) | Trips | Pounds Per Trip | Deflated Value Per Trip[a] |
|---|---|---|---|---|---|---|---|---|
| 2000 | 89.0 | 623.1 | 868.5 | 7.00 | 9.76 | 2,566 | 34.7 | 338 |
| 2001 | 116.7 | 816.3 | 1,106.3 | 7.00 | 9.49 | 3,276 | 35.6 | 338 |
| 2002 | 116.3 | 813.9 | 1,085.8 | 7.00 | 9.34 | 3,429 | 33.9 | 317 |
| 2003 | 106.0 | 742.3 | 968.2 | 7.00 | 9.13 | 3,317 | 32.0 | 292 |
| 2004 | 125.4 | 877.9 | 1,115.4 | 7.00 | 8.89 | 3,575 | 35.1 | 312 |
| 2005 | 120.9 | 967.4 | 1,188.9 | 8.00 | 9.83 | 3,567 | 33.9 | 333 |
| 2006 | 146.6 | 1,172.7 | 1,396.1 | 8.00 | 9.52 | 4,094 | 35.8 | 341 |
| 2007 | 168.0 | 1,344.0 | 1,556.1 | 8.00 | 9.26 | 4,461 | 37.7 | 349 |
| 2008 | 148.0 | 1,184.0 | 1,319.9 | 8.00 | 8.92 | 3,694 | 40.1 | 357 |
| 2009 | 149.9 | 1,094.8 | 1,225.0 | 7.30 | 8.17 | 3,830 | 39.1 | 320 |
| 2010 | 139.7 | 994.7 | 1,094.6 | 7.12 | 7.84 | 3,536 | 39.5 | 310 |
| 2011 | 109.8 | 806.0 | 860.1 | 7.34 | 7.84 | 2,508 | 43.8 | 343 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 2012 | 87.0 | 696.0 | 727.5 | 8.00 | 8.36 | 1,959 | 44.4 | 371 |
| 2013 | 59.4 | 440.1 | 453.4 | 7.41 | 7.63 | 1,547 | 38.4 | 293 |
| 2014 | 39.7 | 294.4 | 298.5 | 7.41 | 7.51 | 1,041 | 38.2 | 287 |
| 2015 | 45.0 | 337.2 | 341.5 | 7.50 | 7.60 | 969 | 46.4 | 352 |
| 2016 | 31.6 | 237 | 237 | 7.51 | 7.51 | 812 | 38.9 | 291 |

Trips and catch in relation to trips

Overall, the reported number of trips by St. Croix commercial fishermen declined steadily over the time period spanning from 2000 through 2016 (Table 3.5.3). During 2000-2004, for example, the reported number of trips averaged 12,065 annually. This number had fallen by more than three-quarters to an average of 2,854 during 2012-2016. During the earlier years of analysis, furthermore, spiny lobster was harvested on approximately one-quarter of the reported number of trips (based on information in Tables 3.5.3 and 3.5.4). Since 2012, the harvest of spiny lobster was reported on approximately 45% of the total commercial trips.[32]

In relation to the declining number of reported trips, the catch per trip gradually increased over time; averaging nearly 160 pounds during 2012-2016 compared to about 82 pounds during 2000-2004. With the increased average pounds landed per trip, the inflation adjusted per trip revenues more than doubled from an average of $457 during 2000-2004 to $990 during 2012-2016 (expressed in 2016 dollars). Among those trips reporting the harvest of spiny lobster, catch of that species increased from an average of 34 pounds per trip during 2000-2004 to about 42 pounds during 2012-2016 (Table 3.5.4).

Trips and catch in relation to number of fishermen

Kojis et al. (2017) reported that the number of licensed fishermen in St. Croix equaled about 141 in 2016[33] of which about 80%, or 113, were "active"[34]. Based on reported dockside value of $2.74 million, average revenue per "active" commercial fisherman in 2016 is estimated to approximate $24.2 thousand (approximately $19.4 thousand based on a population of 141 "active" and "inactive" fishermen). This is somewhat less than that reported by Fleming et al. (2017) in a 2014 survey of St. Croix commercial fishermen wherein the average value of landings among respondents equaled $38 thousand.[35] The average number of trips per St. Croix fisherman in 2016, based on 113 active fishermen in conjunction with the 2,417 reported trips, is

[32] Other species were also frequently harvested in conjunction with spiny lobster on these trips.
[33] Because all fishermen do not renew their fishing licenses on a timely basis, Kojis et al. (2017) estimated the universe of fishermen based on both the 2015-2016 and 2016-2017 lists of fishermen provided to the authors by the appropriate management agency.
[34] Kojis et al. (2017) designated those fishermen who no longer commercially fished as "inactive".
[35] Fishermen participating in St. Croix portion of the survey (a total of 38) were not asked for revenues in the survey. Instead, Fleming et al. (2017) utilized the landings data records for these 38 fishermen to derive revenues. It is worth noting, however, that revenue data among the 38 fishermen are highly skewed with the median value of landings being only $10.5 thousand.

estimated to approximate 21 (or approximately 17 based on the universe of 142 "active and "inactive" fishermen).[36]

Much of the decline in reported number of trips since 2000 can be explained by a reduction in the number of licensed fishermen. Specifically, Kojis (2004), in a 2003 census of USVI commercial fishermen, reported 223 St. Croix licensed fishermen. Of licensed fishermen surveyed, 61% reported being full time.[37] The deflated value of harvest in 2003 (expressed in 2016 dollars) equaled $5.23 million which equates to $23.4 thousand per licensed fishermen. This figure increases to about $38.4 thousand if all harvest is assigned to those fishermen considered full-time (about 136 based on 223 licensed fishermen and 61% being considered full time).

Comparing 2016 estimates with 2003 estimates suggests a relatively large decline in the value of harvest per fishermen. Based on all licensed fishermen, the deflated value of harvest per fishermen fell almost 20% (from $23.4 thousand to $19.4 thousand). If one equates the 2003 "full time" fisherman to being synonymous with the 2016 "active" fisherman, one can infer that the decline in value of landings per fisherman to be more than a third (from $38.4 thousand to 24.2 thousand).[38]

<u>Profitability</u>

In addition to estimating the value of landings among the 38 St. Croix fishermen interviewed, Fleming et al (2017) provided estimates of fishing costs and profits among this group of fishermen. They estimate average net revenues of $23.8 thousand (median value of $2.9 thousand) and total variable costs of $14.5 thousand (median of $4.7 thousand). Fixed costs, based on a lower number of responses (13) averaged $2.3 thousand. The relatively low income estimates presented by Fleming et al. (2017) cannot be explained by a large proportion of part-

[36] Kojis et al. (2017), based on results of a survey of St. Croix commercial fishermen, report that "active" fishermen make an average of 11.9 trips per month, or in excess of 100 trips per year (when both "active" and "inactive" fishermen are included in the analysis, the average number of monthly trips is equal to 11.5). Several explanations can be forwarded regarding the large discrepancy between the reported number of trips associated with the trip tickets and those derived from the survey by Kojis et al. (2017). First, fishermen may only report some fraction of their trips on the trip ticket forms (which also calls into question total industry landings and associated revenues). Second, fishermen may aggregate trips (as well as landings and revenues) when submitting trip tickets (*i.e*., include several trips on a given form). Third, monthly trips as given by the fishermen and reported by Kojis et al. (2017) may be upward biased. Finally, the discrepancy may reflect an amalgam of all the aforementioned factors. Any significant aggregation of trips in the trip ticket database would, of course, distort estimated harvests and revenues per trip derived from the trip ticket database. Similarly, any significant fraction of trips going unreported raises doubt regarding total annual commercial landings and revenues.

[37] Full-time in the 2003 census was defined as spending in excess of 36 hours per week engaged in fishing activities (e.g. catching fish, selling fish, and repair work on boats and gear). The term "active" and "inactive" as Kojis et al. (2017) used in the 2016 census was not used in the 2003 census.

[38] As discussed in later detail in Section 3.9, St. Croix licensed commercial fishermen appear to be less dependent upon fishing as a source of household income than was the situation in 2003.

time fishermen. Specifically, the researchers report that 75% of the interviewed St. Croix commercial fishermen considered themselves full-time. As considered later in this section of the report, however, a sizeable portion of licensed fishermen are retired and likely receiving benefits from other sources. In addition, many licensed fishermen also work as 'helpers' on other boats and receive income from such activities (Kojis, 2017).

### 3.5.8.2 Characteristics of commercial fishermen (including income) and equipment (including boat)

#### 3.5.8.2.1 Age of licensed commercial fishermen

Kojis et al. (2017) conducted a 2016 census of USVI licensed commercial fishermen. They found that the average age of licensed fishermen in St. Croix was 56.9 years with a range from 23 years to 89 years. Fishing experience by the St. Croix licensed fishermen equaled about 27 years and ranged from no years to 63 years. In a 2003 census conducted by Kojis (2004), the average age among St. Croix licensed fishermen was found to be about 51 years (range from 20 years to 80 years) with a comparison of the two censuses indicating an aging population of commercial fishermen. Fishing experience among the St. Croix licensed fishermen in 2003 was found to equal 22 years with a range from none to 65 years. Comparison of the two censuses suggests that, associated with the increased age comes an increase in fishing experience.[39]

#### 3.5.8.2.2 Household income derived from fishing

Kojis et al. (2017), in their 2016 census of USVI licensed commercial fishermen, report that about 55% of the St. Croix fishermen relied on fishing for 50% or more of their household income with almost 40% of the interviewed fishermen indicating that commercial fishing represented their sole source of household income.[40] Conversely, about a third of the fishermen indicated that fishing contributed 25% or less of their household income. On average, respondents indicated that 58% of household income was derived from fishing with a range from 0% to 100%. Those licensed fishermen who indicated employment outside that of fishing relied on fishing for only 36% of their household income, on average. By comparison, those interviewees reporting that they were not employed (but not retired) depended on fishing for almost 80% of their household income. Finally, household income derived from fishing among retirees averaged just over a quarter.

[39] One caveat is that the 2003 census asked about fishing experience in the USVI whereas the question in the 2016 census was not region specific.
[40] Kojis (2004) in her 2003 census of commercial fishermen reported that about one half of the St. Croix fishermen indicated that 50% or more of household income was derived from fishing.

### 3.5.8.3 Fishing Practices

#### 3.5.8.3.1 Equipment used in fishing activities

According to Kojis et al. (2017), more than 95% of the 2016 licensed commercial fishermen in St. Croix owned or co-owned the primary boat engaged in fishing activities. About 55% of the boats were built before 1991 with only two percent being built since 2010. The average boat length was just under22 feet and ranged from 12 feet to 45 feet.[41] Fishermen place the value of their boats and equipment (excluding fishing gear) at $34 thousand but with significant variation (*i.e.*, standard deviation of $59 thousand). The value of the fishing gear, based on responses among St. Croix fishermen averaged $5.3 thousand with an associated range from $75 to $50 thousand.

#### 3.5.8.3.2 Assistance in fishing activities

Kojis et al. (2017) report that virtually all commercially licensed fishermen in St. Croix fish with a crew (almost 98%). The crew may consist of other commercial fishermen, helpers (not licensed), or both. On average, the total number of helpers and/or other commercial fishermen equaled 2.16. Assistance can take any a variety of forms ranging from operation of the boat to help in selling the catch. With few exceptions, those assisting tend to be family, friends, or acquaintances.

#### 3.5.8.3.3 Degree of engagement in fishing

In their 2016 census of USVI licensed fishermen, Kojis et al. (2017) examined engagement in fishing based upon whether the fisherman was considered “active” or “inactive”. Eighty percent of the St. Croix fishermen considered themselves to be “active”. This statistic, however, fails to indicate the degree of activity by the fishermen that are “more” engaged in fishing.

Crosson (2018), in an analysis of the impact of the 2017 Hurricanes Irma and Maria on the USVI commercial fishing industry utilized the Department of Fish and Wildlife license data for 2017 to generate the population of commercial fishermen in St. Croix and the characteristics of this group. Crosson (2018) found that 88 of the 112 licensed fishermen, or almost 80%, were considered to be regularly active in the fishery where an “active” fisherman, as defined by Crosson, as one who was (a) registered and licensed and (b) who fished for at least three months out of the year. Those who submitted nine or more “did not fish” reports during the year were considered “inactive”. This analysis indicates that only about one-fifth of the St. Croix commercial fishing sector is rather seasonal in nature; *i.e.*, fishing three months or less.[42] This

[41] This compares to a mean boat length of 2003 of 20.7 feet (Kojis, 2004).

[42] This finding, of course, is premised on fishermen accurately completing their submitted trip tickets.

figure compares favorably with that reported by Fleming et al. (2017) who, in a 2014 economic survey of USVI commercial fishermen, found that 75% of the St. Croix fishermen interviewed (65 in total) considered themselves to be full time.[43]

While the 2016 census of USVI commercial fishermen did not elicit information as to the full-time versus part-time status of fishermen, the 2003 census, conducted by Kojis (2004) did elicit such information.[44] Based on the definition provided to fishermen, more than 60% of respondents in St. Croix considered themselves to be full-time fishermen. To the extent that the findings by Kojis (2004) are comparable to those reported by Fleming et al. 2017), one can conclude that the proportion of full-time fishermen in relation to the total population of licensed fishermen has increased somewhat between 2003 and 2014 (*i.e.*, from more than 60% to 75%). Caution, however, is warranted with respect to this conclusion because, as noted, no criteria was used in defining "full-time" by Fleming et al. (2017) whereas a specific criteria was used by Kojis (2004).

#### 3.5.8.3.4 Time spent on fishing related activities

Given the artisanal nature of the commercial fisheries in the USVI, fishermen often conduct many of the activities related to fishing (e.g., selling the fish and repairing the boat and gear). Kojis et al. (2017) found that among St. Croix fishermen, the "average" commercial fisherman spent approximately 6.6 hours fishing per trip (including fishing and traveling). Another 6.6 hours per week was spent by the "average" fisherman selling his catch, approximately six hours per week fixing boat/engine/gear, and 2.7 hours per week preparing for fishing.

#### 3.5.8.3.5 Types of fishing

Various types of gear, as noted, are used by the St. Croix commercial fishing fleet. Kojis et al. (2017), in their 2016 census of fishermen, found that 70% of the fishermen engaged in more than one type of fishing with about one-third of the fishermen engaged in three or more types of fishing.

Line fishing (covering a wide variety of line based gear) was the most common fishing technique used by commercial fishermen in St. Croix with 92% of fishermen reporting this type of fishing. This was followed by scuba diving by fisher (45%), trap fishing (32%), and net fishing (15%). Summation of these four types of fishing, equal to 184%, yields some indication as to the many types of fishing practices among the 'average' fisherman. In terms of revenues generated from

[43] No criteria were provided by Fleming et al. (2017) by which to guide respondents in selecting full-time versus part-time status.
[44] For purposes of the study, full time was defined as fishermen spending greater than 36 hours per week on fishing related activities.

the different fishing practices, about half ranked line fishing as the most important. Scuba diving was ranked as the most important revenue-generating practice by about 30% of the interviewed fishermen followed by trap fishing (15%) and free diving (8%).

#### 3.5.8.3.6 Targeted Species

The multitude of species available for harvest in the USVI allows for the targeting of numerous species throughout the course of the year (or even on a given trip). Targeting behavior may be in response to a large number of factors including, but not limited to, weather conditions, prices of the respective species, migration patterns of certain species, size of boat, and location of the fisherman.

Given this to be the case, Kojis (2004), in her 2003 census of USVI commercial fishermen, elicited information on targeting behavior. For purposes of the study, the researcher provided eight categories to which participants could respond (reef fish, coastal pelagics, deep pelagics, deepwater snappers, bait fish, conch, whelk, and lobster). Nineteen percent of the St. Croix interviewed fishermen reported that they targeted only species in one of the eight categories of fish in 2003 while 27% targeted species in two of the categories. More than one-half of the study participants reported the targeting of species in three or more of the previously defined categories.

Based on the 2003 census, 85% of the commercial fishermen in St. Croix reported that they targeted reef fish with deepwater snappers representing the next most targeted category of species (42%). This was closely followed by lobster (41%), conch (39%), and deep pelagic (33%). Bait fish was targeted by another 14% of the interviewed fishermen with whelk being targeted by less than 5% of the interviewed fishermen.

In their 2016 census of USVI fishermen, Kojis et al. (2017) elicited information regarding targeting behavior among St. Croix commercial fishermen.[45] With minor exceptions, the same categories of species were used in the 2016 census as those found in the 2003 census.[46] With respect to the 2016 census, 10% of the St. Croix fishermen indicated targeting species in only one of the categories while 18% stated that they harvested species from two of the listed categories. The remaining 72% targeted species in three or more of the stated categories with the targeting of species in three categories being the most frequently noted (22%).

[45] The question was asked somewhat differently than that in the 2003 survey. Specifically, whereas the 2003 survey specifically elicited information on targeting behavior, the 2016 census queried species that generated the highest revenues. To the extent that 'highest revenues' does not relate directly to 'targeting', comparison of the two studies may be problematic.

[46] Specifically, two new categories, not included in the 2003 census, were included in the 2016 census: "dolphinfish & wahoo" and "other". It is likely that dolphinfish and wahoo were included in the category "deep pelagic" in the 2003 census.

Similar to the findings of the 2003 census, species in the reef fish category were the most frequently targeted with 38% of the respondents doing so. Twenty-two percent of the interviewed fishermen stated that they targeted deepwater snapper with 17% reporting the targeting of dolphin and wahoo. Queen conch and lobster were each targeted by 15% of the St. Croix fishermen.

#### 3.5.8.3.7 Fishing in territorial and federal waters

As noted by Kojis et al. (2017), a large percentage of fishing activities among St. Croix licensed commercial fishermen occurs in territorial waters. Overall, 59% of the fishermen indicated that territorial waters were their primary fishing grounds. Only 15% of the fishermen indicated fishing primarily in federal waters. The remaining 26% reported fishing in both territorial and federal waters in (nearly) equal amounts.

#### 3.5.8.3.8 Sales of harvested product

Given the lack of established marketing channels in the USVI, fishermen of sell their daily catches in a variety of methods. Some fishermen, furthermore, use more than one method. For example, 39% of St. Croix licensed fishermen in 2016 reported selling their catch along roads (usually from the back of trucks) while another 39% sold their catch at the landing site (Kojis et al., 2017). Similarly, about 38% reported selling their product to restaurants while 42% sold their catch from home. Twenty-six percent of the St. Croix fishermen reported the use of government markets to sell their product. Only about five percent indicated selling to stores (either retail stores or supermarkets). On average, St. Croix fishermen used 2.3 outlets, on average, to sell their 2016 catch. The multitude of methods employed by the fishermen in selling product highlights in inherent problem of collecting adequate industry catch data and other relevant information.

### 3.5.8.4 Impacts From Hurricanes Irma and Maria

Crosson (2018) estimated losses to the USVI commercial fishing sector from Hurricanes Irma and Maria. For St. Croix, losses to the commercial fishing fleet were estimated to equal $2.1 million.[47] Gear damage accounted for 40% ($856 thousand of this total while vessel damage represented 32% ($472 thousand). Other losses included lost income of $675 thousand (31%) and facilities and ‘other’ damages ($146 thousand). These estimates, according to Crosson (2018) should be considered preliminary.

[47] This estimate does not include losses to the charter fleet.

#### 3.5.8.5 Recreational Fishing

As noted by Crosson (2018), the Marine Recreational Information Program (MRIP) has not been implemented in the USVI. He further states that, as such, long-term recreational landings are generally not available and economic contribution estimates are also not available.

A pilot study for 2016-2017, however, was completed right before the hurricane impacts (Crosson, 2018). Some salient features of this pilot study include: (a) visitors to St. Croix spent two weeks or more on the island and spent almost $2,000 on their trip; (b) none of the visitors coming to the island reported that fishing was the primary purpose of the visit; (c) the charter fleet in St. Thomas, as might be expected, operated primarily out of Christiansted; (d) peak landings were noticed at the beginning of the calendar year which coincides with peak tourism; and (e) visitors to the island fished, on average, 1.5 days.

Crosson (2018) estimated damages to the St. Croix charter fleet at $327 thousand due to Hurricanes Irma and Maria. Of this total, $276.5 thousand (84%) represented lost income and while vessel damage equaled almost $51 thousand (16%).

### 3.5.9 Social and Cultural Characteristics of the St. Croix Fishery

The following description of the social environment is an overview of historical and recent fishing patterns and location of fishing infrastructure and fishermen in St. Croix. The description relies a great deal on work by Overbey (2016) and incorporates much of the information compiled in that report. It is important to note that this baseline description is prior to the devastating hurricanes of 2017. A section describing the impacts of hurricanes Maria and Irma on the islands and their fisheries would follow the overall description of the social and cultural characteristics.

#### 3.5.9.1 Historical Fishing in St. Croix

Inhabitants of the U.S. Caribbean including St. Croix have relied on fishing and fishery resources for thousands of years. The Arawak and Carib peoples living in the USVI) at the time of European exploration depended on abundant fish and shellfish in the coastal waters to feed their population. Bountiful resources of the coastal and marine environment enabled native peoples, European, African and other settlers to survive and thrive.

#### 3.5.9.2 Fishing Communities

To identify and describe fishing communities and levels of engagement and dependence in fishing in the U.S. Caribbean including St. Croix, NOAA/NMFS sponsored a series of community profiles on U.S. Caribbean fishing communities.

The profile on St. Croix by Valdes Pizzini et al. (2010), NMFS-SEFSC-597, considered fishing activity on the island. As a result of research, Valdes Pizzini et al. (2010) concluded that, while dependence and engagement in fishing was evident, no place-based fishing communities existed on St. Croix. Instead, they argued, fishing communities were "network-based" communities composed of fishermen who remained connected by commercial fishing and fishing-related activities.

In the profile, the coastal community of Gallows Bay, historically a fishing community, is considered and dismissed as a fishing community. Valdes Pizzini et al. (2010) determined that, while Gallows Bay still demonstrates vestiges of a fishing community it represents the appearance of a fishing community with heritage narrative of fishing and fishing related activities.

Yet, research data presented by Valdes Pizzini et al. (2010) indicate that St. Croix fishermen moor vessels at Gallows Bay, fish from Gallows Bay and gather at Gallows Bay. In addition, fishermen sell their catch in the market at Gallows Bay. These data support an alternative perspective that Gallows Bay is indeed a place-based fishing community. More research is recommended.

Research by Stoffle et al. (2009) considered the fishing activity in St. Croix and determined that the whole island of St. Croix be considered a fishing community due to fishermen connectedness and use of the entire island. The island of St. Croix is the largest of islands in USVI, just 20 miles across with a total population in 2010 of 50,601 (U.S. Census Bureau 2010).

While there may not be clearly defined "fishing communities" on St. Croix, for the purposes of developing certain indicators, the sub district geography (see Figure 3.5.8) was chosen to delineate a smaller unit of analysis that may be more appropriate when examining fishing activities, locating fishing infrastructure or determining social vulnerabilities. Sion Farm is the most heavily populated sub district on St. Croix with a population of 13,003 according to the 2010 U.S. Census. The next most populated area is the Southcentral sub district. The communities of Fredricksted and Christiansted (highlighted in purple) have populations of 3,091 and 2,626 respectively.

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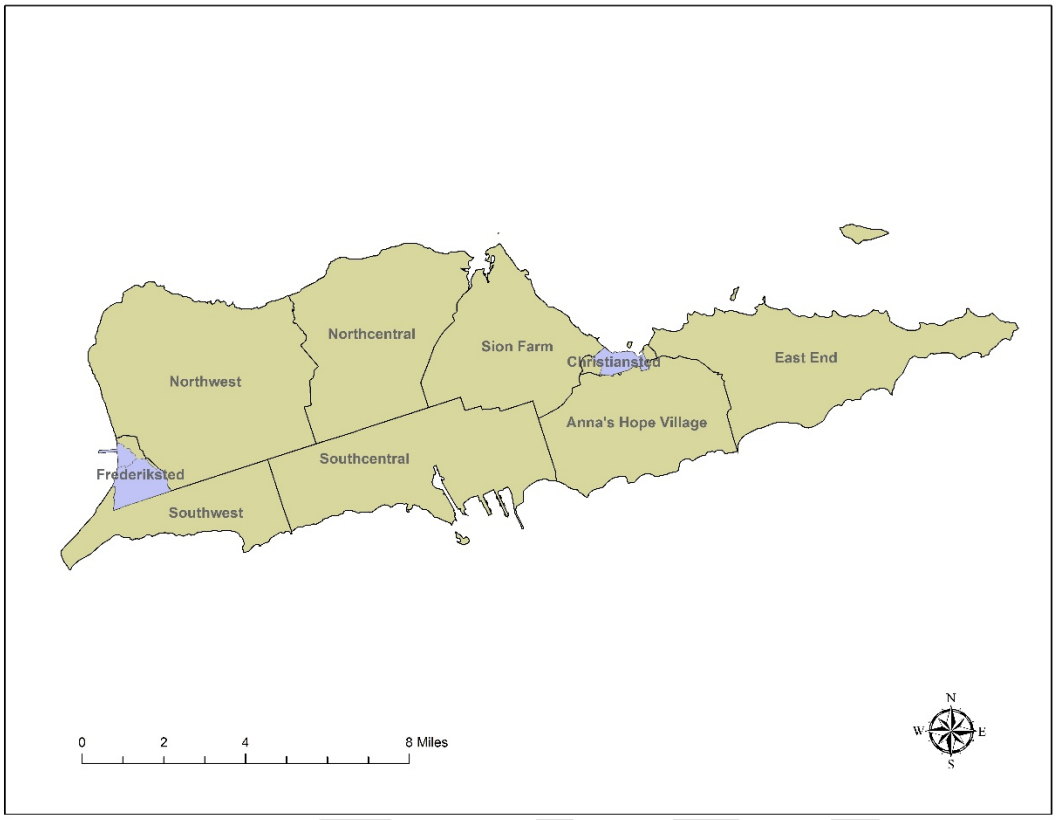


**Figure 3.5.8**. St. Croix coastal communities and sub districts.
(Source: SERO Social Science Branch)

### 3.5.9.3 Characteristics of Commercial Fishing

Commercial fishing in St. Croix and the U.S. Caribbean is small-scale or artisanal. Small-scale or artisanal fisheries, defined as a traditional fishery involving families or households who use relatively small vessels, take short fishing trips, and fish for local consumption or export (UN Food and Agricultural Organization). Small-scale, artisanal fisheries are common in the Caribbean, on the U.S. mainland, and around the world. In St. Croix, there is little or no export of catch.

Although small-scale, USVI commercial fisheries landings for St. Croix, St. Thomas, and St. John in 2016 totaled 815,559 pounds and contributed $5,307,599 to the economy (NMFS, 2017). In USVI including St. Croix, commercial fishermen target multiple fishery species using multiple gear types during the same fishing trip. Commercial fishermen fish the territorial from shore to 3 nautical miles (nm) and federal waters that extend beyond the territorial waters to 200 nm. Most fishermen confine their fishing activity closer to shore. The commercial fisheries may

be described as a daily fishery, with fishermen leaving in the morning or the evening and returning the same day.

**Commercial Fishermen**

The number of commercial fishermen in USVI has been limited by a moratorium on issuing new commercial fishing licenses since 2001. Comparing the results of two recent censuses of commercial fishermen in USVI illustrate continuity and change within the population of commercial fishermen and the commercial fisheries. These censuses were conducted in 2003-2004 (Kojis 2004) and 2010-2011 (Kojis and Quinn, 2011).

In 2003-2004, there were 383 licensed commercial fishermen in USVI, with 223 fishermen in St. Croix (Kojis, 2004; Valdes Pizzini et al., 2010, IAI, 2007). In a census of licensed commercial fishermen, Kojis (2004) interviewed all (100%) of the licensed commercial fishermen in St. Croix.

In 2009-2010, there were 410 licensed commercial fishermen in USVI, with 214 fishermen in St. Croix (Kojis and Quinn, 2011). As of March 18, 2011, there were 297 registered licensed commercial fishermen in USVI, with 177 fishermen in St. Croix (Kojis and Quinn, 2011). While the number of licensed commercial fishermen appears to have declined dramatically between 2009-2010 and March 2011, by approximately 26%, the number of commercial fishermen may be higher and other factors may account for the discrepancy. A similar decline in licensed commercial fishermen occurred in Puerto Rico yet observations indicated that the number of commercial fishermen was greater than registered (Valdes Pizzini and Scharer Umpierre, 2014).

In the follow up census of 2010-2011, Kojis and Quinn (2012) interviewed 143 (81%) of the 177 fishermen in St. Croix. The average age of commercial fishermen in the USVI overall and the average number of years fishing had increased slightly. In 2003-2004, the average age of commercial fishermen in St. Croix was 51 years (Kojis, 2004). In St. Croix, fishermen fished an average of 22 years (Kojis, 2004). In St. Croix, 53% of fishermen expected to fish for the rest of their lives (Kojis, 2004).

In 2010-2011, the average of commercial fishermen in St. Croix was 54 years (Kojis and Quinn, 2011). In St. Croix, fishermen fished an average of 24 years (Kojis and Quinn, 2011). The age for active fishermen was the same in 2015-2017, but for all fishermen the average was 56.9, this included those not active. Overall experience for all fishermen averaged 27 years (Kojis et al. 2017).

Fishing effort has changed, with fewer fishermen working full-time and more fishermen working part-time. In 2003-2004 in St. Croix, 61% of fishermen reported working full-time, more than

36 hours per week (Kojis, 2004). In USVI in 2003-2004, full-time fishermen spent over 38 hours a week on fishing and fishing-related activities, with fishing constituting 22.32 hours, repairing vessels 3.1 hours, repairing gear 4.9 hours, and 8 hours a week selling their catch (Kojis, 2004). In St. Croix, about 32% of fishermen worked part-time and another 8% characterized their fishing as opportunistic (Kojis, 2004).

In 2010-2011, only 41% of St. Croix fishermen worked more than 36 hours per week fishing and in fishing-related activities (Kojis and Quinn, 2011). In St. Croix, 25% of fishermen worked between 15-36 hours per week fishing and in fishing-related activities (Kojis and Quinn, 2011). In St. Croix, 28% of fishermen reported working less than 15 hours per week fishing and conducting fishing-related activities (Kojis and Quinn, 2011). ). In 2015-2017 that number increased to 38% of fishermen working in other employment yet 96% of fishermen said they fished year round (Kojis et al. 2017).

A decline of 20% in full-time fishing-related effort in St. Croix over the seven-year period between 2003-2004 and 2010-2011 are significant. However, Kojis and Quinn (2012) concluded that the decline may not be as great as it appears, noting that the census survey questions on fishing effort were worded differently in 2003-2004 and 2010-2011. In 2003, the question included the terms “full-time” and “part-time” with the definitions “more than 36 hours per week” and “less than 36 hours per week” (Kojis and Quinn, 2011). In 2010, the terms were deleted and only the hours of effort were included, with options “more than 36 hours,” “15-36 hours,” “less than 15 hours” per week (Kojis and Quinn, 2011).

The self-reported ethnic identity of commercial fishermen has changed slightly. In 2003-2004 in St. Croix, approximately 50% identified as Hispanic, 42% identified as black or West Indian, and about 8% as white (Kojis, 2004). In 2010-2011, 52% of fishermen identified as Hispanic, 20% identified as West Indian and 14% identified as Crucian (Kojis and Quinn, 2011).

Residents from Puerto Rico, mostly from Vieques and Culebra, began migrating to USVI in the 1920s through the 1940s, with those from Vieques settling in St. Croix and those from Culebra settling in St. Thomas (Valdes Pizzini et al., 2010). Historic migration of residents from St. Croix and St. Thomas to Puerto Rico, particularly Vieques, is recorded as well (Valdes Pizzini et al., 2010). With slightly different categories, in 2016, 7.8% identified themselves as white with 67% reporting as black or mixed. Of those reporting 58% also identified as Hispanic with the next largest group being West Indian at 35% (Kojis et al. 2017).

In USVI, the majority of fishermen, 86%, fish with helpers (Kojis and Quinn, 2011). In 2003-2004, 59%, of fishermen fished with helpers (Kojis, 2004) or crew. Usually the fishing trip includes the fisherman who owns the vessel (captain) and one helper or sometimes two helpers.

About 32% of fishermen in USVI fish with other commercial fishermen with approximately 37% of St. Croix fishermen fishing with others (Kojis and Quinn, 2011). In 2003-2004, 17% of USVI fishermen fished alone (Kojis, 2004), while in 2010-2011, 13% of St. Croix fishermen fished alone (Kojis and Quinn, 2011), that number dropped to 2.3% in 2016 (Kojis et al. 2017).

In USVI in 2003-2004, approximately 80% of commercial fishing trips are less than nine hours, averaging 7.2 hours (Kojis, 2004). In 2010-2011, USVI fishermen averaged 3.1 trips per week with each trip lasting 6.8 hours (Kojis and Quinn, 2011). Fishermen in St. Croix averaged 3.4 trips per week with each trip lasting 6.5 hours (Kojis and Quinn, 2011). In 2016, fishermen averaged 11.5 trips per month, which is close to the weekly average from earlier reports, maybe slightly less and trip duration was 6.6 hours (Kojis et al. 2017).

In St. Croix, Stoffle et al. (2009) note redistribution of commercial fishing licenses among family members and "sharing" of licenses with others who wish to fish. This may offset the effects of declining numbers of licensed fishermen reportedly due to a moratorium on issuing new commercial fishing licenses and "aging out" fishermen (Stoffle et al., 2009).

USVI recently reconsidered a moratorium on commercial fishing licenses in the past as mentioned. In July 2014, the Senate passed a bill with an amendment to prohibit the government from imposing a moratorium on commercial fishing licenses and to dismiss recreational fishing licenses (Lewin, 2014a). Governor DeJongh vetoed by line item the amendment, along with others, noting it would hinder local fishermen's efforts in working with fishery managers (Lewin, 2014b).

**Fishermen's Organizations**

The vast majority of fishermen in St. Croix do not belong to any fishermen's or fishing-related organizations. In 2010-2011, 91% of fishermen in St. Croix reported they did not belong to a commercial fishing organization (Kojis and Quinn 2012: 19). However, 3% reported belonging to the St. Croix Commercial Fishermen's Association and 3% reported belonging to an organization they would not identify by name (Kojis and Quinn 2012: 19). In addition, 1% belonged to the Caribbean Fishery Management Council, 1% belonged to the St. Croix Fishery Advisory Committee, and 1% belonged to the Golden Hook Fishing Club (Kojis and Quinn 2012: 19). In 2016, the vast majority still do not belong to any fishing organization with only 7% indicating they do and most of those were part of the District Fishery Advisory Committee (Kojis et al. 2017).

**Commercial Fishing Vessels**

Commercial fishing vessels in St. Croix are relatively small. In 2003-2004, the average boat size was approximately 21' in length, with a range of 10' to 54' (Kojis, 2004). In 2010-2011, the average boat length in St. Croix was about 23' in length, with a range of 13' to 56' (Kojis and Quinn, 2011). However, boat size has not increased appreciably, as the census of commercial fishermen in 2010-2011 excluded vessels 12' or small in length, defining them as dinghies (Kojis and Quinn, 2011). In 2016, average fishing boat length was 21.9 ft, but only one fishermen in St. Croix indicated the use of dinghies (Kojis et al. 2017).

In St. Croix, the vast majority of vessels are composed of fiberglass, followed by fiberglass and wood and a few wooden vessels (Kojis and Quinn, 2011: 36; Kojis, 2004). The percent of fiberglass vessels was 81.4% in 2016 (Kojis et al. 2017). Nearly 92% of boats in St. Croix had an outboard engine with a mean range of horsepower from 26-150 (Kojis and Quinn, 2011). These numbers were close to the same in 2016 with the horsepower range slightly less with a mean range of 91.2-139.6 (Kojis et al. 2017).

In 2010-2011, there were 187 boats on St. Croix (Kojis and Quinn, 2011). Nearly all fishermen own their vessel or co-own a vessel (Kojis and Quinn, 2011; Kojis, 2004). In 2010-2011, over 90% of fishermen owned or co-owned the boat they used for fishing, about the same in St. Croix and St. Thomas and St. John (Kojis and Quinn, 2011). Most fishermen owned one vessel and some owned two or more vessels. In St. Croix, 67% of fishermen owned one boat, 17% owned two boats, and about 5% owned three or more boats in 2010-2011 (Kojis and Quinn, 2011). In 2016, three were 129 fishing boats on St. Croix, excluding dinghies, although as mentioned there was only one individual in St. Croix that indicated they owned a dinghy.

On St. Croix, most commercial fishermen haul their vessels on trailers by pickup trucks across the island to various launch and landing sites (Kojis and Quinn, 2011; Valdes Pizzini et al., 2010; Stoffle et al., 2009). In 2010-2011, more than 85% of boats in St. Croix were kept at home and trailered to launch sites for fishing (Kojis and Quinn, 2011) and in 2016 that number was slightly less with 76.8% storing vessels at home (Kojis et al. 2017). This reflects an inland residence pattern among fishermen.

Fishermen in St. Croix land their catch at different locations. In 2010-2011, St. Croix fishermen reported landing their catch at 16 different locations on the island. The most common landing sites were Altoona Lagoon in Christiansted (75%) on the northside, Molasses Pier (66%) on the southside, and Frederiksted Fish Market (42%) on the westside. Gallows Bay was a preferred landing site for 11% of fishermen. In St. Croix, 60% of fishermen landed their catch at two or more landing sites (Kojis and Quinn, 2011). These percentages changed slightly in 2016, with 45.9% using Altoona Lagoon, 42% using Molasses Pier and 34.9% using Frederiksted Fish Market. Gallows Bay and Salt River were the next most popular sites listed (Kojis et al. 2017).

In their study of commercial fishermen of the USVI, Crosson and Hibbert (2017) produced estimated average profit margins of 17% per trip for St. Croix fishermen based upon their data collection efforts. They also found that USVI fisheries have profit margins higher than the Gulf shrimp industry but comparable to the profit margins of Florida's fishery for golden crab and the Wreck fish fishery along the South Atlantic coast (Crosson and Hibbert, 2017).

**Commercial Fishing Gear**

Commercial fishermen in USVI including St. Croix use a variety of gear types to catch different types of fish and shellfish. Line fishing, usually by handline or rod and reel, is the most commonly used gear in USVI and St. Croix (Kojis and Quinn, 2011; Kojis, 2004). In St. Croix, fishing with SCUBA and skin or free diving gear is the second most common gear, with trap fishing and net fishing constituting the third and fourth most common fishing techniques (Kojis and Quinn, 2011).

In St. Croix, line fishing was the most common gear technique reported by 89% of fishermen in 2010-2011 (Kojis and Quinn, 2011) that number increased to over 91% in 2016 (Kojis et al. 2017). In USVI, most hook and line fishing is done by handline at anchor, drift, and while trolling as well as by trolling with rod and reel (Stoffle et al., 2011; IAI, 2007). The majority of hook and line fishing targets reef fish, particularly snapper and grouper, and offshore and coastal pelagic fish.

Free or skin diving and SCUBA diving to fish commercially has become popular in St. Croix within the last 10 years (Valdes Pizzini et al., 2010). In St. Croix, 56% of fishermen in 2010-2011 reported fishing by SCUBA or free diving (Kojis and Quinn, 2011) with the percentage changing slightly in 2016 with 54% of fishermen diving (Kojis et al. 2017). Although free diving for lobster and shellfish in USVI was an early fishing technique (Fiedler and Jarvis, 1932; Valdes Pizzini et al., 2010), fishermen later added SCUBA dive fishing to target highly valued lobster, conch, reef fish, and coastal pelagic species often by hand, snare or spear (Kojis, 2004).

In St. Croix, 38% of fishermen in 2010-2011 reported fishing by traps (Kojis and Quinn, 2011) that number declined to 22% in 2016 (Kojis et al. 2017). Lobster traps, fish traps or "pots" are used to catch reef fishes, particularly snappers and groupers, and lobster. Although an effective gear type, trap fishing requires space and time on the ocean floor and fishermen tend to recognize areas traditionally fished as territory. Kojis and Quinn (2012) reported that committees were meeting on St. Croix, St. Thomas and St. John to reduce the number of fish traps and determine fair allocation of traps among fishermen.

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Historically traps were a primary gear type used by fishermen and their use in St. Croix has declined. The decline in the use of traps in St. Croix may be related to major loss of traps from hurricanes like Hurricane Hugo in 1989 and increased theft of catch from traps (Tobias, 2004; Valdes Pizzini et al., 2010). Other fishing gear, like handline and rod and reel, nets, and dive and SCUBA gear are not subject to these elements.

In St. Croix, 11% of fishermen in 2010-2011 reported fishing by net (Kojis and Quinn, 2011). Recently, USVI implemented and enforced a ban on gill and trammel nets, allowing only limited use of gill nets for specific fishes like ballyhoo, gar, and flying fish (Kojis and Quinn, 2011). Prior to the ban, most net fishing in St. Croix was by gill and trammel net (Kojis and Quinn, 2011). In 2016 beach and haul seines were used by 3.7% and 4.6% of St. Croix fishermen respectively and a few St. Croix fishermen (6.4%) used umbrella nets (Kojis et al. 2017).

**Targeted Species**

With a small shelf surrounding St. Croix, deep waters are closer to shore, allowing fishermen with small boats to target deepwater fish species (Kojis and Quinn, 2011). Among the deepwater pelagic fish, St. Croix fishermen most commonly target dolphinfish, wahoo, tuna, and marlin (Kojis and Quinn, 2011). Around 50% of fishermen from St. Croix harvested dolphinfish and 44% deepwater pelagics overall in 2016 (Kojis et al. 2017). Among the deepwater snapper, St. Croix fishermen targeted silk, vermillion, queen, wenchman, black and blackfin snapper (Kojis and Quinn, 2011) with approximately 53% fishing deepwater species in 2016 (Kojis et al. 2017).

In USVI including St. Croix, fish constitute the majority of the catch. In 2012, fish composed 77% of the total catch, and shellfish 23% of the overall landings in USVI (NMFS, 2013). Fish represented 70% of the total value, and shellfish represented 30% of the total value of landings in USVI (NMFS 2013).

The most common fish caught by hook and line and handline are snapper and grouper and offshore dolphinfish and wahoo (Valdes Pizzini et al., 2010). The most common fish caught by trap were parrotfish, grunt, surgeonfish, and snapper as well as lobster (Valdes Pizzini, et al., 2010).

Lobster and conch, now highly valued, were originally used for bait, and residents only consumed them in times of duress (Valdes Pizzini et al., 2010). Yellowtail snapper, grouper, and pelagic species (especially dolphinfish, tuna, and wahoo) are highly valued, also. Tourists and visitors prefer lobster and the deepwater pelagic fish like dolphinfish, tuna, and wahoo, and commercial fishermen find ready customers in hotels and restaurants catering to tourists (Valdes Pizzini et al., 2010; Stoffle et al., 2009).

Stoffle et al. (2009) identified the targeted species consumed by local residents and served at restaurants for local residents, and those species consumed by tourists and served at restaurants for tourists. Snappers, especially yellowtail snapper, are the most commonly targeted and preferred by local residents and tourists. Local residents also prefer parrotfish. Tuna and dolphinfish are preferred by tourists and sold mainly to restaurants for tourists. Grunts are popular with local residents. When cooked, grunt taste like snapper and they are less expensive (Stoffle et al., 2009). Local residents prefer conch and is served at restaurants for locals, while tourists prefer lobster and served at restaurants for tourists.

Parrotfish, king mackerel, and conch appear to hold cultural significance among fishermen in St. Croix. Parrotfish is a reef fish, an herbivore, preferred and consumed by local residents. At one local restaurant, "plate-size" parrotfish is the most popular fish among customers (Valdes Pizzini 2010). Conch is characteristic of St. Croix's island culture, with the shell historically used as a horn and the meat as a preferred dish. King mackerel is a deepwater and coastal pelagic fish, preferred seafood, and popular game fish.

**Key Areas of Fishing**

The key areas of fishing for St. Croix fishermen are the East End and Lang Bank, the South Shore, and the North Shore. The East End and Lang Bank are considered as having some of the "richest fishing grounds in St. Croix" (Valdes Pizzini et al., 2010). This area is popular with divers seeking conch and lobster, with net fishermen for reef fish, particularly parrotfish, and with trap fishermen (Valdes Pizzini et al., 2010).

The South Shore attracts net fishermen and accounted for 57% of their landings in 2003-2006. Targeted species include parrotfish, conch, and other reef fishes. The North Shore features a deep drop-off near shore. Although not productive for reef fish, the North Shore accounts for nearly 30% of the hook and line landings for deepwater snapper, tuna, and wahoo (Valdes Pizzini et al., 2010).

**Markets**

Commercial fishermen in St. Croix market their catch in formal and informal ways. In St. Croix, fishermen sell their catch directly to consumers. In USVI, fish are usually marketed whole and iced, in coolers with ice. In 2010-2011, 82% of fishermen in St. Croix sold their fish whole and more than 90% iced their fish (Kojis and Quinn 2012: 65). About 34% marketed their fish cleaned (gutted and scaled), 11% steaked (cut into steaks), 10% gutted, and 8% filleted (Kojis and Quinn 2012). Larger deepwater fish like dolphin, wahoo, and tuna, are commonly cut into steaks for market.

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Fishermen sell their catch at a variety of locations. In St. Croix, the most common locations for marketing fish were to private customers (44%), along the road (39%), to restaurants (29%), at government markets (26%), and at landing sites (21%) (Kojis and Quinn 2012: 66). In St. Croix, many fishermen sell their catch to regular customers, some with standing orders. Fishermen sometimes deliver fish to customers. Fishermen often sell fish at the location of landing their catch. In St. Croix, customers often wait for fishermen at landing sites, and fishermen sell their catch as soon as the boat is trailered and out of the water. For instance, at Molasses Pier, Gallows Bay, and Altoona Lagoon, people wait for boats to arrive and fish to be sold (Valdes Pizzini et al. 2010: 103). Fishermen sell fish to restaurants, also.

Fishermen sell their catch at formal markets on St. Croix. In Frederiksted, fishermen sell fish at Albert Edwards Fish Market, a government market with running water and facilities for cleaning fish (Kojis and Quinn 2012: 66). Fishermen sell fish, also, at private stands near Villa La Reine, a second government market that is closed (Kojis and Quinn 2012: 66). Fishermen sell fish at the market at Gallows Bay (Valdes Pizzini et al. 2010). In addition, fishermen sell their catch from informal market locations. Some fishermen lease lots to sell their catch, and others sell their fish from home (Valdes Pizzini et al. 2010: 103-104). In the 2016 surveys, most fishermen did not disclose their market where they sold fish, but of those that did 92% said they used La Reine Market (Kojis et al. 2017).

#### 3.5.9.4 Characteristics of Recreational Fishing

Recreational fishing is a popular activity in USVI including St. Croix. Recreational fishing provides food and enjoyment for residents, tourists and other visitors. Recreational fishermen fish from shoreline, private boat, charter boat, and by diving. Recreational fishermen target the same species as commercial fishermen using similar gear types. Recreational fishing may range from subsistence fishing solely for household consumption of all the catch to sport fishing solely for pleasure with no consumption of catch.

**Recreational Fishermen**

The actual number of recreational fishermen in St. Croix is unknown. Survey research estimates of resident participation in recreational fisheries indicate that between 9.2% and 10.8% of residents in USVI fish recreationally (Mateo, 2004; Jennings, 1992). Given the USVI population of 106,405 in 2010 (U.S. Census Bureau), this would mean between 9,576 to 11,705 residents or 9% to 11% of the territory's population fish recreationally. For St. Croix, estimate of recreational fishermen would be between 4,554 to 5,566 or 9% to 11% of the resident population of 50,601 in 2010 (U.S. Census Bureau).

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In 1985, 2,300 resident and 500 visitor participants, 2,718 private recreational boats, and 5 saltwater tournaments were reported for the marine recreational fisheries in USVI (Schmied and Burgess, 1987). In 1985, resident recreational fishermen reported fishing from private or rental boat (50%), beach or bank (32%), charter or party boat (11%), and bridge, pier or jetty (7%) (Schmied and Burgess, 1987).

In telephone survey research from 1998 to 1999, Mateo (2004) found 60% of recreational anglers fished from shore, with 21% fishing from boats and shore, and 19% fishing only from boat. In contrast, about 50% of recreational anglers in St. Thomas fished from boats, with 38% fishing from boats and shore, and only 12% fishing only from boat (Mateo, 2004). Both St. Croix and St. Thomas/St. John recreational anglers preferred to fish at night, 43% and 50%, respectively (Mateo, 2004). In St. Croix, the most popular fishing location for boat anglers was the east end of Buck Island and shore anglers preferred the Frederiksted pier and Altoona Lagoon (Mateo, 2004).

Analysis of a telephone survey conducted in 2000 with registered boat owners who fish recreationally estimated a total of 2,509 boat-based recreational fishermen in USVI (Eastern Caribbean Center, 2002). Of these, 712 were from St. Croix and 1,797 in St. Thomas and St. John. The USVI fishermen were almost all male, with an average of about 47 and various educational and income levels (Eastern Caribbean Center, 2002).

In St. Croix, economic backgrounds of recreational fishermen vary. Some resident recreational fishermen are fishing for food for their families, and subsistence fishing provides food security and nutrition for those in need and living under conditions of poverty. Some resident and visiting recreational fishermen enjoy fishing in coastal and offshore fishing tournaments, and the competition and company of others meet their interests and needs.

Marinas and sport fishing tournaments are important to recreational fishermen and recreational fishing. Marinas provide a location to convene fishermen and dock, launch and land recreational vessels. Sport fishing tournaments bring fishermen together to compete and benefit others.

**Recreational Vessels**

Recreational fishing vessels in USVI vary. In 1985-1986, there were 31 coastal marinas in USVI and 8 charter boats (Schmied and Burgess, 1987). The Eastern Caribbean Center (2002) reported 2,462 registered boat owners in the USVI, with 566 in St. Croix and 1,896 from St. Thomas and St. John.

Among registered boat owners in USVI, the average recreational boat is nearly 23’ in length, with 82% less than 30’ and only 5% being 40’ or more in length (Eastern Caribbean Center,

2002). In 1985, 65% of fish landed by recreational fishermen came from federal waters beyond three miles from shore, and 34% came from territorial waters, three miles from shore (Schmied and Burgess, 1987). The Eastern Caribbean Center (2002) found that about 53% of private recreational boat fishing in USVI occurred within territorial waters, three miles from shore (IAI, 2007).

**Fishing Gear and Targeted Species**

Recreational fishermen predominantly use hook and line and handline gear to fish. Apeldoorn and Valdes Pizzini (1996) found that 80% of recreational vessels used hook and line or rod and reel gear to fish. In a survey of USVI recreational fishermen, Mateo (2004) found 64% of anglers used handline and 23% used rod and reel in St. Croix (Mateo, 2004). In contrast, 46% of anglers used rod and reel and 30% used handline (Mateo, 2004). Recreational fishermen also use dive and SCUBA gear to fish.

Recreational fishermen target some of the same species that commercial fishermen target. Recreational fishermen harvest some 80 species, 65 of which hold commercial value (DPNR, 2005; Valdes Pizzini et al., 2010). These include reef fish, lobster and conch, coastal pelagic fish, and offshore pelagic fish including dolphinfish, tuna, kingfish, marlin and other billfish.

**Tournament Fishing**

The popularity of fishing tournaments is increasing in St. Croix. Between 2000 and 2005, there were 35 fishing tournaments held, approximately 7 tournaments a year (Toller et al., 2005). In a study of fishing tournaments in USVI, Toller et al. (2005) found that dolphin and wahoo were the predominant species landed in offshore recreational tournaments during a five-year period from 2000-2005. Research at 29 offshore pelagic tournaments on St. Croix found dolphin accounted for about 53% of the number and 48% of the weight of total landings, followed by wahoo at 43% of the number and 48% of the weight (Toller et al., 2005).

### 3.5.10 Environmental Justice (EJ) Considerations

In order to assess whether a community may be experiencing EJ issues, a suite of Community Social Vulnerability Indices (CSVI) created to examine the social vulnerability of coastal communities was developed for the majority fishing communities in the U.S (Colburn and Jepson 2012). Originally, the territories were not included in the development of the CSVIs. A recent attempt to develop similar indicators at the community or Census Designated Place level for Puerto Rico and the USVI was not successful. However, by changing the unit of analysis to the county or sub county level (rather than census designated places), a viable suite of social vulnerability indices were successfully created using the same methodology for all counties within the coastal Southeast including municipalities in Puerto Rico and sub districts in the

USVI. Using the same variables with minor adjustments, a principal component factor analysis was conducted with results meeting the same criteria used previously in creating the CSVIs. The resulting index factor scores for each sub district are reported below.

The three indices reported most often in the Southeast Region are poverty, population composition, and personal disruptions. The variables included in each of these indices have been identified through the literature as being important components that contribute to an individual's or community's vulnerability. Indicators such as increased poverty rates for different groups, more single female-headed households and children under the age of five, disruptions such as higher separation rates, and unemployment all are signs of vulnerable populations. These indicators are closely aligned to previously used measures of EJ, which used thresholds for the number of minorities and those in poverty, but are more comprehensive in their assessment. For those subdistricts that exceed the threshold it would be expected that they would exhibit vulnerabilities to sudden changes or social disruption that might accrue from regulatory change.

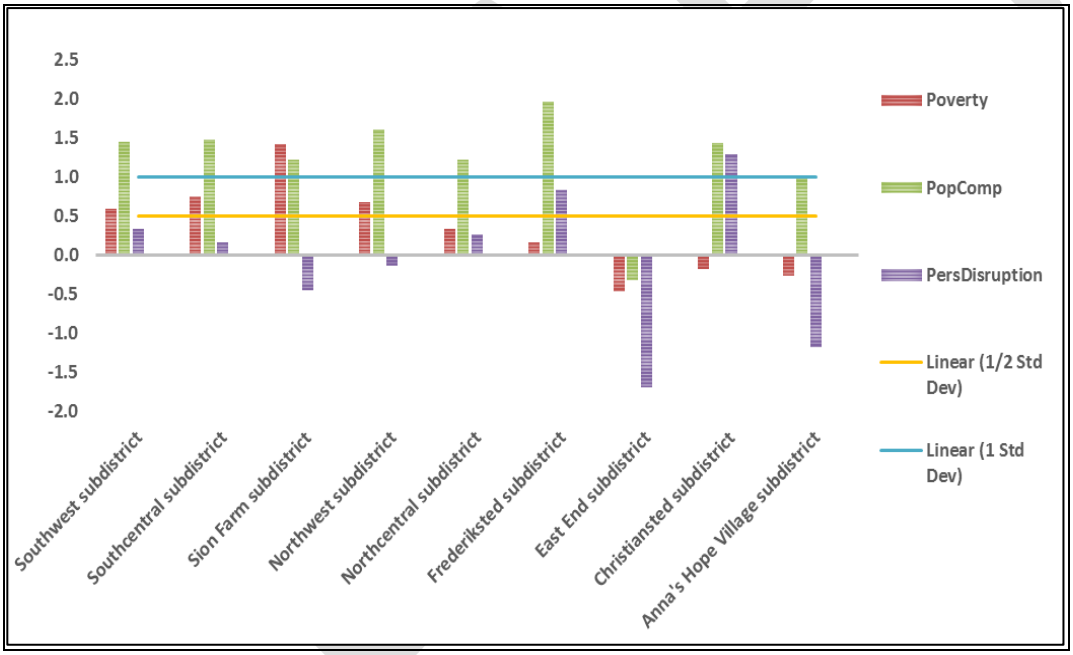


**Figure 3.5.9**. Social vulnerability indices for St. Croix coastal sub districts.
(Source: SERO County Social Vulnerability Indicators database (ACS 2014) 2018)

As is evident in Figure 3.5.9, the majority of sub districts for St. Croix show some vulnerabilities with most exceeding both thresholds of ½ and 1 standard deviation for at least one of the indices. East End is the only sub district that has three indices below the mean. Most other communities show at least one index exceeding the 1 standard deviation. The majority of communities do exceed the threshold for population composition, which is likely a reflection of a higher

population of minorities. Several communities do have high poverty vulnerabilities. However, these vulnerabilities do not take into consideration the recent devastation from Hurricanes Irma and Maria. It is expected that even though these municipalities have high vulnerabilities depicted here, they could now have higher vulnerability scores as a result of the impacts from recent hurricanes.

### 3.5.11 Impacts of Recent Hurricanes

During the 2017 Atlantic hurricane season, the USVI islands suffered two major storms. On September 6, Category Five Hurricane Irma passed directly over St. John and St. Thomas. St. Croix escaped Irma relatively unscathed, however, two weeks later on September 20, the eye of Category Five Hurricane Maria passed just offshore of the southwestern tip of St. Croix before turning north and crossing Puerto Rico. The combined effects of the two storms had a significant impact on the territory's' infrastructure, including that of the fishing industries. Damage was caused to fishing-related infrastructure, ports, docks, fishing businesses, vessels, and fishing gear.

After the storms, NOAA Fisheries conducted damage assessments in the territories and produced reports for Puerto Rico and the USVI[48]. The information provided here comes from those damage assessments. The USVI Division of Fish and Wildlife records currently list 112 licensed and currently registered commercial fishermen on St. Croix with 88 of those being considered active fishermen. Of those surveyed the estimated total capital losses were $1,473,815 and lost revenue of $674,850, which produced total losses of $2,148,665 at the time of surveying, for St. Croix. There was an average vessel damage of $4,212 and average gear damage of $7,639 reported.

For the charter fleet total capital losses of $50,750 and lost revenue of $276,500 were reported, which produced total losses of $327,250 at the time of surveying. These estimates were based upon the assumption that there were 14 active charter operations that DPNR staff were aware of on St. Croix. The average vessel damage estimated for the for-hire fleet was $3,625, and no estimated gear damage. The average revenue lost was estimated to be near $19,750.

One year follow-up surveys are being conducted among these businesses to understand how recovery efforts have fared.

[48] https://www.fisheries.noaa.gov/feature-story/noaa-releases-economic-impact-evaluations-hurricanes-irma-and-maria-disasters

## 3.6 Administrative Environment

The administrative environment affecting the St. Croix management area was discussed in detail in Section 1.6. Additional information regarding fishery management in territorial or federal waters can be found in Section 2.1 of the Caribbean SFA Amendment (CFMC 2005), and in the 2010 Caribbean ACL Amendment (CFMC 2011a).

## 3.7 Issues of Concern to Fisheries Management

### 3.7.1 Introduction

Both fishermen and stakeholders have concerns about the long-term future of fishery resources and the habitats that support those fisheries. According to a 2016 census of licensed fishermen of the USVI (Kojis et al. 2017), fishermen are generally concerned about high costs associated with replacing lost or stolen gear, constraints of a market-driven system such as lack of demand and structures (*i.e.* fish houses), foreign and illegal fishermen depleting local resources, and the lack of enforcement.

The next section lists island-specific concerns expressed by St. Croix fishermen and stakeholders with respect to resource health and availability, socioeconomic concerns, management and operational concerns, and others.

### 3.7.2 Fishermen and Stakeholder Concerns

Kojis et al. (2017) reported that the primary socioeconomic problems reported by St. Croix fishermen were due to regulatory impacts. Almost half of the fishermen interviewed said that regulations were restricting their fishing. Specifically, fishermen on St. Croix felt that their fishing was adversely impacted by the change in the conch quota from 150 per licensed fisher to 200 per boat. Because some boats fish with more than one licensed commercial fisher onboard, this change reduces the number of conch they can harvest each trip. Several fishermen said that closed areas, specifically the St. Croix East End Marine Park and Buck Island Reef National Monument expansion, caused conflict among fishermen because they reduced the area available for fishing. Additionally, the closed areas become a haven for lionfish, which compete with native fish stocks for space and resources. One recommendation was that a special commercial permit for harvesting and selling lionfish be issued, especially to dive shops.

Gear-related concerns for fishermen on St Croix were centered around trap loss (e.g., large vessels heading into port on the south shore run over trap lines, cutting them lose), continuing net-specific problems, and fish attracting devices (FAD) used to attract pelagic fish. Census responses stated that there are a limited number of FADs available, and that more surface rather

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than sub-surface FADs were needed. Additionally, there needs to be a process for replacing or repairing FADs. The fishermen acknowledged the July 2018 implementation of a fish trap reduction plan designed to reduce the number of fish traps in USVI territorial waters by 20%, although this appeared to be less of an issue to the fishermen of St. Croix relative to those fishing from the USVI islands of St. Thomas and St. John.

Other comments provided by fishermen during the recent census centered on competition for resources. First, dishonest reporting of commercial catch has unknown but likely negative impacts on fish stocks. Second, foreign fishermen harvesting fish from local waters are depleting pelagic fish and bait stocks. Finally, because there is no recreational data collection program, it is uncertain how many fish the recreational fishermen (dubbed "weekend warriors") are catching. At the August 2018 CFMC meeting, the USVI DPNR Director of the Division of Fish and Wildlife gave a presentation outlining efforts that are underway to establish a recreational fishery data collection program, which would include data recording and reporting. An ancillary component of this effort would be a trap numbering system that would assist with the identification of stolen traps. To alleviate some of these issues, fishermen recommended better organization among fishermen and enhanced enforcement.

For many fishermen in St. Croix, problems often occur after the fish are landed, most notably with respect to market instability and the fact that people often do not have money to purchase fresh fish. Additionally, there have been instances in which fishermen did not keep the fish on ice, which damaged the reputation of the other fishermen and likely reduced fish sales. Unlicensed/illegal fishermen catch and sell fish in direct competition with licensed fishermen. Adding to these issues, while the price per fish is the same as it was 10 years ago, expenses like fuel and gear have increased. Fishermen using gill nets flood the market with fish, driving prices down. In order to attract buyers, and discourage the selling of illegal catch, the island needs more fish markets with ample parking and running water that can easily be accessed by law enforcement and samplers. Fishermen need to have easily accessible and safe boat ramps. Many of these issues make it hard to attract a younger generation of fishermen interested in sustainably fishing local resources.

Half of the fishermen surveyed in St. Croix indicated that it was hard to find other sources of employment. Cruzan fishermen were especially affected by the closure of HOVENSA and the loss of nearly 2,000 well-paying jobs, which resulted in fewer jobs available, fewer customers to purchase their fish, and fewer charter customers.

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# Chapter 4. Environmental Consequences

## 4.1 Action 1: Transition Fisheries Management to an Island-based Approach - Environmental Consequences

### 4.1.1 Direct and Indirect Effects on the Physical Environment

**Alternative 1** (no action) is an administrative action that would leave in place the existing species-based approach to federal fishery management in the U.S. Caribbean EEZ. Because it would not change the status quo, it would not have any direct effects on the physical environment. NMFS and the Council already prohibit the use of destructive fishing gear types and methods such as explosives, chemicals, power assisted tools, powerheads, gill nets, and trammel nets among others (50 CFR part 622). By prohibiting destructive fishing methods and ensuring that activities do not adversely affect essential fish habitat (EFH) and habitat areas of particular concern, the Council and NMFS would ensure that negative impacts on the physical environment from authorized fishing activities are negligible. Although, **Alternative 1** could potentially have negative indirect long-term effects on the physical environment as federal management was misdirected to stocks over which the Council has little or no influence at the expense of those stocks truly under Council control and in need of federal management.

Establishing an island-based FMP for the St. Croix EEZ in **Preferred Alternative 2** also does not trigger tangible impacts to the physical environment as this is an administrative action that does not directly affect the physical environment. Under **Preferred Alternative 2**, regulations would be repackaged from a Caribbean-wide EEZ domain to a St. Croix EEZ domain, but the regulations would remain the same in most respects. As mentioned above, there are management measures already in place that prohibit the use of destructive fishing gear and methods and ensure that activities do not adversely affect EFH. These measure would be migrated to the new plan under **Preferred Alternative 2**. In addition, as discussed in the 2014 EA (NMFS 2014), tailoring management measures to St. Croix could in the long-term make fisheries management more effective therefore eventually minimizing adverse direct or indirect effects from fishing activities to the physical environment.

### 4.1.2 Direct and Indirect Effects on the Biological/Ecological Environment

**Alternative 1** would leave in place the existing species-based approach to federal management; thus little change would be expected in the biological/ecological environment.

Under **Preferred Alternative 2** regulations would be repackaged from a Caribbean-wide EEZ domain to a St. Croix EEZ domain, but the regulations would remain the same in most respects.

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Short-term effects to the biological/ecological environment would be the same as for **Alternative 1** because, based solely on the outcome from Action 1, the applied regulatory environment would not change. In the long term, the island-based approach proposed by **Preferred Alternative 2** could potentially minimize impacts to the biological environment from fishing activities by enhancing fisheries management. However, the ultimate outcome from implementing **Preferred Alternative 2**, coupled with implementation of any combination of proposed management actions (except the no action alternatives) presented and discussed in Actions 2-7 of this DEIS, likely would be positive and substantial. Long-term effects to the biological/ecological environment would be expected to be positive as discussed in Section 1.4 of the 2014 EA.

No direct or indirect effects to Endangered Species Act (ESA)-listed species are expected from this action, as it would not change how the fisheries within each management area operate (*i.e.* gear types used or effort expended).

### 4.1.3 Direct and Indirect Effects on the Economic Environment

To ascertain whether the net benefits associated with the preferred alternative (**Alternative 2**) exceed those under the no action alternative (**Alternative 1**), one would ideally look at the change in economic surplus (*i.e.*, producer and consumer surplus) which would be forthcoming in moving to the preferred alternative. If positive, the alternative state (*i.e.*, moving from the status quo to the preferred alternative) would be justifiable from the perspective of economic efficiency. Estimating the change in surplus, however, requires a significant amount of information/analyses including (a) costs associated with the commercial harvest of seafood and change in producer surplus associated with movement from the status quo, (b) consumer surplus derived from the consumption of commercially harvested product and its change associated with movement from the no action alternative, (c) benefits derived from recreational activities and the change in these benefits in conjunction with movement to the preferred alternative, and (d) benefits derived from non-consumptive activities and related changes in the transition from a species-based to an island-based management approach. None of this information/analyses exists, however, which makes evaluating the change in surplus infeasible.

While the change in surplus associated with moving from the no-action alternative (**Alternative 1**) to the preferred alternative (**Alternative 2**) cannot be estimated, there are a number of aspects associated with the economic environment that can help establish the expected direction (if any) of the change. First, because transition from a species-based to an island-based management approach is not expected to influence current harvest and resource use, one can surmise that changes in direct economic benefits would be minimal. However, there are likely to be indirect benefits associated with transitioning to an island-based management approach and the prospect of not 'capturing' these indirect benefits would hamper the realization of long-term maximum benefits derived from the fishery. Possibly the most significant effect is the loss in indirect

benefits that may be forthcoming from enhanced compliance. Specifically, it is widely recognized that the ability to adequately monitor and enforce existing regulations is limited due to limited resources. Furthermore, it is the fishermen who have requested an island-based approach to management in lieu of the current species-based approach. More involvement by the fishermen in the development and implementation of the management process could potentially culminate in enhanced compliance. This enhanced compliance may range from the provision of higher quality fishery-dependent data to a voluntary reduction in fishing activities that are in violation of regulations. Such increased compliance may, over time, culminate in more efficient management practices that more adequately protect stocks and stock complexes; thereby increasing indirect benefits.

Finally, transitioning from species-based management approach (**Alternative 1**) to an island-based management approach in the St. Croix EEZ would, over time, allow for the tailoring of management measures more in line with the specific needs of the island; including economic nuances, social nuances, and fishing practices specific to the island. There are likely to be substantial indirect economic benefits in doing so.

### 4.1.4 Direct and Indirect Effects on the Social Environment

The no action **Alternative 1** would not result in changes or direct effects to the social environment, however there may be indirect effects if the no action alternative is chosen as the preferred. There has been considerable discussion at the Council level with regard to island specific management with public input strongly in favor of this style of management. In some cases, displeasure has been expressed toward the lack of understanding of local needs and concerns. This may still be a factor, however, the more recent assessment has suggested island level management may accommodate some of these concerns and moving toward island management may afford a more streamlined and successful management of Caribbean fisheries. If **Alternative 1** is chosen as preferred, fishermen may become dissatisfied and perceptions of the efficacy of management may erode. Such an erosion of perception can lead to lesser compliance and affect participation in management. Cooperation and participation in management have been shown to improve compliance with fishery regulations and can contribute to the overall well-being of fishermen and other stakeholders including the well-being of the resource. Developing a new Island FMP under **Preferred Alternative 2** would consider the unique attributes of the island group taking into account the specific cultural, social, economic, physical, geological, and biological environment of St. Croix. **Preferred Alternative 2** would create an individual plan for St. Croix and would addresses the concerns that have been expressed by the public regarding island management.

The different histories of the islands have had a unique effect on the development of the fishing economy on each. Based upon different governance, dissimilar colonization and development of

plantations and slavery, the islands have today developed their own unique culture and social environments. These differences are evident as one examines the ethnic and cultural makeup of the stakeholders within each island fishery. While all share common experiences and historical provenance, over the decades, significant differences have evolved. Present day economies differ on each island as affected by unique histories and the new trends of tourism and global economies have helped transform the older more traditional coastal way of life. Fishing is one of those historical activities that has remained an important part of island culture, yet each of the social and economic environments differ and have dictated unique trajectories for the development of all three sectors of fishing. By allowing for more island centric management, each locale may be able to take advantage of the historical trends that have created each unique social and cultural environment that may offer more streamlined and effective management. This may bring about more participation as stakeholders see management more responsive to their local needs. The increased cooperation may lead to more compliance which should benefit the biological, economic and social environments.

### 4.1.5 Direct and Indirect Effects on the Administrative Environment

Choosing to take no action in **Alternative 1** would not require additional rulemaking and would therefore have no additional effects on the administrative environment. Choosing to take no action in **Alternative 1** might prove beneficial to the administrative environment in the short-term because maintaining the status quo would not require administrative adjustments

Under **Preferred Alternative 2** regulations would be repackaged from a Caribbean-wide EEZ domain to a St. Croix EEZ domain, but the regulations would remain the same in most respects. Short-term effects on the administrative environment would be negative as the new regulations are established. However, long-term effects would be positive and possibly substantial as federal management was properly directed to stocks for which the Council actually has management influence while avoiding application of administrative effort to those stocks for which the Council has no management control.

## 4.2 Action 2: Identify Stocks in Need of Federal Conservation and Management - Environmental Consequences

### 4.2.1 Direct and Indirect Effects on the Physical Environment

Action 2 (stock selection) is primarily an administrative action because adding or removing species for management does not directly affect how the fisheries operate (*i.e.*, gear used) and is not expected to have direct effects on the physical environment. Indirect effects may apply depending on the species selected for management.

**Alternative 1** would not be expected to have direct effects on the physical environment, nor any indirect affects that were not previously considered in the 2010 and 2011 ACL Amendments as current fishing practices are not expected to change.

Under **Preferred Alternative 2**, species for which the majority of catch occurs in territorial waters would be removed, indirectly reducing impacts to the physical environment in those areas. Removing species infrequently caught in federal waters is not expected to impact the physical environment due to the small amount of effort involved in catching these non-targeted species.

Adding species previously not managed would potentially have indirect effects on the physical environment if it resulted in new gear types, fishing areas, or fishing effort not previously analyzed, but these routes are not expected for any of the species added in **Preferred Alternative 2**. Any indirect effects that may occur from interactions between the physical environment and fisheries catching these new species would be expected to be limited. For example, including sea urchins and sea cucumber species in the St. Croix FMP could have indirect physical effects by placing all species included in these two groups into the management regime, thereby ensuring that harvest levels and methods are commensurate with the important role these two groups play as ecosystem engineers within the coral reef ecosystem. Healthy populations of sea cucumbers and sea urchins help to ensure their contributions to sediment bioturbation and biofouling reduction are maintained at appropriate levels. However, considering that harvest from the St. Croix EEZ is unknown but likely near zero, such physical effects would be expected to be minimal when compared to outcomes expected from **Alternative 1**. Regarding managed pelagic species such as dolphin and wahoo, these species are already legally harvested from the St. Croix EEZ by both commercial and recreational fishermen, generally using hook-and-line methods. Adding pelagic species to management would therefore be expected to have no direct or indirect physical effects on the environment beyond those already being experienced. Only for coral would indirect physical effects to the environment be anticipated to change, as a complete inclusion of all hard, soft, and black corals to the St. Croix FMP would ensure that all corals are managed. Assuming the Council's past approach to managing these foundational components of the ecosystem, that being to prohibit harvest of all managed coral species, is carried forward into the new St. Croix FMP, the physical environment could benefit from the elimination of any mechanisms used to harvest non-managed corals.

**Alternative 3** would allow the Council to select, in no certain order, the species to be included for management. Depending on the criteria and order selected, indirect impacts to the physical environment from the list of species selected for management could include range from no new

effects (if the same species composition as in the current FMPs was selected), the same as **Alternative 1**; minimal effects (if some species were added while others removed, assuming those fishing-related effects to the physical environment would balance out) similar to **Preferred Alternative 2**; and maximum effects (if all species landed in St. Croix were selected, increasing effort and including new gear types). The Council and expert panel used the best data and information available to develop the species selection criteria used in both **Preferred Alternative 2** and **Alternative 3** to best manage the federal fisheries of St. Croix. However, that process depended largely on the order that the criteria are applied, and because **Alternative 3** decreases the effectiveness of that process by allowing for some criteria to be excluded, or for a different order to be applied, **Preferred Alternative 2** may be a better choice for determining which species to manage.

### 4.2.2 Direct and Indirect Effects on the Biological/Ecological Environment

Action 2 (stock selection) is primarily an administrative action because adding or removing species for management does not directly affect how the fisheries operate (*i.e.*, amount of fish caught) and is not expected to have direct effects on the biological/ecological environment. Indirect effects may apply depending on the species selected for management.

**Alternative 1** would retain the same indirect effects to the biological/ecological environment as those previously analyzed and described in the 2010 and 2011 Caribbean ACL Amendments (CFMC 2011a, 2011b), such as the improved monitoring of managed stocks resulting in more careful and responsive management actions, but it would not allow for the inclusion of new species for management. Since those amendments were published, other species have been identified as playing an important role in St. Croix fisheries and/or the coral reef ecosystem supporting those fisheries and may be in need of protection. **Alternative 1** would not allow new species to be added to the St. Croix FMP, thus would be expected to have indirect biological/ecological effects as it would not extend management to other species in need of conservation and management based on the criteria established in the Magnuson-Stevens Act. The Council would not set management reference points or other conservation measures for those species, or otherwise ensure those species are managed in a manner that prevents overfishing while achieving, on a continuing basis, the OY) from the fishery as required by National Standard (NS) 1 of the Magnuson-Stevens Act. In addition, the Reef Fish, Spiny Lobster, Queen Conch, and Coral FMPs are Caribbean-wide, and **Alternative 1** would retain species that might not be as applicable for the St. Croix FMP due to the geography and location of management zones. Finally, in response to changing environmental (e.g., habitat availability or health) or anthropogenic (e.g., fishing practices) factors, the species to be managed need to be reevaluated periodically to maximize biological as well as socioeconomic benefits. Under **Alternative 1**, that opportunity is lost, as the Council would take no action to reevaluate and revise (as appropriate) the species to be included for federal management.

Like **Alternative 1**, **Preferred Alternative 2** would continue to manage species considered to be classified as overfished in U.S. Caribbean federal waters (queen conch, Nassau grouper and goliath grouper), or for which harvest is prohibited due to their ecological importance (rainbow, blue and midnight parrotfish), or for species that have seasonal closures or size limits (queen conch, spiny lobster and select snappers and groupers). These species are susceptible to excess fishing pressure and/or vulnerable to environmental conditions. Unlike **Alternative 1**, **Preferred Alternative 2** has the flexibility to include species that that were not included in the previous FMPs, but are currently considered to be biologically vulnerable or ecologically important. Under **Preferred Alternative 2**, the Council would choose to include all species of sea urchins and sea cucumbers found in U.S. Caribbean waters off St. Croix, increasing the protection of these benthic species and their habitat, as harvesting techniques for these species could be destructive to coral reef resources. **Preferred Alternative 2** would also benefit the biological/ecological environment indirectly by establishing catch limits for highly targeted stocks that are currently without management measures, like dolphin and wahoo. Establishing harvest limits for these pelagic stocks would provide a more comprehensive management of the St. Croix coral reef ecosystem.

Conversely, NMFS' NS guidelines state that the principle implicit in NS7 is that not every fishery needs regulation. As such, not all species that are landed in St. Croix or that were included in the Reef Fish FMP list of managed species are appropriate for management in federal waters off St. Croix. During the stepwise process of **Preferred Alternative 2**, expert analysis guided by available data identified species that were either infrequently caught in federal waters or primarily caught in territorial waters, which were then excluded from federal management. Removal of species preliminarily caught in territorial waters or those with low or infrequent catch levels in federal waters would allow management efforts to be concentrated on the more heavily targeted and exploited stocks that are in need of management, thus providing increased benefits to the biological/ecological environment. In response to changing environmental (e.g., habitat availability or health) or anthropogenic (e.g., fishing practices) factors, the species to be managed need to be reevaluated periodically to maximize biological as well as socioeconomic benefits. Revising federal fishery management in St. Croix EEZ waters, as proposed herein, provides that opportunity.

**Preferred Alterative 2** would include for management all corals, sea cucumbers, and sea urchins, which could reduce direct (habitat) and indirect (grazers) effects to ESA coral critical habitat. Species new to management proposed under this alternative would not be expected to increase impacts to ESA-listed species, as the gear used in the harvest of these species were previously considered and analyzed under the 2011 Biological Opinion of the Reef Fish FMP (F/SER/2010/06680).

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In summary, relative to **Alternative 1**, **Preferred Alternative 2** would be more beneficial to the biological/ecological environment because it would (1) direct resources to the management and protection of species that are truly in need of conservation and management; (2) allow inclusion of species that have not been previously subject to conservation and management; and (3) remove current management measures in place for species that are not targeted in federal waters. That rearrangement of species to be managed would increase the likelihood of sustainable harvest, as a means both to enhance food security for the island of St. Croix and to rebuild and sustain the natural ecological balance of the coral reef ecosystem within the context of sustainable harvest.

Unlike **Preferred Alternative 2**, which follows a regimented process including an integrated attributes analysis, **Alternative 3** does not require that the Council use all of the determined selection criteria, or apply them in a logical, stepwise process. This added flexibility could have greater indirect effects on the biological/ecological environment than either **Alternative 1** or **Preferred Alternative 2**, depending on the outcomes of those selections. For example, if Criterion A was not applied, then the species that are overfished or undergoing overfishing and most in need of conservation and management would not be included, indirectly increasing adverse effects to the biological/ecological environment. Or, if Criterion B was not applied, then species that are harvested primarily in territorial waters or infrequently in federal waters could be included in the FMP. In theory, including species in the FMP, establishing management measures, and constraining fisheries to annual catch limits (ACL) would provide biological and ecological benefits; however, for some species, because a small portion of the overall fishing activity for those species occurs in federal waters, federal enforcement is limited in its ability to ensure compliance with protective measures, such as measures to ensure accountability with ACLs.

### 4.2.3 Direct and Indirect Effects on the Economic Environment

Management alternatives considered under this action are largely administrative in nature and therefore would have no direct economic effects. **Alternative 1** (no action) maintains the status quo with species subject to management remaining unchanged. While largely administrative in nature, there may be some indirect economic effects associated with maintaining the status quo. First, there may be species not included under the no action alternative which are in need of management for the realization of long-term maximum benefits derived therefrom. Specifically, some species commonly found in federal waters but not included in the no action alternative may be vulnerable to overfishing. Exclusion of these species from the St. Croix FMP translates to an inability to properly manage these species to ensure a stock level above that associated with an overfished condition. Second, enforcement resources are limited in the U.S. Caribbean and the current inclusion of species in the existing FMPs not in need of management may take resources

away from enforcement activities for those species in greater need of monitoring and enforcement.[49]

Like **Alternative 1**, **Preferred Alternative 2** is largely administrative in nature though selection of **Preferred Alternative 2** would likely entail numerous economic effects. From an economic perspective, including species in an overfished status (as defined by NMFS) would, in the long run, allow for the rebuilding of respective stocks under proper management. Rebuilding of the respective stocks would, after sufficient recovery (*i.e.*, no longer being declared as overfished), potentially allow for commercial and/or recreational harvest of these species (*i.e.*, Nassau grouper, goliath grouper, and queen conch) and presumably the associated economic benefits.[50] Similarly, protection of species and corals due to their ecological importance (as habitat in the case of corals or habitat engineers in the case of midnight, blue, and rainbow parrotfish) would allow for a more 'healthy' ecosystem upon which other species rely upon. A healthier ecosystem implies a larger carrying capacity for other species dependent upon that ecosystem. This, in turn, translates into larger stocks (controlling for other factors) and greater fishing opportunities. Finally species for which seasonal closures or size limits apply are also included in the St. Croix FMP under Criterion A. Presumably, these regulations were initiated out of concern that the respective species were susceptible to overfishing in the absence of regulation and/or that benefits derived from commercial and recreational activities could be enhanced via regulation. Including these species in the St. Croix FMP would help to ensure that benefits would not be reduced as might be the case should the species not be included.

Given rare occurrence of species excluded under Criterion B, implying that these species contribute little to catch, one would anticipate no direct economic effects associated with exclusion of these species from the St. Croix FMP.[51] Given limited enforcement capabilities in the region, furthermore, exclusion of these infrequently harvested species may also permit enhanced enforcement activities associated with those species of greater economic or ecological relevance.

Landings for some species included under Criterion C tend to be relatively limited and targeting of any of these species would also be expected to be limited. Rather, catches would likely be incidental; often in conjunction with catch of a targeted species. Inclusion of these species is

[49] The outcome of this, of course, depends upon what species are added and what species are deleted in the St. Croix FMP in relation to the no action alternative (Alternative 1). This is discussed in greater detail in association with the other alternatives under this Action.

[50] A qualification needs to be given here. Commercial fisheries in the St. Croix EEZ are not restricted in terms of access. Being largely 'open access', these fisheries likely generate little producer surplus. While the rebuilding of stocks and increased harvests may allow for the generation of some short-run producer surplus (profit), this would likely be dissipated over time.

[51] This assertion is, of course, conditioned on Criteria A and C (inclusion of species that, even if rarely harvested, have essential ecological value).

largely administrative in nature though indirect economic losses associated with not managing these species could be forthcoming if the rate of fishing (*i.e.*, fishing pressure) is large relative to their ability to reproduce, thereby resulting in declining harvests.

Addition of species under Criterion D would be largely administrative in nature but there could be some indirect economic impacts. Historical landings for some of the species added are relatively large and are migratory in nature (e.g., dolphin and wahoo). The migratory nature of these species calls into question the benefits of including them in the St. Croix FMP. The relatively large landings of some of these species imply that subsequent regulations can have substantial economic impacts. Until such regulations are specified, however, one cannot determine if the economic impacts are positive, negative, or mixed.[52] Finally, to fully consider economic impacts that may, in the long run, be attributable to including many of the species listed under Criterion D in the St. Croix FMP, one must consider how limited enforcement reacts to regulation associated with these species. This may be an important consideration given the large landings and, hence, possible large enforcement activities that would detract from other enforcement activities.

Criterion E is administrative and (1) given the very limited landings of those species that might be included and (2) given that most species in need of conservation and management would be already protected (see Criterion A), no economic impacts would expected from Criterion E.

Unlike **Preferred Alternative 2**, which follows a regimented process including an integrated attributes analysis, **Alternative 3** does not require that the Council use all of the determined selection criteria, or apply them in a logical, stepwise process. This added flexibility could have lesser or greater indirect effects on the economic environment than either **Alternative 1** or **Preferred Alternative 2**, depending on the outcomes of those selections. Because so many options are available under **Alternative 3**, it is not possible at the present time to fully evaluate the direct and indirect effects of choosing **Alternative 3**. A more thorough analysis of direct and indirect effects associated with **Alternative 3** can be developed only with additional guidance as to the criteria to be included and the order of application of those criteria. However, the Council when considering this alternative decided to eliminate it from further study.

### 4.2.4 Direct and Indirect Effects on the Social Environment

The social effects from adding species are indirect benefits that help fulfill the goals of the FMP and protect stocks that are important both economically and socially to St. Croix stakeholders. Under **Alternative 1** (no action) those species that are currently managed under the old FMPs

[52] Given that there are no permit requirements associated with the commercial harvesting of these species, any producer surplus generated as a result of regulation would likely be transitory in nature.

are included, but new species are not added nor are species that are not relevant excluded. Not tailoring the FMP to those species of interest to St. Croix is contrary to the purpose of developing an island-based FMP. With **Preferred Alternative 2**, a stepwise process using the identified criteria allows for a more methodical approach that takes into consideration biological, socioeconomic and ecological considerations for St. Croix fisheries that should have indirect beneficial social effects. The process under **Preferred Alternative 2** uses an expert panel and other management panels to apply the criteria that give a broad interpretation of social, economic and ecological importance which should benefit the stocks included and the fishery and more meaningfully meet the intent of creating an island-based FMP. Including specific species that are relevant to St. Croix fishermen and stakeholders would facilitate monitoring and assessment which is critical to ensuring stock status remains above critical thresholds of overfishing and overfished status. It also provides monitoring of fishing activity that can provide important information in determining whether actions may need to be undertaken to meet social and economic objectives within the St. Croix FMP. The criterion included in **Preferred Alternative 2** criteria offer an opportunity to consider social, economic and ecological benchmarks by which to include species that are important to St. Croix into the FMP and should have positive social effects although indirect.

### 4.2.5 Direct and Indirect Effects on the Administrative Environment

**Alternative 1** would not result in increased administrative effects associated with selecting species to be included for management because the Reef Fish, Spiny Lobster, Queen Conch and Coral FMPs already have the list of species place. However, there would be some administrative costs associated with retaining the current management measures in place for those species if the current management measures continually result in the need to apply AMs. Although the costs associated with implementing AMs is not well known, retaining outdated management measures would certainly add to the administrative workload. Also, continuing to monitor species that may not be landed primarily in federal waters would increase administrative effects, especially if that monitoring required additional administrative action.

**Preferred Alternative 2** would result in increased administrative impacts associated with establishing ACLs and AMs for stocks new to management, but would also have decreased costs associated with the stocks that were removed from the previous FMPs. Under Criterion B, 43 individual species of finfish, all reef fish and invertebrates included in the aquarium trade categories in the Reef Fish and Coral FMPs, would be excluded from the St. Croix FMP. The decreased administrative costs for those removed stocks would be expected to outweigh the costs associated with adding the two new fish stocks and new invertebrate stock complexes included for management under this alternative. Even though all species of corals, sea urchins, and sea cucumbers would be included in the St. Croix FMP, which would potentially including hundreds

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of species, they would be managed at either the Class (urchins and cucumbers) or Order (corals) level, requiring management measures for only three stock complexes.

Administrative effects related to **Alternative 3** are harder to anticipate, as it is unknown at this time which of the species selection criteria may be applied, or in what order. In general, the administrative costs would be expected to increase if species are included for management, as they would require management measures be established and harvest levels be monitored annually. There is a greater risk under **Alternative 3** of including species not appropriate for federal management (*i.e.*, primarily caught in territorial waters, or low of infrequent landings from federal waters), thereby increasing the burden on the administrative environment.

## 4.3 Action 3: Compose Stock Complexes and Identify Indicator Stocks - Environmental Consequences

### 4.3.1 Direct and Indirect Effects on the Physical Environment

Action 3 (revision of stocks) is primarily an administrative action because grouping stocks into stock complexes and selecting indicators stocks does not directly affect how the fisheries operate (*i.e.*, gear used) and is not expected to have direct effects on the physical environment. Indirect effects may apply depending if stock complexes or indicator stocks were selected for management.

**Alternative 1** (no action) would bring all stocks and stock complexes as they are currently managed in the Reef Fish, Spiny Lobster, Queen Conch, and Coral FMPs into the new St. Croix FMP. Stocks that are new to management would be managed as individual stocks. **Alternative 1** would continue to manage 139 reef fish stocks in 23 stock complexes, including the finfish and aquarium trade stock complexes, as well as the spiny lobster, queen conch, and corals stocks/stock complexes and would include two new fish stocks and all sea cucumbers and sea urchins expected from Action 2. Indirect effects to the physical environment could continue to occur based on interactions of the fisheries with the sea floor, but the effects would not be expected to be greater that those previously discussed in the 2010 and 2011 Caribbean ACL Amendments (CFMC 2011a, b) as the way the stocks are grouped or not grouped is not expected to impact the amount of effort or gear types used.

**Alternative 2** would not establish stock complexes, but rather would manage all stocks as individual stocks, resulting in one spiny lobster, one queen conch, 43 individual reef fish stocks and an unknown number of coral, sea urchin and sea cucumber stocks. Even though the stocks would be managed separately, fishing practices would not be expected to change, so any direct

or indirect effects to the physical environment would be expected to be the same as in **Alternative 1**.

Under **Preferred Alternative 3**, the stocks selected for management in Action 2 would be managed as 13 individual stocks and 13 stock complexes. These stocks and stock complexes would be grouped based on the similar characteristics of the current St. Croix fisheries, like gear type used and depth and/or habitat targeted. Updating the stocks/stock complexes using recent data and information pertaining to the current fisheries would be expected to increase the overall effectiveness of established management measures, when compared to historical stocks/stock complexes, and decrease the potential for negative impacts to the physical environment.

**Alternative 4** determines whether to assign an indicator stock to a stock complex (**Preferred Sub-Alternative 4a**) or to not assign an indicator stock (**Preferred Sub-alternative 4b**), neither of which would be expected to change fishing practices or have additional direct or indirect effects on the physical environment relative to the status quo.

### 4.3.2 Direct and Indirect Effects on the Biological/Ecological Environment

Action 3 is primarily an administrative action because grouping stocks into stock complexes and selecting indicators stocks does not directly affect how the fisheries operate (*i.e.*, amount of fish caught) and is not expected to have direct effects on the biological/ecological environment. Indirect effects may apply depending if stock complexes or indicator stocks were selected for management.

**Alternative 1** would not be expected to have direct impacts to the biological/ecological environment because it is not changing the amount of allowable harvest, it would be expected to have indirect effects due to the stocks/stock complexes that would be managed. At the time the 2010 and 2011 ACL Amendments were developed, the stocks/stock complexes that were established were based on the best available information at that time, but that information is not necessarily applicable to the way the fishery operates at this time. Additionally, those stocks/stock complexes were established for the entire U.S. Caribbean and might not be suitable to an island-based FMP for St. Croix. Since no stock complexes were previously established for the stocks that were selected as new to management in Action 2, they would be managed as individual stocks. Not allowing for updates to the stocks/complexes could result in less effective management.

**Alternative 2** would not group stocks into stock complexes and would result in management measures being established for each individual stock, even if life history information or landings data are not available for that species. Magnuson-Stevens Act NS3 states that interrelated stocks of fish shall be managed as a unit or in close coordination and guidance from the recently

amended NS1 defines a stock complex as a group of stocks that are sufficiently similar in geographic distribution, life history, and vulnerabilities to the fishery such that the impact of management actions on the stocks is similar (74 FR 3178). Thus, by not allowing for stocks to be grouped into stock complexes, Alternative 2 would be expected to result in ineffective management measures and additional burdens to the biological/ecological environment.

Stock complexes established under **Preferred Alternative 3** would be more likely to be based on the most recent information available and therefore more representative of the current fisheries. Currently, stock assessments are not available for the majority of U.S. Caribbean species, and so grouping unassessed stocks into complexes may help to avoid implementing AMs for stocks whose landings fluctuate due to rarity or species identification issues. National Standard guidelines state that stocks may be grouped into complexes if: (1) they cannot be targeted independently of one another in a multispecies fishery; (2) data are insufficient to measure their status relative to established status determination criteria; or (3) when it is not feasible for fishermen to distinguish individual stocks among their catch (50 CFR 600.310 (b) (8) in 74 FR 3178). Those criteria are applicable to several stocks that were selected for management under the St. Croix FMP, and were considered by the Council and expert panel when the stock complexes were assigned. This alternative would be expected to result in more careful and responsive management of the fisheries, and provide increased benefits, albeit indirect ones, to the biological/ecological environment.

No direct effects to ESA-listed species are expected from this action, as it re-organizes how stocks are grouped, or not grouped, which would not be expected to alter fishing practices in the St. Croix management area. Indirect effects to ESA-listed species may occur through the improved management of stocks (e.g., restructuring stock complexes to more accurately reflect current fishing practices may reduce the amount of regulatory discards and/or bycatch) that were updated under this Action using applicable scientific analysis and expert opinion from the scientific and fishing communities.

**Alternative 4** could be applied to each stock complex as necessary, depending on the desire to select (**Preferred Sub-alternative 4a**) or not select (**Preferred Sub-alternative 4b**) indicator stocks for the complex. While this alternative is purely administrative, **Preferred Sub-alternative 4a** increases the potential benefits to the biological/ecological environment as the selected indicator stock can be used to help manage and evaluate more poorly known stocks within a stock complex. If an indicator stock is selected, it would represent the typical vulnerability of the stocks within the complex, with special regard to interactions with the fishery. Indicator stocks minimize the risk associated with the probability of overfishing, as all stocks in the stock complex are managed under the measures created for the indicator stock. Conversely, having the option to not select an indicator stock, as in **Preferred Sub-alternative**

**4b**, would provide flexibility in creating management measures for stock complexes for which an appropriate indicator cannot be identified. In those instances, the management measures would be based on the complex as a whole, thus providing increased biological/ecological benefits to the stocks within the complex. For each stock complex established in **Preferred Alternative 3**, the Council's SSC determined whether or not an indicator stock would provide additional biological benefits.

### 4.3.3 Direct and Indirect Effects on the Economic Environment

Overall, the arrangement (or change in arrangement) of stocks into stocks/stock complexes, as proposed under Action 3, would not result in direct economic effects. This is because it is not expected to influence current harvest or use of the resource and direct effects are manifested via management actions that influence current harvest and resource use. **Alternative 2** would constitute the simplest of the proposed alternatives since it does not organize stocks into stock complexes. As noted in Section 5.3, however, all stocks may not benefit from being managed on an individual basis due to issues associated with identification of some individual stocks and unreliability of landings associated with the 'more' infrequently caught stocks. Both of these factors would likely result in establishment of reference points in instances where little is known about the 'true' stock status. Furthermore, the 'more' infrequently landed stocks are not targeted by fishermen but are instead caught in conjunction with other stocks (*i.e.*, they are a part of a multi-species fishery). Thus, efforts to protect the stock status of these infrequently caught species via ACL, are likely to be relatively ineffective (assuming a high discard mortality which would likely be the case for, at least the reef fish stocks, given the depth of federal waters) unless catch of the other targeted stocks are also simultaneously curtailed. Furthermore, ACLs associated with each individual stock within the St. Croix FMP would most likely result in a significant increase in administrative burden as AMs would need to be imposed when the ACLs are reached. These frequent AMs can be disruptive to the fishing communities.[53]

Like **Alternative 2**, **Alternative 1** would not be expected to influence current harvest or use of the resource and thus has no direct economic effects. Given that many of the fisheries in St. Croix are multi-species in nature, however, management of fishery complexes as in **Alternative 1**, via regulation, can result in different economic outcomes than managing at the individual stock level (**Alternative 2**). Specifically, managing at the individual stock level is likely to result in more regulatory discards than that which would occur under **Alternative 1**. Hence, benefits associated with **Alternative 2** are less than those of **Alternative 1**.

[53] The disruption is not as much a result of needing to curtail/change fishing practices but, rather, staying informed of the numerous AMs that might be forthcoming. Given the low landings of these 'infrequently' caught stocks, short-term producer surplus would likely not be reduced significantly with even numerous AMs specific to the infrequently caught stocks.

**Preferred Alternative 3**, like that of **Alternative 1**, would use the concept of stocks and stock complexes to manage species (the selection of which is derived from the outcome of Action 2). However, the designation of stocks and stock complexes would differ from those designated in **Alternative 1**. A comparison of **Alternative 1** with **Preferred Alternative 3** indicates that much (though not all) of the differences in the arrangement of stocks/stock complexes represents inclusion of stocks managed individually in **Alternative 2** into various stocks and stock complexes in **Preferred Alternative 3**. Other changes in stocks/stock complexes represent additional scientific information that allowed for a 'better' (in terms of scientific justification) specification of the stocks and stock complexes. Many of the stocks being added to a stock or stock complex in **Preferred Alternative 3** which would be managed at the species level in **Alternative 2** (as well as removing a species under one stock or stock complex in **Alternative 2** and putting it into a different stock or stock complex in **Preferred Alternative 3**) represent 'minor' species in that annual landings are relatively limited.

Like **Alternative 1** and **Alternative 2**, **Preferred Alternative 3** is not expected to directly affect the economic environment because it does not directly change the current harvest or use of the resource. Subsequent regulations, such as implementation of AMs, could trigger a change in the economic environment. Given the language in the previous paragraph regarding primary differences between **Alternative 2** and **Preferred Alternative 3**, furthermore, changes in the economic environment related to **Alternative 2** are compared to changes related to **Preferred Alternative 3**. While differences between **Alternative 2** and **Preferred Alternative 3** are relatively minor (in terms of changes in the economic environment that may be forthcoming with regulation), better and more recent scientific information is used in **Preferred Alternative 3** to create stock complexes than is the case with **Alternative 2**. As such, there is likely a better chance of setting ACLs that would provide adequate protection of the stock with **Preferred Alternative 3** than with **Alternative 2** which, overtime, would provide greater indirect economic benefits.

**Preferred Alternative 4 Preferred Sub-alternative 4a** or **Preferred Sub-alternative 4b** would not be expected to directly affect the economic environment because they not directly change the current harvest or use of the resource.

Assuming subsequent regulation, however, the economic outcome of assigning one or more indicator stocks for stock complexes may have important implications relative to not assigning indicator stocks. This would depend upon two factors: (1) the indicator stock selected and (2) the 'jointness in catch' among the individual stock in the complex.[54] Presumably, the indicator

[54] Jointness in catch reflects the inability of the fishermen to change fishing practices in a manner that would change species composition in the multispecies fishery.

stock selected would reflect those stocks which provide the most informative catch data.[55] If this is the situation and if catch in the multispecies fishery is highly joint in nature, use of indicator stock can help manage and evaluate the conditions for some of those stocks for which catch and other relevant data that can be used in the management process are less informative. Thus, use of one or more indicator stocks could be used to better assure that catches of more infrequently caught stocks (which have less informative data) would not be overfished, which would then detract from any long-term benefits that may result from harvesting these stocks. If true jointness does not exist in the harvesting (production) process, however, any economic benefits that might be derived from the use of an indicator stock may also be diminished.[56]

### 4.3.4 Direct and Indirect Effects on the Social Environment

The social effects from establishing stock complexes are likely to be indirect as many of the impacts would come from the thresholds for ACLs and other reference points that are determined for each stock complex as a result. This solution helps resolve the problem of placing reference points on each individual stocks, especially those that do not have stock assessments, which can place unnecessary burdens on different fishing sectors according to their fishing practices for a particular stock.

**Alternative 1** would organize stocks and stock complexes as they are currently under the existing FMPs, which could induce a slightly cumbersome management regime for new stocks that are added to the FMP and are not included in other stock complexes. Those stocks that are not in complexes would need to have reference points established individually, such as an ACL, maximum sustainable yield (MSY), among others, which may prove difficult if data are not available. Without reliable and consistent data, the reference points that are established and AMs that could follow may create closures and other problems that disrupt current fishing patterns.

By grouping stocks according to the methodology in **Alternative 2**, the burden of placing reference points on individual stocks would create an even more difficult management regime that would stem from the lack of consistent and reliable data on certain stocks. Without consistent and reliable data for some stocks, as mentioned previously, establishing reference points with little or no data could trigger unnecessary and onerous management that could have complex negative social effects.

[55] See Section 5.8 for the set of criteria that may be used to select one or more indicator stock.
[56] As noted, entry into most of the fisheries in the federal waters off of the St. Croix coast is not limited which would tend to suggest relatively limited producer surplus. This fact and the fact that the landings of the more infrequently harvested species are more limited suggest that economic benefits associated with the use of one or more indicator stocks would be limited.

With **Preferred Alternative 3** the selection of stock complexes or single stocks would entail a process that includes analysis and review by expert and experience based panels that provide extensive input into the process of creating stock complexes and single stocks. Such a process garners both scientific and public support and can provide a more consistent approach that is in line with the purpose of creating an FMP tailored for St. Croix.

**Alternative 4** would allow the Council to choose indicator stocks that have measurable status determination criteria (SDC) that would be used to set criteria for a particular complex, which should have beneficial indirect social benefits as it would allow for monitoring of those stocks with little or no information and facilitate setting SDC. Under **Alternative 4**, **Preferred Sub-alternative 4a** criteria are used to select indicator stocks along with expert and experiential input which should add more confidence the selection of future status determination criteria for the complexes. With **Alternative 4**, **Preferred Sub-alternative 4b** no indicator stock would be chosen for stocks or complexes for which the criteria do not apply and AMs would be established for the stock complex based upon the aggregate ACL. It is anticipated that the preferred alternatives would have positive social benefits through practical grouping that is less cumbersome than single stock ACLs and the selection of indicator stocks where possible would provide some oversight, albeit a proxy. However, the formation of ACLs for grouped stocks and the use of indicator stocks may induce some changes in fishing behavior if unanticipated closures occur as a result of these thresholds being exceeded. However, in the long term, if these measures provide sufficient protection for stocks there should be positive social effects.

### 4.3.5 Direct and Indirect Effects on the Administrative Environment

**Alternative 1** would result in increased administrative impacts associated with establishing stocks and stock complexes for the species new to management, but not for those previously managed in the Reef Fish, Spiny Lobster, Queen Conch and Coral FMPs, as these groupings are already in place. Indirect administrative effects could also occur if the stock complexes in those FMPs are now considered to be outdated, resulting in additional administrative actions from the continuation of management for those stock complexes.

**Alternative 2** would result in the greatest administrative burden, as it would require that management measures be established for a minimum of 48 individual stocks. Some of these species are misidentified or misreported or have extreme fluctuations in landings through time due to rarity, or lack of targeted fishing effort. Thus, specifying individual management measures for these stocks might result in periodic overages that would require AM implementation, creating additional burdens on science and enforcement in the future.

**Preferred Alternative 3** would increase the number of stock/stock complexes, generally increasing the effects to the administrative environment. However, the long-term effects of this

alternative would be expected to be reduced through better management of the stocks in the St. Croix FMP, as the stocks and stock complexes were selected using the best information available. Thus, it would be expected that the number of administrative actions related to these stocks/stock complexes would be fewer and less frequent than the status quo.

Both **Preferred Sub-alternative 4a** and **Preferred Sub-alternative 4b** would be expected to have no direct effect on the administrative environment. However, depending on the determination on an indicator stock for the complex, the process for establishing management measures would be slightly different and could have differing administrative effects. For those stock complexes where an indicator stock was selected (**Preferred Sub-alternative 4a**), the process for establishing management measures would be similar to single species stocks, which is a simpler process. For those stock complexes where an indicator stock was not selected (**Preferred Sub-alternative 4b**), establishing management measures would require an extra step to combine the data for the species within that stock complex. Similarly, monitoring the multi-species stock complexes without an indicator stock would require that additional step before determining if the ACL was exceeded. Overall, the expected effects of selecting or not selecting an indicator stock would be expected to be minimal, as those determinations were based on the best available information at the time and would provide managers with increased flexibility in the monitoring and management of stock complexes.

## 4.4 Action 4: Establish SDC and Management Reference Points - Environmental Consequences

### 4.4.1 Direct and Indirect Effects on the Physical Environment

**Alternative 1**, the no action alternative, would result in the continuation of SDC and management reference points established in the 2010 and 2011 Caribbean ACL Amendments and the Caribbean SFA Amendment. **Alternative 1** simply carries over the existing reference points and SDC. **Alternative 1** does not respond to and incorporate additional data, and does not adapt to a changing suite of managed stocks. In particular, stocks newly added to the St. Croix FMP would not be accounted for in **Alternative 1**, and would not meet the requirements of the Magnuson-Stevens Act. Adoption of **Alternative 1** could create potential short- and long-term negative effects on the physical environment because harvest levels and associated fishing activities would not be specified, monitored, or managed for newly added stocks. This could result in higher levels of gear deployment, potentially including those presently employed gear types that may negatively impact the physical environment.

**Preferred Alternative 2** would specify new reference points for all stocks and stock complexes (as appropriate) proposed for management in the St. Croix FMP. Applying the best scientific

information available to ensure federally managed stocks are harvested sustainably over the long-term ensures those finfish and invertebrate populations supporting harvest are exploited to the greatest practicable extent while protecting reproductive capacity and maintaining effective ecological contributions. Establishing appropriate harvest reference points, taking into account both the biological needs and the ecological contributions of the stock as would be prescribed by **Preferred Alternative 2**, provides positive short- and long-term benefits to the physical environment both directly by managing fishing effort and associated gear impacts and indirectly by managing the ecological integrity of the coral reef ecosystem.

**Alternative 3** would follow the SDC and reference point setting methodologies developed in the 2010 and 2011 Caribbean ACL Amendments. However, unlike **Preferred Alternative 2**, **Alternative 3** would not apply the best scientific information available and would not be based on the recommendations of the Council's SSC or the SEFSC. Those same methodologies were used to establish the SDC and reference points that would be applied under **Alternative 1**. The final step in **Alternative 3** is to set the ACL by applying a reduction buffer to the ABC to account for uncertainty in the management process. The specific effects would depend on the choice of sub-alternative and cannot be fully analyzed prior to that Council decision. In general, the benefits to the physical environment would be enhanced with a larger buffer between ABC and ACL.

Effects to the physical environment resulting from implementation of **Alternative 3** would be expected to be more beneficial than those that would result from implementation of **Alternative 1** but less beneficial than those that would result from implementation of **Preferred Alternative 2**. For data poor situations, **Preferred Alternative 2** is a tiered control rule that allows for and anticipates updates with additional information, but **Alternative 3** sets a specific process regardless of information. Thus, providing a mechanism for developing reference points for all managed stocks, as called for in **Alternative 3**, could result in positive effects, but the extent of those positive effects would be limited by an inability to consider and apply the best scientific information available and to update management as those data expand and improve.

### 4.4.2 Direct and Indirect Effects on the Biological/Ecological Environment

Direct and indirect effects would result from the revision (species presently managed in U.S. Caribbean EEZ waters) or establishment (species newly added to the St. Croix FMP) of management reference points. Reference points directly affect how the fisheries operate (*i.e.*, amount of fish caught) and are therefore expected to have direct effects on the biological/ecological environment. In addition, indirect effects such as effects on other species (e.g., trophic interactions) may be experienced. Those direct and indirect effects would differ depending upon the alternative chosen by the Council for establishing management reference points, and are discussed below.

Under the no action **Alternative 1**, management reference points and in particular ACLs included in the St. Croix FMP would be carried over from the Reef Fish, Spiny Lobster, Queen Conch, and Coral FMPs. Those reference points resulted from a lengthy process of data evaluation and analysis led by the Council's SSC, as described in the 2010 and 2011 Caribbean ACL Amendments (CFMC 2011a, b), and remain valid within the context of that process. However, that context is founded upon landings data obtained during those years for which the data were available and were considered valid at the time. While the validity of the reference year data has changed little, the years during which landings are available has changed. For those stocks (snapper, grouper, parrotfish, queen conch) addressed in the 2010 Caribbean ACL Amendment, the most recent reference year was 2005, whereas for the remaining stocks under federal management, the most recent reference year was 2009. As reference points are reevaluated for application in the St. Croix FMP, additional years of data are available extending through 2016.

Under **Alternative 1**, those more recent years of landings data would not be considered. Much has changed with fisheries in the St. Croix EEZ waters since 2009, and even more so since 2005. In particular, implementation of the Caribbean SFA Amendment (CFMC 2005) along with the 2010 and 2011 Caribbean ACL Amendments altered many facets of the regulatory environment in St. Croix EEZ waters, for example by establishing area and season closures, altering the composition of the managed fisheries, and implementing ACLs and AMs. In some instances it may be appropriate to use only reference years preceding some or all of those events, as landings during those years may best represent a sustainable harvest level. But for other components of St. Croix EEZ fishery, accounting for those changes best represents modern fishing practices as well as fishing activity into the future. These recent events would not be considered by the Council under **Alternative 1**. This could result in potentially direct negative effects by not ensuring each stock in the St. Croix FMP is managed at OY. **Alternative 1** also may result in negative indirect effects by not allowing the Council to properly address ecological functionality such as those associated with trophic interactions (including grazing capacity) to the extent those interactions can be influenced by fishery management.

Of equal or greater effect, reference points for those species newly added to management would not be specified under **Alternative 1**. That outcome could result in direct negative biological effects by preventing achievement for OY, as required by the Magnuson-Stevens Act, and indirect negative ecological effects by failing to ensure the provision of essential ecosystem services such as grazing capacity.

**Preferred Alternative 2** would be expected to have positive short- and long-term effects on the biological/ecological environment associated with the St. Croix EEZ. Applying the best

scientific information available would ensure federally managed stocks are harvested sustainably while protecting reproductive capacity and maintaining effective ecological contributions. The Council and their SSC applied considerable expertise and effort to the process of developing their ABC CR, establishing the process and protocols for implementing that ABC CR, and identifying the best available scientific data and expertise to be used in the ABC CR analytical process. That effort would ensure, to the greatest practicable extent, the most appropriate quantitative estimates of SYL and ABC to ensure sustainability of a stock or stock complex. The Council carefully considered the process applied by the SSC, along with the environment within which management would be applied, when assigning an appropriate buffer to derive the ACL from the ABC established by the SSC. These outcomes provide positive short- and long-term benefits to the biological/ecological environment by reducing the likelihood of stock depletion and by providing guideposts on (SYL) and limits to (ACL) indicative of potential negative trends in reproductive capacity and ecological function. Management measures implemented to achieve the harvest objectives set by the $F_{MSY}$ proxy would directly impact the biological environment in the form of controlling fishing effort. The choice of the $F_{MSY}$ proxy depends on the life history of a species and how much risk the Council is willing to take. **Sub-Alternative 2b**, which uses $F_{40\%SPR}$ as a proxy for $F_{MSY}$ is more conservative and would provide greater assurance overfishing would not occur than the $F_{MSY}$ proxies specified under **Sub-Alternative 2a** and **Preferred Sub-Alternative 2c**. Therefore, the biological benefits of **Sub-Alternative 2b** would be greater than **Sub-Alternative 2a** and **Preferred Sub-Alternative 2c**.

Effects to the biological/ecological environment resulting from implementation of any combination of sub-alternatives under **Alternative 3** would be expected to be more beneficial than those that would result from implementation of **Alternative 1** but less beneficial than those that would result from implementation of **Preferred Alternative 2**. Providing a mechanism for developing reference points for all managed stocks, as called for in **Alternative 3**, would result in positive effects, but the extent of those positive effects would be limited by an inability to consider and apply the best scientific information available and to update management as those data expand and improve. Those relative effects would be exacerbated by establishment of a scientifically indefensible and therefore implausible OFL.

With respect to ESA-listed species, direct effects could be expected from this action, even though gear types and fishing effort are not expected to substantially differ from those previously analyzed, as it updates ACLs for several stocks previously managed and establishes ACLs for stocks new to management. Additionally, this action would prohibit harvest for all species of corals, sea urchins, and sea cucumbers. However, it is uncertain how fishing under those new ACLs would impact ESA-listed species, since some stock/stock complex-specific ACLs increased while others decreased. These impacts would be considered in the accompanying biological opinion for the St. Croix FMP.

### 4.4.3 Direct and Indirect Effects on the Economic Environment

Alternatives under Action 4 outline different approaches for specifying management reference points and SDC, in order to protect stocks (or complexes) from being overfished, while achieving, on a continual basis, optimum yield. Ideally, these alternatives would be analyzed by examining the changes in producer and consumer surplus under each of the alternatives. Given no information on costs in the commercial sector, no information regarding consumer surplus is derived from the commercial harvest, no information on the benefits derived from recreational fishing activities, and no information on the benefits from non-consumptive activities prohibits any in-depth analysis of the changes in producer surplus. Hence, a more general analysis will be presented here relying more on expected changes in catch.

**Alternative 1** maintains the status quo. As such, reference points as specified in the 2010 and 2011 Caribbean ACL Amendments would remain in effect. There are no direct economic impacts associated with maintaining the status quo but there may be indirect effects if the reference points as specified in the 2010 and 2011 Caribbean ACL Amendments are not based on the best available data or, for other reasons, are incorrectly specified. If the status quo ACLs are specified in such a manner that they do not adequately protect stocks/stock complexes, there would be indirect economic effects from maintaining the status quo (*i.e.*, assuming sufficient effort, stocks may become overfished). On the other hand, if the no action management reference points are overly restrictive, AMs may be triggered in instances where such action is not warranted (*i.e.*, overfishing on the stocks is not occurring and they are not in an overfished status). These AMs triggered based on incorrect management reference points would result in indirect economic losses.

A primary reason for revising federal fishery management in the St. Croix EEZ is to shift management focus away from stocks occurring primarily in territorial waters. This led to the removal of some species in the transition to island-based management from species-based management and the addition of other species (See Action 2, Preferred Alternative 2). Also, and partially in response to the removal of some species and the addition of other species for federal management, changes were made in the stock composition of complexes (See Action 3, Preferred Alternative 3). This being the case, SDCs and reference points may no longer be valid, and would need to be updated.

Adoption of the ABC control rule under **Preferred Alternative 2** is entirely administrative in nature and is expected to have no direct or indirect effects on the economic environment. Upon adoption of this control rule, the second step is to establish a proxy that would be used when $F_{MSY}$ cannot be determined. There are three sub-alternatives related to establishing this proxy ranging from **Sub-alternative 2a** ($F_{MSY} = F_{max}$) to **Preferred Sub-alternative 2c** ($F_{MSY}$ =

$F_{30\%SPR}$) with **Sub-alternative 2b** ($F_{MSY} = F_{40\%SPR}$) falling between these extremes. Economics has little to offer as guidance as to which of these three sub-alternatives most closely represents $F_{MSY}$ other than to note that using $F_{30\%SPR}$ as a proxy for $F_{MSY}$ represents a more 'risky' strategy than that of $F_{40\%SPR}$.

The third step would determine OY and ACL based on six sub-alternatives. As noted, there are no cost data by which to estimate the differences in producer that might be forthcoming (at least in the short run[57]) under the different sub-alternatives. One could look at change in dockside revenues in conjunction with the ex-vessel price data but there is little to be gained from this exercise because the fractions associated with each of the sub-alternatives would provide the proportionate change in ex-vessel value that would be forthcoming under each sub-alternative if it is binding.[58]

Given the lack of information, discussion of each of the sub-alternatives is also limited. Certainly as one moves from **Sub-alternative 2d** to **Sub-alternative 2i** harvest that would be allowed before AMs are triggered would be reduced. This would provide enhanced protection of the stocks/stock complexes but this protection may be unwarranted (such as under **Sub-alternative 2i** except in the rare instance where a species is heavily overfished). The reduction in catch as one moves from **Sub-alternative 2d** to **Sub-alternative 2i** would, at least in the short run, reduce producer surplus (assuming the response in price is relatively limited). If warranted, however, it would provide the necessary biological protection to the stock/stock complex. If a reduction in harvest is not warranted (*i.e.*, selection of a sub-alternative which dictates a lower harvest than that which is necessary to adequately protect the stock/stock complex), then selection of that sub-alternative would unnecessarily result in a reduction in surplus with no long-run benefits. Thus, there is an obvious tradeoff. Moving from **Sub-alternative 2d** to **Sub-alternative 2i** reduces surplus that society gains from fishing activities but provides greater stock protection. There is no way to determine what level of protection yields the highest net benefits.[59]

**Alternative 3** is similar to **Preferred Alternative 2** in that its purpose is to provide a procedure for calculating an ACL and OY for each stock/stock complex. Possible effects to the economic environment that might be forthcoming from the selection of any sub-alternative in Step 3 of

[57] It is important to specify short-run at this point because the purpose of setting an ACL to protect a stock/stock complex from being overfished. There would be no need to specify alternative ACLs for a given stock/stock complex if there were no uncertainty as to the scientific 'appropriate' ACL. Unfortunately, this is not the case and selection of a fraction that is too high, say 0.95, may result in insufficient protection of the stock/stock complex. Conversely, selection of a fraction that is too low may result the triggering of AMs that are not warranted for protection of the stock/stock complex.
[58] The assumption is being made that dockside price does not change in response to changes in binding ACLs.
[59] From a technical point of view, the question comes down to how much risk society is willing to take that a stock/stock complex would not be overfished versus the costs associated with a reduction in the ACLs.

**Preferred Alternative 2** would be similar to the effects of any of the sub-alternatives selected in Step 4 of **Alternative 3**, because the sub-alternatives contain the same reduction factors. Specifically, it cannot be stated with any certainty which sub-alternative would yield the greatest net benefits. As such, it is also not possible to compare changes in the economic environment in the two alternatives.

### 4.4.4 Direct and Indirect Effects on the Social Environment

The social effects of retaining reference points for stocks or stock complexes under **Alternative 1** may have negative social effects as those reference points may not mirror the St. Croix fishery and be more indicative of a U.S. Caribbean fishery as they were established by species and not islands. In applying **Preferred Alternative 2** the Council would utilize a three step process to establish reference points for each stock or stock complex that has four tiers to account for data availability. This alternative would likely have positive social benefits as the ensuing reference points would be more specific to each sector and its fishing patterns and behaviors and incorporate the state of data available for a particular stock or stock complex. It also has social benefits as the process allows for specific information to be considered in choosing reference points for a particular stock or complex that have assessments or those with more data (Tiers 1-2) and helps assess the risk of overfishing. It also provides a more involved process for those species that do not have assessments (Tiers 4a and 4b), thereby accounting for factors that might be missed and incorporates some risk assessment. With a series of sub-alternatives in **Preferred Alternative 2** Step 2, going from **Sub-alternative 2a** – **Preferred Sub-alternative 2c**, several different alternatives offer choices for an MSY proxy with **Preferred Sub-alternative 2c** establishing a proxy for FMSY = F30%SPR. **Preferred Alternative 2**, Step 3 provides alternatives for selecting different OYs and ACLs for different species, with **Sub-alternative 2d** preferred for queen conch with ABC = ACL = OY; **Preferred Sub-alternative 2e** establishing OY = ACL = ABC x 0.95 for all stocks except angelfish, parrotfish, surgeonfish and conch; and **Preferred Sub-alternative 2g** establishing OY = ACL = ABC x 0.85 for angelfish, parrotfish, and surgeonfish. With **Alternative 3**, the 4 steps to establish reference points is what was used to establish reference points in previous 2010 and/or 2011ACL amendments.

Establishing reference points do not have direct social effects and at times the effects are difficult to determine until they have been implemented and other processes, like stock assessments have been completed. Because the references points here are being selected with St. Croix and its stocks and stock complexes that are important for island fishermen in mind, then it is assumed that the social effects would be beneficial. Therefore **Preferred Alternative 2** should have the most social benefits because it is more responsive to the actual fishery in St. Croix and uses more timely information. **Alternative 3** is somewhat outdated because of the timeframes that were used in previous amendments and was based on species that were more Caribbean wide and not specific to the St. Croix fishery. However, it is difficult to determine precise social effects and

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the scope of their nature as mentioned because they are indirect effects that depend on many other factors. If the fishery remains healthy as a result and fishermen are not unnecessarily constrained in their ability to make a living or recreate, there should be positive benefits.

### 4.4.5 Direct and Indirect Effects on the Administrative Environment

Administrative effects from **Alternative 1** are expected to be neutral because no additional action would be taken.

**Preferred Alternative 2** would be expected to result in minor negative short-term administrative effects as effort is expended to modernize landings tracking protocols to account for establishment of new reference points and inclusion of new species. With respect to setting an $F_{MSY}$ proxy, greater positive effects on the administrative environment could be expected from **Preferred Sub-alternative 2c** of Step 2 because it would constrain harvest to the least extent relative to **Sub-alternatives 2a** or **2b**, and therefore could require less frequent management responses if ACLs are met compared to greater harvest constraints.

Under **Alternative 3**, administrative short-term effects would be negative but minor, due to the additional administrative effort to update regulations and public awareness documents. Long-term administrative effects likely would be minor and positive, due to the expected stabilization of management and enforcement.

## 4.5 Action 5: Accountability Measures for Stocks and Stock Complexes - Environmental Consequences

### 4.5.1 Direct and Indirect Effects on the Physical Environment

Effects to the physical environment resulting from establishment of accountability measures for stocks/stock complexes included in the St. Croix FMP are expected to be indirect, minimal and generally neutral. Physical effects to the environment from fishing activities primarily result from gear interactions with physical structures such as seagrass beds for coral reefs. Those physical impacts may result from interactions with fishing gear or from vessel and especially anchor impacts. With regard to gear impacts, the extent of those impacts would reflect fishing effort. Within the constraints of ACLs, more intensive deployment of gear may result in greater physical impacts, but would also likely result in increased harvest rates that would achieve the ACL sooner within the year. As a result, the intensity of gear interactions would increase but the duration of those effects would be shorter. That trade-off between intensity of the effect and duration of the effect would likely result in a neutral overall effect. Specifically with respect to trap gear, which remains deployed throughout the year regardless of stock status, effects would likely be consistent throughout the year. Effects from anchoring may be reduced as a result of

applying an AM. That AM would reduce the length of the fishing season, thereby reducing the number of anchoring events. In this case, fishing effort may increase but would not necessarily result in an increase in the number of anchoring events because more effort can be expended within a single such event. Overall effects would depend on the extent to which other fishing opportunities, including effort shifts to stocks that remain available for harvest, alter overall fishing effort. For example, if an AM was applied to the spiny lobster stock harvested by hand, and fishermen responded by shifting effort to hook-and line harvest of a finfish stock, the overall effect could be detrimental resulting from increased interactions of the fishing gear with physical structures such as coral. But, this would be tempered by the limit imposed by the ACL, such that the overall effect would again be neutral.

In general, benefits to the physical environment would be expected from the application of **Alternative 1**, and **Preferred Alternatives 2, 4,** or **5**, and this is the case regardless of the sub-alternative(s) chosen in **Preferred Alternative 2**. Indirect physical effects from the application of AMs reflect the reduction in fishing effort resulting from a reduction in the length of the fishing season (**Alternative 1**, and **Preferred Alternatives 2** and **4**) or a complete prohibition on harvest (**Preferred Alternative 5**). Reducing fishing effort reduces the opportunity for negative physical impacts from non-trap fishing gear and anchors with the sea bottom, including structural habitat such as coral. Beneficial physical effects also may be realized for those fisheries using trap gear, although the extent of that effect would depend on the extent to which traps are hauled and redeployed less frequently (traps generally are not removed from the water even during fishing closures). These effects would not be expected from **Preferred Alternative 3** because triggering an AM does not result in a fishery closure as in the other alternatives.

### 4.5.2 Direct and Indirect Effects on the Biological/Ecological Environment

Biological/ecological effects resulting from AM application would be indirect and positive, and in some cases could be substantial in nature. **Preferred Alternative 5** provides the greatest overall benefit to the biological/ecological environment, but only for those stocks to which it applies (*i.e.*, stocks for which harvest is prohibited). For those stock available for harvest, **Preferred Alternative 4** provides the greatest biological/ecological benefit because that approach ensures that harvest is constrained to a pre-determined, biologically sustainable level. However, application of **Preferred Alternative 4** depends on the timely availability of landings data, and at present those in-season data are only available for queen conch. As in-season landings data become available for one or more stocks, **Preferred Alternative 4** would be available to provide the most biologically and ecologically beneficial option. In the meantime, **Preferred Alternative 2** would result in the most biologically/ecologically beneficial effects to the environment. Those effects are immediately achievable. **Preferred Alternative 2** simply continues and extends (to those stocks newly added to management) the beneficial effects realized from the original implementation of the 2010 and 2011 Caribbean ACL Amendments

and fully discussed in those amendments (CFMC 2011a, 2011b). **Alternative 1** provides biological and ecological benefits similar to those presented for **Preferred Alternative 2**, but fails to provide such benefits to those stocks newly added to management. Finally, **Preferred Alternative 3** addresses a special case of pelagic stocks newly added to management. Those stocks have not been previously managed in St. Croix EEZ waters, are broadly migratory, are relatively short-lived, and as a result tend to experience substantial year-class variability. Because of that, reducing the length of the fishing season in response to an ACL overage may provide little positive biological/ecological benefit. While short-term effects of ACT application are likely neutral, long-term beneficial biological/ecological effects would be anticipated. Consulting with the SEFSC to assess stock status based on the most up-to-date biological and fishery information would provide an opportunity to better understand stock function relative to fishing pressure while providing guidance as to additional data and management needs.

No direct effects to ESA-listed species are expected from this action, as it established how and when an accountability measure would be applied. Indirect effects to ESA-listed species may occur if and when those AMs are applied, although it is difficult to ascertain at this time the timing and duration of those closures or the stocks/stock complexes to which they would apply. Following from Action 4, several stocks/stock complexes would experience increases in their applicable ACLs, and so it would be expected that fewer AMs would be triggered and applied. Again, however, it is difficult to predict which fisheries would experience fishing season reductions.

### 4.5.3 Direct and Indirect Effects on the Economic Environment

Assuming stocks/stock complexes newly added to the St. Croix FMP are subject to overfishing or being overfished, **Alternative 1** would not provide the mechanism needed to adequately protect these stocks/stock complexes. This could result in long-term economic losses to the users of the resource via reduction in stock/stock complex levels that due to excessive harvests cannot support harvest of MSY. The reorganization of stock complexes under Action 3 also suggests that existing AM for the reef fish stock complexes carried into the St. Croix FMP would be inappropriate and may lead to insufficient (or possibly excessive) protection of those reef fish stock complexes (again, suggesting long-term economic losses to users of the resource).

In determining the economic consequences associated with the implementation of any of the sub-alternatives associated with **Preferred Alternative 2**, it is important to realize that landings data for St. Croix are likely to be somewhat imprecise; particularly given the self-reporting nature of the data. In addition, there is likely to be significant natural annual variation in stock/indicator stock/stock complex size; particularly for stocks/stock complexes comprised of short-lived species. Large annual variation in stock/complex size can result in significant annual variation in reported landings. These two factors would suggest that a longer sequence of years (up to some

point) may be preferable to a shorter sequence in a comparison against the ACL. Given this to be the case, **Sub-alternative 2a** would likely lead to the triggering of an AM in many instances where such a triggering is based merely on imprecise landings data for any given year. This situation, which is caused by 'artificial' annual perturbations in the landings data can result in significant disruption to fishing communities and a loss in economic benefits derived from fishing activities with no real benefits associated with protection of the stock/stock complex. Regulatory discards resulting from bycatch of species caught during an AM closure represents another potential economic cost in terms of lost benefits to the harvesting sector; particularly if the AM closure is the result of estimated landings over a short period (say, one or two years) exceeding 'true' landings. Finally, administrative burden associated with frequent AM closures is likely to be significant. While **Sub-alternative 2b** uses an average of the two most recent years of complete landings to be compared against the applicable ACL (after the first year), the use of only two years of landings data may not be sufficient to 'smooth out' errors in the landings data. Thus, from an economic perspective, **Sub-alternative 2c** would appear to adequately protect the stocks/stock complexes while imposing the least economic costs on the fishing communities as well as imposing the least amount of administrative burden when compared to either **Sub-alternative 2a** or **Sub-alternative 2b**. Finally, the economic costs associated with **Preferred Sub-alternative 2d** would be of a similar magnitude of those under **Sub-alternative 2c** with the only difference being those which are entailed during the first few years of FMP operation. However, **Sub-alternative 2c** is likely to have marginally lower economic costs because a longer sequence of years is used after the first year of FMP operation. Finally, since **Preferred Alternative 2** provides protection for those species newly added to the St. Croix FMP whereas **Alternative 1** does not, economic benefits from protection of the stocks/stock complexes under the sub-alternatives listed in **Preferred Alternative 2** likely exceed the benefits associated with **Alternative 1**. The difference in benefits is likely to be particularly pronounced in a comparison of **Sub-alternative 2c** with **Alternative 1**.

**Preferred Alternative 3**, as noted, applies only to pelagic stocks new to management in the St. Croix EEZ. These pelagic stocks, as discussed in Section 4.2.3, are largely migratory in nature and the benefits to management of these stocks/stock complexes was called into question. Specifically, the long-run impact on population of any of these stocks/stock complexes from harvest in the St. Croix EEZ is likely insignificant given the migratory nature of these species and the wide geographic area over which harvesting occurs. Given this to be the case, there appears to be little reason to constrain harvest via AM. Based on these assumptions and considering all the possible combinations of sub-alternatives, **Preferred Sub-alternative 3a** in conjunction with **Sub-alternative 3f** would impose the least costs on fishing communities and would also entail least amount of administrative burden.[60] The rationale for **Preferred Sub-**

[60] It is worth noting that triggering of the AM would not automatically necessitate any mitigation in overages. Instead, it would call for the Council to consult with the SEFSC to review available data and evaluate what factors

**alternative 3a** is that it gives the highest ACT relative to ACL. The rationale for S**ub-alternative 3f** follows the line of reasoning used in the selection of **Sub-alternative 2c** in the economic analysis of **Preferred Alternative 2**. Conversely, the greatest costs to fishing communities (and high administrative burden) with little benefits given to protection of the stocks/stock complexes (given the migratory nature of the stocks/stock complexes in conjunction with the overall insignificant harvest taken from St. Croix waters) would be the combination of **Sub-alternative 3c** in conjunction with **Sub-alternative 3d**. Costs associated with all other combinations would fall somewhere in between these two extremes.[61]

In-season landings data for stocks proposed for inclusion in the St. Croix FMP are unavailable, with the exception of queen conch, which implies that in-season management (*i.e.*, **Preferred Alternative 4**) is currently infeasible. As such, an economic assessment of the benefits and costs of in-season management cannot be presented until (1) such time that the data become available to allow for such management and (2) greater detail is provided as to how in-season management would proceed.

Potential benefits relative to costs associated with **Preferred Alternative 5** are expected to be relatively large. This is based on the consideration that ABC for these species is set to zero due to the overfished nature of some stocks (*i.e.*, queen conch, Nassau grouper, goliath grouper) and the ecological importance of other stocks (blue parrotfish, midnight parrotfish, rainbow parrotfish, sea cucumbers, sea urchins, and corals). Hence, enhanced protection of these stocks is warranted with the enhanced protection.

### 4.5.4 Direct and Indirect Effects on the Social Environment

Accountability measures assist managers in maintaining an annual catch limit within its bounds and can prevent overages from occurring or would account for overages in some manner. In **Alternative 1** there would be no revision for determining the trigger for an AM or specifying an AM for the new stocks/stock complexes in the St. Croix Island Fishery Management Plan. The AMs applicable to the old stocks/stock complexes would continue to apply which could have negative social effects, as management would not reflect the new Island-based management. Stakeholders have expressed a desire to have management be more island specific; therefore, **Alternative 1** may contain inconsistencies that cause dissatisfaction with management under this alternative. In **Preferred Alternative 2** an AM is triggered if total landings exceeds the total ACL for a stock/indicator stock/stock complex in the St. Croix FMP, and may be more aligned

led to the exceedance and whether corrective action is warranted (such as revision of the ACL). Comparison of the combination of sub-alternatives presented herein is premised on corrective action being taken (I., a restriction on future harvests due to exceeding the current limit). The only costs to consider if no action is taken to curtail future harvests can be represented by convening with the SEFSC.

[61] Benefits in all cases would likely be very low for reasons already cited.

with stakeholder desires. Under several sub-alternatives, the AM may be implemented in a variety of ways. Under **Sub-alternative 2a** a single year of the most recent year of landings is used as the determinant. This alternative is more reactive to immediate circumstances but may not be the best predictor of future fishing practices. It assumes that fishing effort is constant and unchanged by other factors. Using the most recent year of landings then a progressive 2 year average starting with the initial year and subsequent year **Sub-alternative 2b** may account for trends that may be better predictors of future fishing behavior. The **Sub-alternative 2c** is similar to 2b but uses a longer three year average. The final **Preferred Sub-alternative 2d** uses a stepwise approach that once a three year average is attained it moves forward by one year into the future. Which of these sub-alternatives would have the least negative social effects is difficult to determine. The alternative that best reflects fishing trends and prevents overages from occurring is the more desirable. Those that incorporate running averages may be more in tune with fishing practices at the time considered and what may occur in the future. Under **Preferred Alternative 3** a two step process is considered to establish an ACT and then an AM through several sub-alternatives for pelagic stocks/indicator stock/stock complex. An ACT of 90% of the ACL would be established under **Preferred Sub-alternative 3a** with an ACT of 80% of ACL under **Sub-alternative 3b** and an ACT of 70% of ACL under **Sub-alternative 3c**. Moving from **Preferred Sub-alternative 3a** to **Sub-alternative 3c**, the social effects are likely less negative to more negative respectively. That is if there are no negative effects to the stock, in which case a more conservative approach may have more positive social effects in the long term. The step 2 in **Preferred Alternative 3** would trigger the AM with the same suite of sub-alternatives from **Preferred Alternative 2**. Again, it is difficult to determine which sub-alternative would have the least negative social effects, but those that best reflect fishing trends into the future and prevent overages are more desirable. By establishing an in-season AM in **Preferred Alternative 4** fishing would be prohibited for the remainder of the year once the total ACL is reached. This alternative would pertain to those stocks for which data are available to make such a determination, therefore would be limited in its scope as for most stocks included in the FMP in season data are not available. Therefore, the inability to implement an in-season AM would have negative social effects. For those stocks with an ABC of zero, **Preferred Alternative 5** would establish the harvest prohibition as the required AM. There would be few if any social effects from choosing this alternative.

### 4.5.5 Direct and Indirect Effects on the Administrative Environment

**Alternative 1** would not produce administrative effects in the short-term as it would not change the status quo, but by not complying with Magnuson-Stevens Act requirements it may trigger some type of legal action for not doing so. **Preferred Alternatives 2, 3, 4**, and **5** would all have direct minor administrative effects because they all require rulemaking to establish AMs for managed stocks. Although, **Preferred Alternative 4** effects would be larger because of additional administrative cost and time burdens associated with tracking landings in-season,

however at this time, in-season tracking of landings is not feasible for most stocks included in the St. Croix FMP.

## 4.6 Action 6: Describe and Identify EFH for Stocks not Previously Managed - Environmental Consequences

### 4.6.1 Direct and Indirect Effects on the Physical Environment

**Alternative 1** would not comply with the Magnuson-Stevens Act, which requires that EFH be designated for all managed species, and therefore would not be viable. However, if the alternative was viable, protection of fish habitat in the St. Croix EEZ would still occur under existing and possible future regulatory actions. Many Federal and state laws and regulations require evaluation of the consequences of projects proposed for the marine (and other) environments. NMFS already has the ability to recommend, through Fish and Wildlife Consultation Act consultations, mitigation, or minimization of adverse impacts on those habitats important to fisheries resources. The Council and NMFS have a wide range of management authority, which includes the ability to manage fishing activities and protect fish habitats to ensure healthy stocks and sustainable fisheries. The Council and NMFS have taken a variety of measures in past management plan amendments that protect fish habitat. In some cases, the habitat protection occurred as direct action for habitat (e.g., anchoring prohibitions on sensitive areas, designation of marine protected areas, restrictions on certain fishing gear), while in other cases the habitat protection occurred as a benefit of management measures directed for other purposes (e.g., gear modifications, harvest limits, time/areal restrictions).

EFH designation indirectly benefit the physical environment (future regulatory action, and EFH consultations). The indirect effects stemming from the decision not to designate EFH for the proposed species is that the Council would not designate new areas, and thus would not be able to take action to protect these areas from fishing or to consult on effects to these areas. We would not realize potential benefits, but of course those potential benefits depend on new areas of EFH being identified (or there being something different about how the species use the EFH that results in additional protections from any consults).

Immediate direct and indirect effects on the physical environment are expected to be non-significant for **Preferred Alternative 2** and **Alternative 3**.

Under **Preferred Alternative 2**, determining/describing EFH for species new to management would follow the same procedure used in the 2004 FEIS for the Generic EFH Amendment (CFMC 2004). **Preferred Alternative 2** would designate EFH by specifying functional relationships for life stages and habitat types that might be regarded as meriting special attention

for their importance to managed species based on the limited information available through literature review, fishery-dependent and independent data and expert opinion (Section 2.6, Appendix H).

**Alternative 3** proposes other method(s) to describe and identify EFH for species new to federal management. The alternative lists five different methods that were explored in the 2004 EFH FEIS for describing and identifying EFH that could be used depending on data availability. The limiting factor is the lack of species-specific data (density, abundance, etc.) and the lack of geographical boundaries for the marine habitats used by the species new to management.

Designation of EFH has no direct impact on the physical environment, but may have indirect impacts due to two other provisions of the Magnuson-Stevens Act. First, every FMP must minimize to the extent practicable adverse effects of fishing on EFH, pursuant to section 303(a)(7) of the Magnuson-Stevens Act. Second, federal agency actions that may adversely affect EFH trigger consultation and/or recommendations under sections 305(b)(2)-(4) of the Magnuson-Stevens Act.

From a geological point of view, EFH alternatives would have no direct impacts on the physical environment. None of the alternatives considered would change the general bathymetry, geological configuration, or water quality of the U.S. Caribbean. However, fishing gear could have impacts on the biogenic structure and biota living on the bottom.

Non-fishing activities can adversely affect some geological features through digging, scraping, drilling, modifying deposition, or dumping. These actions could homogenize the seabed surface, cause sedimentation to cover surface features, cause subsidence through removal of oil or gas, or form barriers to river-transported sediments. Consultation by responsible federal agencies with NMFS (and the Council) would have indirect impacts to the degree that consultations mitigate the effects of proposed non-fishing activities.

Non-fishing activities, such as coastal development, dredging, sand and mineral mining, oil and gas exploration, pipelines, and contaminants can affect water quality, dissolved oxygen, or turbidity. In many cases, the indirect impacts of non-fishing activities on EFH occur in areas removed from the area where the activity takes place. For example, rivers may transport high levels of suspended sediments that travel long distances in the marine environment. A wide definition of EFH may, therefore, have benefits in terms of ensuring the consultative process associated with non-fishing activities includes as many potentially damaging activities as possible.

### 4.6.2 Direct and Indirect Effects on the Biological/Ecological Environment

Designation of EFH in US waters has no direct impact on the biological environment, but is likely to result in indirect impacts due to two other provisions of the Magnuson-Stevens Act. First, every FMP must minimize to the extent practicable adverse effects of fishing on EFH, pursuant to section 303(a)(7) of the Act. Second, Federal agency actions that may adversely affect EFH trigger consultation and/or recommendations under sections 305(b)(2)-(4) of the Act.

Adverse impacts have occurred on habitats used by many fishes. Many large and small, possibly insignificant, actions have accumulated to the current significant habitat losses. Describing and identifying EFH would not by itself restore degraded habitat, but any resulting Council action to minimize effects to EFH and EFH consultations may help to arrest the current degradation and prevent future adverse impacts due to fishing and non-fishing activities. This may allow the habitat to begin a recovery from past impacts, if it has not been replaced or destroyed. Measures that improve habitat conditions would have regional and local benefits to the biological environment. Local habitat improvements resulting from protective measures and/or recommendations arising out of EFH consultations would offer an opportunity for increased productivity that would likely have spillover effects to surrounding areas as fish move on and off with daily and seasonal movements. Uncertainty of the role that habitat plays in fish production limits the conclusions one may draw on the effects of designating EFH, however, we conservatively estimate that habitat improvements and protections for certain habitats, especially spawning habitats, could have a beneficial effect on the biological/ecological environment. **Preferred Alternative 2** designates EFH for newly proposed species for federal management but does not add additional designations other than those previously done in the species-specific FMPs. **Alternative 3** would allow the Council to more finely designate EFH and promulgate additional protection if needed..

The Council and NMFS can currently regulate fishing activities that have potential to adversely impact EFH, but designation of EFH would help to focus additional consultation in this area. The Council and NMFS can also provide input into decisions regarding nonfishing activities, through consultation with other federal agencies that have responsibility for non-fishing activities. Councils are required to comment on federal or state activities that are likely to substantially affect habitat of anadromous fishery resources (§ 305(b)(3)(B)), and may comment on federal or state activities that may affect fish habitat. The effectiveness of consultations on mitigating potential adverse impacts would likely depend on the level at which a managed fish species depends on the habitats at risk, and on the ability to justify that dependence. The available information with which to document fish dependence on habitat is incomplete.

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**Alternative 1** (the no action alternative), **Preferred Alternative 2,** and **Alternative 3** would have no direct impact on the biological/ecological environments unless actions were to be taken to regulate impacts to the EFH designations. The indirect effect of **Preferred Alternative 2** and **Alternative 3** would ultimately depend on the management actions taken. The Council may not need to take additional action if the same areas area designated as EFH for the species new to management as the existing EFH designations. **Preferred Alternative 2** does not result in designation of new EFH areas, or any new information on the habitat use, thus these designations may not lead to additional protective measures from fishing gears (as the gears have not changed, and the Council has already taken action to protect these same areas from gears) or additional protections in consultations. **Alternative 3** results in no EFH designations at present but in the future it might provide better information to inform management or consultations, for example.

No direct or indirect effects to ESA-listed species are expected from this action, as it just defines and then describes EFH for species new to management. The protective measures the Council puts in place to protect EFH however could limit fishing in an area, and that could benefit ESA-listed species in those areas.

### 4.6.3 Direct and Indirect Effects on the Economic Environment

**Alternative 1** takes no action in in describing and identifying EFH for species not previously managed in Federal waters. As identified in Action 2 (Preferred Alternative 2), this would involve three finfish species new to management under the St. Croix FMP. While one of the species added to the St. Croix FMP would be added to a complex for which EFH has already been identified, it does not follow that habitat for the newly added species would be the same. While identifying or not identifying EFH is merely an administrative action that would have no direct economic effects, not identifying it may have economic effects if the gear types and/or fishing practices used by fishermen to harvest these new species impact the surrounding physical environment and regulations to protect the environment are not an outcome of specifying EFH for these species. This, through time, may result in a loss of carrying capacity of the environment and, hence, long-run yield of species to be added to the St. Croix FMP as well as species currently managed in federal waters. The reduction in long-run yields may translate into a loss of revenues and catch rates fishermen.[62]

In addition, degradation of EFH may impact the enjoyment associated with non-consumptive activities (e.g. scuba diving) which, in turn, could reduce consumer surplus to this component. Benefits associated with protection of habitat through regulation of gear types/practices that

[62] Whether revenues decline in reaction to any reduction in catch depends on the price response to the change in landings. Given that there are few entry restrictions associated with fishing in federal waters, however, reduction producer surplus associated with a reduction in harvest may be limited

impact the habitat must, of course, be weighed in conjunction with the costs imposed on the various sectors from the regulations. Specifically, regulations implemented to protect EFH impose a direct cost on those sectors upon whom regulation is imposed. Until such regulations are outlined, however, one cannot determine whether direct and indirect economic effects would be positive or negative. If gear and/or fishing practices do not impact the habitat, one would expect no indirect benefits from specifying EFH for the added species.

**Preferred Alternative 2** and **Alternative 3** both call for describing and identifying EFH for species not previously managed in federal waters of St. Croix but use different techniques for doing so. **Preferred Alternative 2** would describe and identify EFH according to functional relationships between life history stages for those species not previously managed in federal waters of St. Croix based on available information from the literature, expert opinion and usable data while **Alternative 3** would use other methods explored in the March 2004 FEIS for the Generic EFH Amendment, and outlined herein in Section 2.4. As with **Alternative 1**, these are merely administrative in nature and would result in no direct economic impacts. Whether any indirect economic benefits (or costs) would be forthcoming from either of these two alternatives depends upon a number of factors. The first, of course, is whether the gear and/or fishing activities impact EFH. If there is no impact, there would be no indirect benefits or costs associated with describing and identifying EFH for species not managed in federal waters of St. Croix under either **Preferred Alternative 2** or **Alternative 3**. In general, if there are impacts to EFH from gear and/or activities and regulations are implemented to protect EFH, there would be direct benefits (as previously discussed). However, these benefits must be compared to costs (e.g., gear restrictions that are costly financially or result in a reduction in catch) to determine whether the net benefits that society receives from regulations imposed to protect EFH would be positive or negative. Both **Preferred Alternative 2** and **Alternative 3** are warranted from an economic perspective (that of efficiency) if protection of EFH via regulation generates positive net benefits. **Preferred Alternative 2** does not result in new or different designations and therefore the actions already taken action to protect these same areas from gears or additional protections in consultations result in direct positive benefits.

### 4.6.4 Direct and Indirect Effects on the Social Environment

Designating EFH has limited direct social impacts, although by designating and possibly protecting habitat from measures to minimize effects from fishing or through taking actions in EFH consultations, it can have positive indirect social effects. Social impacts include for example the knowledge that marine habitats are being protected, the expectation that by protecting these habitats fishery resources could be positively impacted (e.g., fish population growth) and the expectations that these habitats would be available for non-consumptive uses (e.g., snorkeling). In **Alternative 1,** EFH is not designated for new species included in the FMP and could therefore have negative indirect social effects. However, the Magnuson-Stevens Act

requires that EFH be established for species under management, so **Preferred Alternative 2** and **Alternative 3** would meet that mandate although by using different methods to identify EFH. **Preferred Alternative 2** would be the use available presence/absence information to describe and identify EFH, whereas **Alternative 3** would allow the Council to select among different sources of information to determine EFH. The social effects of either alternative would be hard to determine given the indirect links to other management alternatives that may or may not have some impacts. Of course, any protection to fishery habitat that is afforded by any alternative should have beneficial social impacts if it provides protection for stocks throughout their life history which in turn ensures healthy stocks that can be harvested at levels that provide optimum yield.

### 4.6.5 Direct and Indirect Effects on the Administrative Environment

**Alternative 1** would have a direct negative impact on the administrative environment since the description and identification of EFH is a required provision for the FMPs as stated in the Magnuson-Stevens Act. This could potentially result in lawsuits for non-compliance which, which would require resources to address.

**Preferred Alternative 2** complies with the requirements of the law and applies available information to describe and identify EFH. This is the method that the Council previously used to identify EFH for the species under management in the species-based plans

**Alternative 3** would allow the Council to select among a variety of methods to determine essential fish habitat. Given that the data are not available to provide a useful description of EFH, this is not a viable alternative. Selecting this alternative would not result in EFH being designated, with the same effects as **Alternative 1**, at least with respect to the newly managed species, above. If the information were to become available, the benefits of using one or more of the methods put forth in **Alternative 3** could be higher than using **Preferred Alternative 2**. The direct impact on the administrative environment supposes a more defined identification of EFH perhaps resulting in the promulgation of additional or new management measures..

Under section 305(b)(2) of the Magnuson-Stevens Act, each Federal agency must consult with NMFS regarding any action authorized, funded, or undertaken by the agency that may adversely affect EFH. The EFH regulations require that Federal agencies prepare EFH Assessments as part of the consultation process (50 CFR 600.920(e)). Under section 305(b)(4)(A) of the Act, NMFS must provide EFH conservation recommendations to federal and state agencies regarding any action that would adversely affect EFH. Under section 305(b)(3) of the Act, Councils may comment on and make recommendations to federal and state agencies regarding any action that may affect the habitat, including EFH, of a fishery resource under Council authority.

Federal agencies would incur costs as a result of conducting EFH consultations, since time and resources would be required to develop EFH Assessments, exchange correspondence, and engage in other coordination activities required for effective interagency consultation. In some cases, federal agencies might also request information from applicants for permits, licenses, or funding to assist the agency in completing EFH consultation. However, the EFH regulations encourage agencies to combine EFH consultations with existing environmental review procedures to promote efficiency and avoid duplication of effort. Agreements to streamline the EFH consultation process have been developed for key federal agencies having responsibility in the U.S. Caribbean. State agencies and other non-federal entities are not required to consult with NMFS regarding the effects of their actions on EFH. At a general level, **Alternative 1** does not have new EFH designations, and thus does not create new areas for which the action agencies would need to consult. **Preferred Alternative 2** and **Alternative 3** could both result in new designations and new consultations, with the burdens described.

Comparing to the baseline, though, requires us to know if we are going to have new areas designated under **Preferred Alternative 2**. There is no indication of new areas being designated under the **Preferred Alternative 2,** the same areas currently identified are EFH for the species new to management, and then these burdens already apply; consultations are already required on effects to these areas. **Alternative 3** does not result in an EFH designation, and would not result in these burdens.

## 4.7 Action 7: Framework Procedures for the St. Croix FMP - Environmental Consequences

### 4.7.1 Direct and Indirect Effects on the Physical Environment

Modifying the framework procedure is not expected to have direct effects on the physical environment; however, if the level of fishing effort or the use of certain gear types is affected by the management strategies modified by the framework, this could affect the physical environment by changing the interactions between gear and the habitat.

**Alternative 1** would not modify the framework procedures established in the Council's Reef Fish, Spiny Lobster, Queen Conch, and Coral FMPs and thus would have no additional effects to the physical environment from the baseline. Indirect effects to the physical environment would be expected from those measures included in the framework that result in a faster protection to the habitat from gear/habitat interactions than if the measures were approved through a regular amendment, which may take more time to develop and implement. Examples of these measures include the specification or modification of gear restrictions including those that minimize the interaction of fishing gear with endangered species, such as listed habitat-forming corals (e.g.,

*Orbicella annularis*, *Orbicella franski*) and those actions that close/open areas to fishing, adjust harvest, and regulate fishing effort (e.g., adjustment of trip limits, bag limits, size limits, ACLs), among others.

**Preferred Alternative 2** would allow the Council to change management measures more expeditiously than via a regular amendment in response to changes in resource abundance and new scientific information. This is expected to indirectly affect the physical environment similar to that described above for **Alternative 1**. The abbreviated framework option available in **Preferred Alternative 2**, but not available in the other alternatives proposed, is not expected to provide additional indirect benefits to the physical environment as changes that can be made through the abbreviated framework would be insignificant.

**Alternatives 3** and **4** would also alter the existing framework in a broader or narrower procedure, respectively. These alternatives may result in indirect physical impacts as a result of the timeliness of implementing the change to the management measures. Similar to **Alternative 1** and **Preferred Alternative 2**, this is expected to indirectly benefit the physical environment if a speedier application of measures protecting the biological integrity of managed resources and the modification of gear restrictions result in quicker protection to the physical environment from gear/habitat interactions. The potential indirect benefits from **Alternative 3** are slightly larger than those from **Alternatives 1, 2,** and **4,** given that **Alternative 3** allows for a broader spectrum of measures that can be rapidly implemented through framework when compared to the other alternatives proposed. **Alternative 4** would be the least beneficial to the physical environment because the range of actions that can be taken more expeditiously through framework is more limited than the other alternatives.

### 4.7.2 Direct and Indirect Effects on the Biological/Ecological Environment

Modifying the framework procedure in the St. Croix FMP is primarily an administrative action that provides a more expeditious way for implementing management changes. The managed stocks in the St. Croix FMP could benefit from the modification of framework procedures in Action 6 as a speedier implementation of management measures could yield biological benefits in the future by protecting the biological integrity of the managed resources and preventing overfishing. In addition, Action 6 meets the objectives of the St. Croix FMP. No direct or indirect effects to ESA-listed species are expected from this action, as it just outlines management measures that could be amended through the selected framework procedure.

**Alternative 1** would not modify the framework established in the Council's Reef Fish, Spiny Lobster, Queen Conch, and Coral FMPs; therefore, it would not have any effects on the biological/ecological environment outside the baseline.

**Preferred Alternative 2** would allow the Council to make more expeditious regulation changes to a list of management actions in response to changes in resource abundance and new scientific information, therefore protecting the biological integrity of the managed resources and decreasing the risk of overfishing those resources. For example, under **Preferred Alternative 2**, changes to ABCs and ACLs would be implemented quicker than if such changes proceeded via a full FMP amendment, which could help to prevent overfishing of the resources.

Both **Alternatives 3** and **4** would modify the existing framework in a broader (**Alternative 3**) or narrower (**Alternative 4**) procedure. These alternatives may result in indirect biological/ecological impacts as a result of the timeliness of implementing the measure. Although both alternatives allow for a speedier adjustment of management measures, **Alternative 3** provides the advantage that the framework actions may be implemented at any time in response to any additional information or changed circumstances. This is beneficial to the biological/ecological environment as changes would be implemented quicker, helping to prevent overfishing of the stocks.

**Alternative 4** is more restrictive than **Alternatives 1, 2,** and **3** with respect to the circumstances where a framework can be applied, thus, benefits to the biological environment would be more limited in **Alternative 4** than in those alternatives. In addition, the list of actions that can be done through a framework is also very narrow, thus positive effects from a faster adjustment of measures would be limited to those measures on the list, contrasting with the benefits from the more extensive list of measures that can be rapidly adjusted in **Alternatives 1, 2,** and **3** in response to biological changes to the managed resources.

### 4.7.3 Direct and Indirect Effects on the Economic Environment

None of the four alternatives listed in Action 7 are expected to have any direct effects on the economic environment since they represent administrative actions. However, framework procedures can reduce the amount of time needed to change a management measure and this reduction in time could provide benefits in the nature of stock/stock complex protection or rebuilding. In addition, regulations that may be forthcoming in response to a change in framework procedures could indirectly result in a change in the economic environment via a change in effort and/or fishing techniques.

Relative to **Alternative 1**, **Preferred Alternative 2** expands the range of management measures that can be implemented by the Council without going through a full plan amendment process. Therefore, **Preferred Alternative 2** should allow for a wider suite of measures that can more rapidly be implemented (compared to the time to develop an FMP amendment) that would be beneficial to the stocks, thereby yielding biological benefits in the future. This would, in turn,

yield future economic benefits to the fishing sectors. Anticipated indirect benefits are dependent upon the relative speed at which regulatory changes can be made.

Given that **Alternative 3** (Table 8.2.3) provides a broader suite of options that can be implemented under the framework procedure than either **Alternative 1** or **Preferred Alternative 2**, one would expect indirect economic benefits associated with implementation of **Alternative 3** to exceed those of either **Alternative 1** or **Preferred Alternative 2**.

Conversely, since **Alternative 4** provides a narrower set of options that can be implemented under framework than either **Preferred Alternative 2** or **Alternative 3**, economic benefits derived from implementation of **Alternative 4** are likely to be less than those associated with either **Preferred Alternative 2** or **Alternative 3**.

### 4.7.4 Direct and Indirect Effects on the Social Environment

The development of a framework procedure would have beneficial impacts on the social environment as management can react in a timelier manner to changes in the fishery or stock status. Yet, framework actions that are done rapidly do not always provide for as much public input and comment as other regulatory processes. In using the framework procedure, then, care must be taken so that the benefits of timely action outweigh the diminished period for public comment. **Alternative 1** would not allow for a select type of changes developed for specific fisheries and not St. Croix specifically and could, over time, have negative indirect social effects. **Preferred Alternative 2** would be the base framework that incorporates the most options with an abbreviated open framework, but does require a completed framework document for standard framework processes. **Alternative 3** provides options for implementing a framework procedure that becomes more open in terms of timing and public input because any new information can be used in the framework action and offers all options for requesting action. It provides for limited public input with discussion required at only one council meeting. **Alternative 4** is the narrowest interpretation as it is only adopted when a new stock assessment has been accomplished and requires discussion during at least three council meetings. As mentioned earlier, timing and public input become the parameters that are constrained by these options. While public input and participation by advisory panels can be beneficial, it can also be time consuming and can extend the process. Yet, that participation can provide a more and effective input to the process which may lead to better regulatory compliance. A more timely application of framework actions can respond to needed changes that may be applied quickly and alleviate short term negative impacts that may impose hardships if extended by more cumbersome frameworks.

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### 4.7.5 Direct and Indirect Effects on the Administrative Environment

**Preferred Alternative 2** allows the use of both abbreviated and standard frameworks and includes a comprehensive list of actions. Of all alternatives proposed, **Preferred Alternative 2** provides the best balance between the actions allowed to be implemented under the framework and the procedure required to take these actions. Also when compared to **Alternatives 1, 3,** and **4**, **Preferred Alternative 2** provides the opportunity for sufficient public review and involvement in the process, while still accommodating the ability for more streamlined implementation.

**Alternative 3** allows for a broader range of actions to be taken through framework rather than by the regular FMP amendment process and requires less discussion at Council meetings and, similar to **Preferred Alternative 2**, does not specifically require SSC and DAP input, thus would minimize the administrative burden of implementing regulations and planning/funding public and advisory meetings.

**Alternative 4** would be the least beneficial to the administrative environment because the range of actions that can be taken more expeditiously through framework is more limited than the other alternatives, making **Alternative 4** more administratively burdensome as many actions that could be rapidly taken through framework would need to be taken through the lengthier regular amendment process. In addition, **Alternative 4** requires additional public, SSC, and DAP input which requires more administrative resources and efforts than the other alternatives proposed.

## 4.8 Cumulative Effects Analysis (CEA)

The National Environmental Policy Act (NEPA) requires federal agencies prepare an environmental assessment (EA) to consider not only the direct and indirect effects associated with regulatory actions, but also the cumulative effects resulting from those actions. NEPA defines a cumulative effect as the effect on the environment which results from the incremental effect of an action when added to other past, present, and reasonably foreseeable future actions, regardless of which agency (federal or non-federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions that take place over a period of time (40 CFR 1508.7), and can be either additive or synergistic. A synergistic effect results when the combined effects are greater than the sum of the individual effects. The five-step cumulative effects analysis presented below addresses the effects of the Council's preferred alternatives for all seven actions identified in Chapter 2.

#### 1. The area in which the effects of the proposed action will occur

If the St. Croix FMP is implemented, the geographic scope of the area directly affected would include waters of the St. Croix EEZ. Those waters extend from three nautical miles (nm) off the

coast of St. Croix out to 200 nm, or to a point equidistant between the coast of St. Croix and the coast of any neighboring island-state (including the islands of the USVI) with an abutting EEZ, or to an otherwise negotiated boundary between conjoining international EEZs. Additionally, because implementation of the St. Croix FMP requires transitioning Caribbean-wide management included in each of the Spiny Lobster, Queen Conch, Reef Fish, and Corals FMPs to island-based management inherent in the St. Croix FMP, the geographic scope of the action includes those EEZ waters surrounding the islands of St. Thomas/St. John and Puerto Rico. Those waters extend from three (St. Thomas/St. John) or nine (Puerto Rico) nautical miles off the coast of each island to 200 nm off that coast, or to a point equidistant between the St. Croix coast and the coast of any neighboring island-state (including Puerto Rico) with an abutting EEZ, or to an otherwise negotiated boundary between conjoining international EEZs. In combination, these areas of the U.S. EEZ constitute the Council's area of jurisdiction. This area is described in detail in Section 3.1 of this document (see Figure 1.5.1), and represents the entire area in which fishing activities for Council-managed stocks could be affected by the alternatives analyzed in this EA. Information about the affected area in the St. Thomas/St. John EEZ and Puerto Rico EEZ can be found in Section 3.1 of each of the corresponding FMPs/EAs. The most measurable and substantial effects of the St. Croix FMP would be limited to the area encompassed by the St. Croix EEZ.

### 2. The impacts that are expected in that area from the proposed action

Transitioning from Caribbean-wide, species-based FMPs to an island-based FMP for the St. Croix EEZ (Action 1 in this EA) only rearranges past Council actions, without affecting those actions or any other past or present actions taken by federal or non-federal entities. Modifying the stocks managed under the St. Croix FMP would include altering the composition of the stocks (Action 2) and their organization within complexes (Action 3), and would for the first time identify indicator stocks for some of those stock complexes (Action 3). Associated with this modification to the list of managed stocks would be revision (in the case of stocks previously managed by the Council) or establishment (in the case of stocks newly added to management) of harvest reference points (Action 4) and associated AMs (Action 5). The impacts of these changes would be minimal as discussed in Chapter 4. Based on application of guidance provided in NS 1 of the Magnuson-Stevens Act regarding identification of stocks in need of federal conservation and management, several reef fish, and a host of smaller fish and invertebrates harvested for the aquarium trade, were removed from federal management. In most cases, the decision to remove was based on their infrequent occurrence in federal waters. Applying the same Magnuson-Stevens Act criteria, other reef fish species were identified as being in need of federal conservation and management, but inclusion of those species did not substantially alter the basic character of the reef fish stock complex arrangement previously established for St. Croix EEZ waters. Harvest reference points would be revised (Action 4), based upon the application of the best available data, but that is an ongoing obligation of effective fishery

management. Because of their biological vulnerability or their importance to the regional or national economy, two pelagic species (dolphin and wahoo) were added to the St. Croix FMP. Although these species are not reef dependent and therefore constitute an essentially new 'group' of (pelagic) stocks, they have been and continue to be targeted by fishers, so the impacts from inclusion in the St. Croix FMP would be minimal. Moreover, establishment of an ACT for these pelagic species as the AM provides a mechanism for the Council in consultation with NMFS' SEFSC to evaluate the factors contributing to an exceedance of the ACT and to determine whether corrective action is needed. Identifying indicator species (included in Action 3) increases management efficiency but would have no impacts in the area of interest.

Identifying EFH for species new to management (Action 6) addresses a required provision from the Magnuson-Stevens Act. All species new to management co–occur in the same habitats as those already managed, but there are a number of species that have a much more extensive distribution and are only seasonally present in the St. Croix EEZ (e.g., dolphin). Any impacts from identifying and designating EFH for these new species would be administrative due to consultation requirements, to the extent that new areas are designated. Finally, modifying framework procedures (Action 7) is an administrative action with no direct impacts to the biological/ecological or socioeconomic environments. Minor indirect impacts on these environments would be expected from those actions that modify fishing effort and/or fishing techniques to protect the biological integrity of the managed resources or decrease the risk of overfishing those resources.

### *3. Other Past, Present and Reasonably Foreseeable Future Actions that have or are expected to have impacts in the area and the impacts or expected impacts of these actions:*

Listed are past, present, and reasonably foreseeable actions affecting the fisheries in the St. Croix EEZ. A list of regulations applicable to stocks managed by the Council in the St. Croix EEZ that would be migrated into the St. Croix FMP/EA is found in Chapter 5.

*Other Fishery-related actions*

**Past Actions**

The reader is referred to Appendix A (History of Management) for past fishery management actions affecting all stocks managed under the Reef Fish, Spiny Lobster, Queen Conch, and Coral FMPs. The most relevant past actions are summarized below.

*2010 and 2011 Caribbean Annual Catch Limit (ACL) Amendments (CFMC 2011a, b) and associated EIS*

The CEAs included in each of the Environmental Impact Statements (EISs) for the 2010 and 2011 Caribbean ACL Amendments (CFMC 2011a, b) analyzed cumulative effects from the Reef Fish FMP related to management of reef fish in the U.S. Caribbean EEZ. The 2010 Caribbean ACL Amendment (CFMC 2011a) CEA analyzed cumulative effects to reef fish and queen conch, whereas the CEA included in the 2011 Caribbean ACL Amendment (CFMC 2011b) analyzed cumulative effects to reef fish, spiny lobster, and coral reef resources, in the U.S. Caribbean EEZ. Both of those CEAs also described baseline economic and social conditions for fishing communities in St. Croix. The CEAs described the effects of the implementation of ACLs, AMs, and the selection of revised management reference points for Council-managed species, and how those actions would serve to restore and stabilize natural trophic and competitive relationships, rebuild species abundances, re-establish natural sex ratios, contribute to the long-term health of the ecosystem, and reinvigorate sustainable fisheries while minimizing to the extent practicable negative socioeconomic impacts. These CEAs are still considered accurate and useful at the present time and are incorporated herein by reference. Both CEAs discussed that, although ACLs and AMs are intended to prevent or greatly reduce the risk of overfishing and are expected to have positive biological benefits, they may also impose more restrictive catch levels on fisheries resulting in negative social and economic impacts over the short-term. However, to the extent that ACLs and AMs prevent overfishing and assist in rebuilding overfished stocks, they should have positive long-term benefits to both the biological and socioeconomic environments.

*Comprehensive Amendment to the U.S. Caribbean FMPs: Application of AMs (AM Application Amendment*) and EA (CFMC 2016)

This amendment modified AM-applicability language in the four Council FMPs to correct an inconsistency with the implementing regulations. Although this action directly affected AMs, the action did not result in regulatory changes and did not change the way AMs are currently implemented in the EEZ. The action in the AM Application amendment is not expected to contribute to the effects expected from the actions considered in the St. Croix FMP, and vice-versa. The CEA included in the AM Application Amendment analyzed cumulative effects to the spiny lobster, queen conch, reef fish, and coral resources in the U.S. Caribbean EEZ and revealed no significant, cumulative adverse effects on the human environment. The CEA in the AM Application Amendment also considered the analyses of cumulative effects listed in each of the 2010 and 2011 Caribbean ACL Amendments/EISs, mentioned above. These analyses are still considered accurate and useful at the present time and are incorporated herein by reference.

*Amendments to the Reef Fish, Spiny Lobster, and Corals and Reef Associated Plants and Invertebrates FMPs: Timing of AM-Based Closures and EA (CFMC 2017a)*

The CEA included in this document discussed the implications of changing the end date for AM-based closures from December 31$^{st}$ to September 30$^{th}$ each year, with the closure period

extending backward toward the beginning of the year for the number of days necessary to achieve the required reduction in landings. The CEA revealed no significant beneficial or adverse cumulative effects on the physical or biological/ecological environments but identified positive non-significant effects on the social and economic environments by minimizing adverse socioeconomic effects from the application of AMs. The CEA also considered the analyses of cumulative effects listed in each of the 2010 and 2011 Caribbean ACL Amendments/EISs, mentioned above. The CEA of this amendment is still considered to be accurate and useful at the present time.

**Present and Reasonably Foreseeable Future Actions**

The overarching goal of the present action, establishing a St. Croix FMP, is to ensure the continued health of fishery resources occurring in the EEZ surrounding St. Croix within the context of the unique biological, ecological, economic, and cultural characteristics of those resources and the communities dependent upon them. To achieve this fundamental goal, the St. Croix FMP establishes a place-based framework designed to provide the foundation for conserving and managing the St. Croix fishery within an integrative, ecosystem-based approach. Essential to this ecosystem-based fishery management (EBFM) approach is enhanced stewardship among fishermen, residents and others who value the fishery resources and marine and coastal environment of St. Croix and the U.S. (reference or link to the NMFS EBFM policy and the Caribbean EBFM Regional Implementation Plan).

The Council, in partnership with NMFS and other regional constituencies, is in the process of moving towards full implementation of EBFM in the region. EBFM enables a more holistic approach to decision-making by considering trade-offs among fisheries, aquaculture, protected species, biodiversity, habitats, and the human community, within the context of climate, habitat, ecological, and other environmental change.

*Consideration of Climate Change and Other Non-Fishery Related Issues*

Stresses affecting fishery resources and protected resources as well as the human communities that depend on those resources include, but are not limited to, natural events, habitat quality, human population growth, and anthropogenic threats (e.g., habitat loss and degradation, sedimentation, pollution, water quality, overharvest, climate change). Some managed species may be more sensitive to the quality of their environment than are others. For example, any changes in benthic conditions resulting from land-based increases in sedimentation or turbidity will adversely affect the available productive habitat for queen conch (Appeldoorn et al. 2011) and corals. Consideration of these stressors, and the changing nature of stressors within the context of climate variability and change, is an important component of the EBFM approach.

Emerging information sheds light on how global climate change will affect, and is already affecting, fishery resources and the habitats upon which they depend. Climate change can affect marine ecosystems through altered patterns of thermal stratification, changes to upwelling patterns, sea level rise, increases in wave height and frequency, loss of sea ice, changes to storm frequency and intensity, and increased risk of diseases in marine biota, among other things. Potential vulnerabilities for coastal zones include increased shoreline erosion leading to alteration of the coastline, loss of coastal wetlands, and changes in the profiles of fish and other marine life populations (Lorde et al. 2013). Changes in ocean temperatures have been linked to shifting fish stock distribution and productivity in many marine ecosystems, and these impacts are expected to increase in the future (NMFS 2014). Any of these could affect the local or regional seafood output and thus the local economy (Carter et al. 2014). In the U.S. Caribbean region and throughout the southeastern U.S., the major climate induced ecosystem concerns include: 1) Threats to coral reef ecosystems - coral bleaching, disease, and ocean acidification; 2) Threats to habitat from sea level rise – loss of essential fish habitat; and 3) Climate induced changes to species phenology and distribution (Osgood 2008).

Climate variability is also a factor that needs to be considered when addressing climate effects, and in the reasonably foreseeable future, it may be far more influential than unidirectional climate change. For example, inter-annual (e.g., El Niño/La Niña) changes in the ocean environment may result in altered patterns of fish distribution, productivity, reproduction, and recruitment (NOAA PFL Climate Variability and Marine Fisheries, accessed November 2018). Additionally, cyclical water temperature variability may result in relatively short-term (decadal) changes in water temperature that substantially exceed (cyclical temperature maximum) the evident long-term pattern of temperature increase, or that act in opposition (cyclical temperature minimum) to that long-term pattern. Such decadal-scale events may be far more influential with respect to fishery management regulations such as those included in the St. Croix FMP than are long-term climate change events, because these decadal-scale events operate on the time frame of the fishery management action and effect the ecosystem in the short-term.

Many types of "pollution" may adversely affect the coral reef ecosystem, but increasing atmospheric carbon dioxide concentration is having substantial and clearly documented negative effects. Excess carbon dioxide ($CO_2$) dissolves into the ocean and is converted to corrosive carbonic acid, resulting in the phenomenon known as "ocean acidification" (Madin 2010). At the same time, the $CO_2$ also supplies carbon that combines with calcium already dissolved in seawater to provide the main ingredient for shells and coral skeletons, calcium carbonate ($CaCO_3$) (Madin 2010). The net responses of organisms to rising $CO_2$ concentration will vary depending on often opposing sensitivities to decreased seawater pH, carbonate concentration, and carbonate saturation state, and to elevated oceanic total inorganic carbon and gaseous $CO_2$ (Cooley and Doney 2009). Increased ocean acidity caused by elevated $CO_2$ could directly

damage organisms by partially dissolving their skeletal structure (Madin 2010) or by decreasing skeletal growth rate. Other species with more protective coverings on their shells and skeletons, such as crustaceans, temperate urchins, mussels, and coralline red algae, may be less vulnerable to decreasing seawater pH (Madin 2010). Projections based on the Intergovernmental Panel on Climate Change (IPCC) Special Report on Emissions Scenarios (SRES) estimate a reduction in average global surface ocean pH of between 0.14 and 0.35 units during the 21st century (Climate Change 2007). Although the extent and direction of effects on species and ecosystems resulting from ocean acidification are not fully understood, deleterious impacts have been unequivocally documented and the need for effective management is clear.

Although the full range of effects resulting from climate change, climate variation, and ocean acidification cannot be quantified at this time, nor is the exact timeframe known in which these impacts will occur, the need for proactive management is evident. Both globally and throughout the Caribbean basin, coral bleaching events are occurring more frequently and with greater severity. Other coral diseases also contribute to coral reef degradation. Few of the management actions proposed in this FMP/EA are expected to increase or decrease the potential impacts of climate change and ocean acidification on fishery resources and other protected resources. However, prohibitions on and reductions in allowable catch of grazing species, including parrotfish and surgeonfish, are designed to ensure adequate grazing capacity and thereby strengthen the resilience of corals to environmental impacts resulting from climate variability and change. Unfortunately, other anthropogenic impacts to Council-managed resources in the affected area may be more pressing than climate change or even decadal-scale climate variability. Those anthropogenic impacts may include, but are not limited to, nitrification, sedimentation, and other symptoms of an ever-increasing human population. Nonetheless, continued monitoring of the effects of climate change, climate variability, and ocean acidification should be a priority of national and local programs. For more information about climate impacts in U.S. marine living resources concerning NMFS, see Osgood (2008). For additional information about climate change in the Caribbean and Southeast region, please see Chapter 17 of the Third National Climate Assessment: *Climate Change Impacts in the United States* (Carter et al. 2014).

Tropical storms constitute past, present and certainly foreseeable future events with significant effects on St. Croix fishery resources, the habitats upon which those resources depend, and the human communities dependent upon that fishery ecosystem. Historically, such tropical events substantially impact the ecosystem. Although those impacts may be relatively short-lived, they can be severe and tragic. In 2017, Hurricanes Maria and Irma affected all of the islands constituting the U.S. Caribbean region, with resultant loss of life and property from which the region has not yet recovered. Stresses caused by the impact of those recent hurricanes on St. Croix fishery and to the social structure and economy of St. Croix, and the resulting recovery,

are discussed in detail in Sections 3.4 and 3.5.11. Within the fishery ecosystem, target and non-target resources were redistributed with both beneficial and detrimental effects. Habitat, and specifically coral reefs, were severely damaged although rapidly developing restoration and recovery strategies are reducing the extent and duration of these impacts. Socially and economically, impacts to gear and infrastructure were substantial and prevented fishing in the short-term and to this day continue to constrain fishing, although the magnitude of that constraint varies as fishers have modified their fishing techniques, gears, or target species to adapt to new environmental conditions after the hurricanes' impact. Those fishing constraints result not just from the fishermen's loss of their trade tools, but also from loss of markets due to residents leaving the island and tourists staying away. Tropical storm events are a future certainty, and the prediction is for climate change to increase the frequency and severity of tropical storm events.

Other issues directly affecting human communities include high fuel costs, increased seafood imports, restricted access to traditional fishing grounds, and regional economies. Additional information on these topics as they pertain to the St. Croix FMP can be found in Sections 3.4, 3.5, and 3.7.

### 4. *The overall impact that can be expected if the individual impacts are allowed to accumulate:*

Cumulative effects resulting from creation of a St. Croix FMP in combination with other past, present, and reasonably foreseeable future actions would be expected to be minimal. Some minor short-term negative effects would result from revision of regulatory text and other descriptive documents, and some positive socioeconomic effects may result from increased compliance and cooperation from affected constituents. But transitioning from Caribbean-wide, species-based FMPs to an island-based FMP for the St. Croix EEZ only rearranges past Council actions, without affecting those actions or any other past or present actions taken by federal or non-federal entities.

No significant overall impacts to the biological/ecological environment, to protected species occurring within that environment, to the habitats constituting and supporting that environment, or to the dependent socioeconomic environment are expected to result from the cumulative past, present, or reasonably foreseeable future impacts of the actions that comprise this transition to a St. Croix FMP. As discussed earlier, the impacts from recent hurricanes on the fishery ecosystem were both positive (e.g., increase in abundance of some species in some areas) and negative (e.g., physical damage to coral reefs). But restoration activities, either current or planned for the immediate future, are expected to reduce the extent and duration of these impacts. Similarly, no cumulative effects would be expected to result from reasonably foreseeable future actions that may be taken, by other federal or non-federal agencies, which would otherwise not occur if the management transition did not take place.

### 5. *Summary:*

The transition to a St. Croix FMP from the Council species-based FMPs is not expected to have individually significant effects to the biological/ecological, physical, or socioeconomic environment or to combine with the effects of other past, present, or reasonably foreseeable future actions in such a way that could have a potentially significant, cumulative effect.

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# Chapter 5 Conservation and Management Measures - Action Plan

## 5.1 Introduction

In order to conserve, maintain, and sustain the fisheries and related environment and habitats in the U.S. Caribbean, the goal of the Caribbean Fishery Management Council (Council) is to develop and establish effective conservation and management measures that maintain a healthy fishery that meets the needs of fishermen and the general public. These conservation and management measures are based on (1) determining the status of the fisheries stocks and overall biological productivity and capacity to maintain vital fishery resources for the near- and long-term, (2) considering the economic, social and cultural aspects of the fisheries, and (3) determining effective fishing practices, rules, and regulations to ensure sustainable harvest of fishery resources within the context of optimum yield (OY). The federal guidelines regarding these conservation and management measures are fully described in National Standard (NS) 1 of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) and are discussed in Appendix G.

Chapter 5 describes the Council's conservation and management measures included in the St. Croix FMP to achieve the Council's management objectives in the St. Croix exclusive economic zone (EEZ). Chapter 5 also discusses the criteria used to assess the status of Council-managed stocks and the management measures that the Council has developed as a means to prevent overfishing and avoid an overfished resource. As discussed in Chapter 2 (Action 1: Transition Fisheries Management in the St. Croix EEZ from a Species-Based Approach to an Island-Based Approach), although the St. Croix FMP would replace the Council's Reef Fish, Spiny Lobster, Queen Conch, and Coral FMPs[63], the new FMP carries forward most of the management measures from those four species-based FMPs. Importantly, the St. Croix FMP introduces some new management measures as well as new reference points and status determination criteria (SDC) evaluated and ultimately selected by the Council in the draft environmental assessment included within this document. For additional information on the management measures migrated from the Council's previous FMPs (Reef Fish, Spiny Lobster, Queen Conch, and Coral), please see the Council's FMPs and amendments as those documents contain comprehensive discussions of the need and analysis of each of the measures transitioned into this plan at the time they were created. All management measures in the St. Croix FMP have been developed and analyzed in accordance with Magnuson-Stevens Act requirements and guidance, National Environmental Policy Act, and other applicable law. The Council continues to believe

[63] Action 1 established a new island-based FMP for St. Croix EEZ waters, repealed the existing species-based FMPs and replaced them with the St. Croix FMP.

that the measures that the Council is retaining from the species-based plans are necessary and appropriate to manage the fishery under the St. Croix FMP, as they remain important to ensure that the Council is managing the resources in a manner that is consistent with the Magnuson-Stevens Act, including National Standard 1, that is, preventing overfishing while achieving OY, and other applicable law.

Management measures listed in this chapter include harvest guidelines, minimum size limits, gear restrictions and identification, seasonal and area closures, and harvest limits (among others) for all stocks managed by the Council in the St. Croix EEZ. The following sections list all provisions and regulations applicable to the fishery resources managed in the St. Croix EEZ by fishery group (finfish [reef fish, pelagic fish], spiny lobster, queen conch, and coral reef resources [corals, sea urchins and sea cucumbers]).

## 5.2 Prohibited Species and Harvest Restrictions

Harvest prohibitions/restrictions for species described below apply to all harvest commercial and recreational sectors of those fishing within the St. Croix EEZ.

### 5.2.1 Finfish (Reef Fish and Pelagics)

This provision applies to the following stocks/stock complexes:
Groupers: Grouper Complex 1 - Nassau (*Epinephelus striatus)* and Grouper Complex 2 - goliath (*E. itajara*)
Parrotfish: Parrotfish Complex 1 - blue (*Scarus coeruleus*); midnight (*Scarus coelestinus*); rainbow (*Scarus guacamaia*)

No person may fish for or possess goliath grouper, Nassau grouper, blue parrotfish, midnight parrotfish, or rainbow parrotfish in or from the St. Croix EEZ. Such fish caught in the St. Croix EEZ must be released immediately with a minimum of harm.
This provision applies to all managed finfish. Landing fish intact.

- Finfish in or from the St. Croix EEZ must be maintained with head and fins intact, with the following exceptions:
    - Bait is exempt from the requirement to be maintained with head and fins intact.
        - "Bait" means: (A) Packaged, headless fish fillets that have the skin attached and are frozen or refrigerated; (B) Headless fish fillets that have the skin attached and are held in brine; or (C) Small pieces no larger than 3 $in^3$ (7.6 $cm^3$) or strips no larger than 3 inches by 9 inches (7.6 cm by 22.9 cm) that have the skin attached and are frozen, refrigerated, or held in brine.

        - Note a finfish or part thereof possessed in or landed from the St. Croix EEZ that is subsequently sold or purchased as a finfish species, rather than as bait, is not bait.
    - Legal-sized finfish possessed for consumption at sea on the harvesting vessel are exempt from the requirement to have head and fins intact, provided: (i) Such finfish do not exceed any applicable bag limit; (ii) Such finfish do not exceed 1.5 lbs. (680 g) of finfish parts per person aboard; and (iii) The vessel is equipped to cook such finfish on board.
- The operator of a vessel that fishes in the St. Croix EEZ is responsible for ensuring that fish possessed on the vessel while in the St. Croix EEZ are maintained intact and, if taken from the EEZ, are maintained intact through offloading ashore.

Gear restrictions and minimum size limits apply. See Sections 5.3 and 5.4 below.

### 5.2.2 Spiny Lobster

No species harvest prohibition.
No harvest of egg bearing females (see image below). Egg-bearing spiny lobster in the St. Croix EEZ must be returned to the water unharmed. An egg-bearing spiny lobster may be retained in a trap, provided the trap is returned immediately to the water. An egg-bearing spiny lobster may not be stripped, scraped, shaved, clipped, or in any other manner molested, in order to remove eggs.

Landing spiny lobster intact. A Caribbean spiny lobster in or from the St. Croix EEZ must be maintained with head and carapace intact. The operator of a vessel that fishes in the EEZ is responsible for ensuring that spiny lobster on that vessel in the EEZ are maintained intact and, if taken from the EEZ, are maintained intact through offloading ashore.

Gear restrictions and minimum size limit apply. See Sections 5.3 and 5.4 below.

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Spiny lobster with eggs (berried).

### 5.2.3 Queen Conch

No person may fish for or possess a queen conch in or from the St. Croix EEZ in the area west of 64°34′ W. longitude. Seasonal and area closures apply in the area east of 64°34′ W. longitude (see Sections 5.8.2 and 5.9.2).

### 5.2.4 Coral Reef Resources

#### 5.2.4.1 Corals

No person may fish for or possess any species of coral (stony corals, octocorals, black corals) in or from the St. Croix EEZ. The taking of any corals in the St. Croix EEZ is not considered unlawful possession provided it is returned immediately to the sea in the general area of fishing.

#### 5.2.4.2 Sea Urchins and Sea Cucumbers

No person may fish for or possess any species of sea urchins or sea cucumbers in or from the St. Croix EEZ.

## 5.3 Gear and Methods

### 5.3.1 Prohibited Gear and Methods Applicable to all Stocks

***Explosives.*** An explosive (except an explosive in a powerhead where a powerhead is an allowable gear) may not be used to fish in the St. Croix EEZ. A vessel fishing in the St. Croix EEZ for a species managed under the St. Croix FMP, may not have on board any dynamite or similar explosive substance.

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## 5.3.2 Gear and Methods for the Harvest of Finfish (Reef Fish, Pelagics)

### 5.3.2.1 Prohibited Gear and Methods for the Harvest of Reef Fish

Poisons

A poison, drug, or other chemical may not be used to fish for Caribbean reef fish in the St. Croix EEZ.

Powerheads

A powerhead may not be used in the St. Croix EEZ to harvest Caribbean reef fish. The possession of a mutilated Caribbean reef fish in or from the St. Croix EEZ and a powerhead is prima facie evidence that such fish was harvested by a powerhead.

Gillnets and trammel nets

A gillnet or trammel net may not be used in the St. Croix EEZ to fish for Caribbean reef fish. Possession of a gillnet or trammel net and any Caribbean reef fish in or from the St. Croix EEZ is prima facie evidence of violation of this paragraph. A gillnet or trammel net used in the St. Croix EEZ to fish for any other species must be tended at all times.

### 5.3.2.2 Allowed Gear and Methods for the Harvest of Reef fish

**A.** Reef Fish-- Applicable to the Commercial Sector

*Gear Type Allowed*

| St. Croix Reef Fish Fishery: | Gear Type |
|---|---|
| A. Commercial Longline/hook and line fishery | A. Longline, hook and line |
| B. Commercial Trap/pot fishery | B. Trap, pot |
| C. Other commercial fishery | D. Spear |

Specifications are provided only for the trap/pot gear, as follows:

I. *Fish Trap Identification*

- Fish Traps and Associated buoys

  A fish trap used or possessed in the St. Croix EEZ must display the official number specified for the vessel by Puerto Rico or the U.S. Virgin Islands so as to be easily identified. Fish traps used to target reef fish in the St. Croix EEZ that are fished individually, rather than tied together in a trap line, must have at least one buoy attached that floats on the surface. Fish traps used in the St. Croix EEZ that are tied together in a trap line must have at least one buoy that floats at the surface attached at each end of the trap line. Each buoy must display the official number and color code

assigned to the vessel by Puerto Rico or the U.S. Virgin Islands, whichever is applicable, so as to be easily distinguished, located, and identified.

- Presumption of ownership of fish traps
  A fish trap in the St. Croix EEZ will be presumed to be the property of the most recently documented owner. This presumption will not apply with respect to such traps that are lost or sold if the owner reports the loss or sale within 15 days to the Regional Administrator (RA).

- Disposition of unmarked fish traps or buoys
  An unmarked fish trap or a buoy deployed in the St. Croix EEZ where such trap or buoy is required to be marked is illegal and may be disposed of in any appropriate manner by the Assistant Administrator or an authorized officer.

II. *Fish Trap Construction Specifications and Tending Restrictions*

- Minimum Mesh Size
  - A bare wire fish trap used or possessed in the St. Croix EEZ that has hexagonal mesh openings must have a minimum mesh size of 1.5 inches (3.8 cm) in the smallest dimension measured between centers of opposite strands.

  - A bare wire fish trap used or possessed in the St. Croix EEZ that has other than hexagonal mesh openings or a fish trap of other than bare wire, such as coated wire or plastic, used or possessed in the St. Croix EEZ, must have a minimum mesh size of 2.0 inches (5.1 cm) in the smallest dimension measured between centers of opposite strands.

- Escape Mechanisms
  A fish trap used or possessed in the St. Croix EEZ must have a panel located on one side of the trap, excluding the top, bottom, and side containing the trap entrance. The opening covered by the panel must measure not less than 8 by 8 inches (20.3 by 20.3 cm). The mesh size of the panel may not be smaller than the mesh size of the trap. The panel must be attached to the trap with untreated jute twine with a diameter not exceeding 1/8 inches (3.2 mm). An access door may serve as the panel, provided it is on an appropriate side, it is hinged only at its bottom, its only other fastening is untreated jute twine with a diameter not exceeding 1/8 inches (3.2 mm), and such fastening is at the top of the door so that the door will fall open when such twine degrades. Jute twine used to secure a panel may not be wrapped or overlapped.

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- Tending Restrictions
  A fish trap in the St. Croix EEZ may be pulled or tended only by a person (other than an authorized officer) aboard the fish trap owner's vessel, or aboard another vessel if such vessel has on board written consent of the trap owner, or if the trap owner is aboard and has documentation verifying his identification number and color code. An owner's written consent must specify the time period such consent is effective and the trap owner's gear identification number and color code.

B. Reef Fish - Applicable to the Recreational Sector

*Gear Type Allowed*

| **Caribbean Reef Fish Fishery** | **Gear Type** |
|---|---|
| Recreational fishery | Dip net, handline, rod and reel, slurp gun, spear |

## 5.3.3. Gear and Methods for the Harvest of Caribbean Spiny Lobster

### 5.3.3.1 Prohibited Gear and Methods for the Harvest of Spiny Lobster

A. Applicable to all harvest (*i.e.*, commercial and recreational)

Spears and hooks
A spear, hook, or similar device may not be used in the St. Croix EEZ to harvest a Caribbean spiny lobster. The possession of a speared, pierced, or punctured Caribbean spiny lobster in or from the St. Croix EEZ is prima facie evidence of violation of this section.

Gillnets and trammel nets
A gillnet or trammel net may not be used in the St. Croix EEZ to fish for Caribbean spiny lobster. Possession of a gillnet or trammel net and any Caribbean spiny lobster in or from the St. Croix EEZ is prima facie evidence of violation of this paragraph. A gillnet or trammel net used in the St. Croix EEZ to fish for any other species must be tended at all times.

### 5.3.3.2 Allowed Gear and Methods for the Harvest of Caribbean Spiny Lobster

A. Applicable to the Commercial Sector

*Gear Type Allowed*

| Caribbean Spiny Lobster Fishery | **Gear Type** |
|---|---|
| A. Trap/pot fishery | A. Trap/pot |
| B. Dip net fishery | B. Dip net |

| | |
|---|---|
| C. Hand harvest fishery | C. Hand harvest, snare |

Specifications are provided only for the trap/pot gear.

I. *Caribbean Spiny Lobster Trap Identification*

- Caribbean Spiny Lobster traps and associated buoys
  A Caribbean spiny lobster trap used or possessed in the St. Croix EEZ must display the official number specified for the vessel by Puerto Rico or the U.S. Virgin Islands so as to be easily identified. Caribbean spiny lobster traps used in the St. Croix EEZ that are fished individually, rather than tied together in a trap line, must have at least one buoy attached that floats on the surface. Caribbean spiny lobster traps used in the St. Croix spiny lobster fishery that are tied together in a trap line must have at least one buoy that floats at the surface attached at each end of the trap line. Each buoy must display the official number and color code assigned to the vessel by Puerto Rico or the U.S. Virgin Islands, whichever is applicable, so as to be easily distinguished, located, and identified.

- Presumption of ownership of Caribbean spiny lobster traps
  A Caribbean spiny lobster trap in the St. Croix EEZ will be presumed to be the property of the most recently documented owner. This presumption will not apply with respect to such traps that are lost or sold if the owner reports the loss or sale within 15 days to the RA.

- Disposition of unmarked Caribbean spiny lobster
  An unmarked Caribbean spiny lobster trap or a buoy deployed in the St. Croix EEZ where such trap or buoy is required to be marked is illegal and may be disposed of in any appropriate manner by the Assistant Administrator or an authorized officer.

II. *Caribbean Spiny Lobster Trap Construction Specifications and Tending Restrictions*

- Escape mechanisms
  A spiny lobster trap used or possessed in the St. Croix EEZ must contain on any vertical side or on the top a panel no smaller in diameter than the throat or entrance of the trap. The panel must be made of or attached to the trap by one of the following degradable materials:
  - Untreated fiber of biological origin with a diameter not exceeding 1/8 inches (3.2 mm). This includes, but is not limited to tyre palm, hemp, jute, cotton, wool, or silk.
  - Ungalvanized or uncoated iron wire with a diameter not exceeding 1/16 inches (1.6 mm), that is, 16 gauge wire.

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- Tending restrictions
  A Caribbean spiny lobster trap in the St. Croix EEZ may be pulled or tended only by a person (other than an authorized officer) aboard the fish trap owner's vessel, or aboard another vessel if such vessel has on board written consent of the trap owner, or if the trap owner is aboard and has documentation verifying his identification number and color code. An owner's written consent must specify the time period such consent is effective and the trap owner's gear identification number and color code.

B. Applicable to the Recreational Sector

*Gear Type Allowed*

| Caribbean Spiny Lobster Fishery | Gear Type |
|---|---|
| Recreational fishery | Dip net, hand harvest, snare |

### 5.3.4. Gear and Methods for the Harvest of Queen Conch

Prohibited Gear and Methods for the Harvest of Queen Conch. Applicable to both the Commercial and Recreational Sectors:

No person may harvest queen conch in the St. Croix EEZ by diving while using a device that provides a continuous air supply from the surface.

Landing conch intact

- Queen conch in or from the St. Croix EEZ must be maintained with meat and shell intact.
- The operator of a vessel that fishes in the EEZ is responsible for ensuring that Caribbean queen conch on that vessel in the EEZ are maintained intact and, if taken from the EEZ, are maintained intact through offloading ashore, as specified in this section.

## 5.4 Size Limits

Species that are not in compliance with the size limits, in or from the St. Croix EEZ, may not be possessed, sold, or purchased and must be released immediately with a minimum amount of harm. The operator of a vessel that fishes in the St. Croix EEZ is responsible for ensuring that the species on board the vessel are in compliance with the size limits specified below.

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### 5.4.1 Applicable to Reef Fish

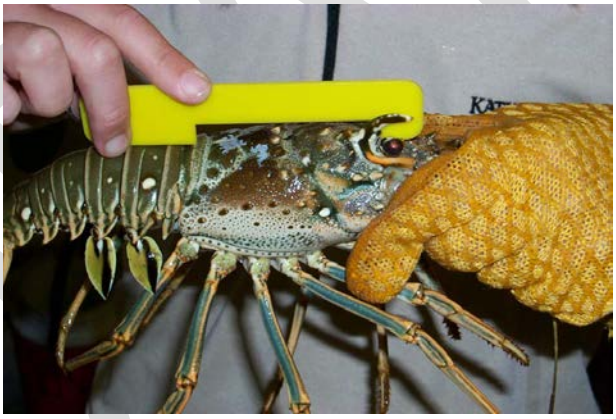
Yellowtail Snapper (*Ocyurus chrysurus*)
The minimum size limit is 12 inches (in) (30.48 cm) total length (TL). This size limit applies year-round.

Redband Parrotfish (*Sparisoma aurofrenatum*)
Minimum size limit of 8 inches (in) (20.3 cm) fork length. This size limit applies year-round.

Princess (*Scarus taeniopterus*), Queen (*Scarus vetula*), Striped (*Scarus iseri*), Redtail (*Sparisoma chrysopterum*), Stoplight (*Sparisoma viride*), and Redfin (*Sparisoma rubripinne*) Parrotfish
Minimum size limit of 9 inches (in) (22.9 cm) fork length. Size limits apply year-round.

### 5.4.2 Caribbean Spiny Lobster

The minimum size limit is 3.5 in or 8.9 cm carapace length (see image below). See Section 5.2.2 above for harvest restrictions applicable to the harvest of Caribbean spiny lobster, including the requirement that Caribbean spiny lobster must be maintained with head and carapace intact.



Measurement of a spiny lobster carapace.

### 5.4.3 Queen Conch

The minimum size limit for queen conch is either 9 inches (22.9 cm) in length, that is, from the tip of the spire to the distal end of the shell, or 3/8 inch (9.5 mm) in lip width at its widest point.

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## 5.5 Commercial Trip Limits

Commercial trip limits are limits on the amount of the applicable species that may be possessed on board or landed, purchased, or sold from a vessel per day. A person who fishes in the EEZ may not combine a trip limit specified in this section with any trip or possession limit applicable to state waters. A species subject to a trip limit specified in this section taken in the EEZ may not be transferred at sea, regardless of where such transfer takes place, and such species may not be transferred in the EEZ.

### 5.5.1 Queen Conch

The trip limit for queen conch in or from the St. Croix EEZ is 200 queen conch per day.

## 5.6 Recreational Bag Limits

### 5.6.1 General Applicability of Bag and Possession limits for Certain Reef Fish Species and Spiny Lobster

The bag and possession limits apply for stocks in or from the St. Croix EEZ. Unless specified otherwise, bag limits apply to a person on a daily basis, regardless of the number of trips in a day. Unless specified otherwise, a person is limited to a single bag limit for a trip lasting longer than one calendar day. Unless specified otherwise, possession limits apply to a person on a trip after the first 24 hours of that trip. The bag and possession limits apply to a person who fishes in the St. Croix EEZ in any manner, except a person aboard a vessel in the St. Croix EEZ that has on board the commercial vessel permit required for the appropriate stock/stock complex. The possession of a commercial vessel permit notwithstanding, the bag and possession limits apply when the vessel is operating as a charter vessel or headboat. A person who fishes in the St. Croix EEZ may not combine a bag limit specified for the St. Croix EEZ with a bag or possession limit applicable to state waters. A stock/stock complex subject to a bag limit taken in the St. Croix EEZ by a person subject to the bag limits may not be transferred at sea, regardless of where such transfer takes place, and such fish may not be transferred in the St. Croix EEZ. The operator of a vessel that fishes in the St. Croix EEZ is responsible for ensuring that the specified bag and possession limits are not exceeded.

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### 5.6.2 Bag and Possession Limits for Reef Fish[64]

Groupers, snappers, and parrotfishes combined—5 per person per day or, if 3 or more persons are aboard, 15 fish total per vessel per day; but not to exceed 2 parrotfish per person per day or 6 parrotfish per vessel per day.

Angelfish, grunts, porgies, wrasses, jacks, triggerfish, surgeonfish combined —5 per person per day or, if 3 or more persons are aboard, 15 fish total per vessel per day, but not to exceed 1 surgeonfish per person per day or 4 surgeonfish per vessel per day.

### 5.6.3 Bag and Possession Limits for Caribbean Spiny Lobster

The bag limit for Caribbean spiny lobster in or from the St. Croix EEZ is 3 per person per day, not to exceed 10 per vessel per day, whichever is less.

### 5.6.4 Queen Conch

The bag limit for queen conch in or from the St. Croix EEZ is 3 per person per day or, if more than 4 persons are aboard, 12 per boat/day.

## 5.7 Restrictions on Sale/Purchase

### 5.7.1 General

The Magnuson-Stevens Act defines recreational fishing as fishing for sport and pleasure.

### 5.7.2 Reef Fish

A live red hind or live mutton snapper in or from the St. Croix EEZ may not be sold or purchased and used in the marine aquarium trade.

### 5.7.3 Caribbean Spiny Lobster

No person may import a Caribbean spiny lobster with less than a 6-ounce (170-gram) tail weight **into St. Croix**. A 6-ounce (170-gram) tail weight is defined as a tail that weighs 5.9-6.4 ounces (167-181 grams). If the documentation accompanying an imported Caribbean spiny lobster (including but not limited to product packaging, customs entry forms, bills of lading, brokerage

[64] The recreational bag limit only applies to reef fish. It does not apply to pelagic stocks, which are new to management in the St. Croix FMP such as dolphin, and wahoo.

forms, or commercial invoices) indicates that the product does not satisfy the minimum tail weight, the person importing such Caribbean spiny lobster has the burden to prove that such Caribbean spiny lobster actually does satisfy the minimum tail-weight requirement or that such Caribbean spiny lobster has a tail length of 6.2 inches (15.75 cm) or greater or that such Caribbean spiny lobster has or had a carapace length of 3.5 inches (8.89 cm) or greater. If the imported product itself does not satisfy the minimum tail-weight requirement, the person importing such Caribbean spiny lobster has the burden to prove that such Caribbean spiny lobster has a 302 tail length of 6.2 inches (15.75 cm) or greater or that such Caribbean spiny lobster has or had a carapace length of 3.5 inches (8.89 cm) or greater. If the burden is satisfied such Caribbean spiny lobster will be considered to be in compliance with the minimum 6-ounce (170-gram) tail-weight requirement.

No person may import a spiny lobster with less than a 5-ounce (142-gram) tail weight **into any place subject to the jurisdiction of the United States excluding Puerto Rico and the U.S. Virgin Islands**. A 5-ounce (142-gram) tail weight is defined as a tail that weighs 4.2-5.4 ounces (119-153 grams). If the documentation accompanying an imported spiny lobster (including but not limited to product packaging, customs entry forms, bills of lading, brokerage forms, or commercial invoices) indicates that the product does not satisfy the minimum tail-weight requirement, the person importing such spiny lobster has the burden to prove that such spiny lobster actually does satisfy the minimum tail-weight requirement or that such spiny lobster has a tail length of 5.5 inches (13.97 cm) or greater or that such spiny lobster has or had a carapace length of greater than 3.0 inches (7.62 cm). If the imported product itself does not satisfy the minimum tail-weight requirement, the person importing such spiny lobster has the burden to prove that such spiny lobster has a tail length of 5.5 inches (13.97 cm) or greater or that such spiny lobster has or had a carapace length of greater than 3.0 inches (7.62 cm). If the burden is satisfied, such spiny lobster will be considered to be in compliance with the minimum 5-ounce (142-gram) tail-weight requirement.

No person may import, into any place subject to the jurisdiction of the United States, Caribbean spiny lobster tail meat that is not in whole tail form with the exoskeleton attached.

No person may import, into any place subject to the jurisdiction of the United States, Caribbean spiny lobster with eggs attached or Caribbean spiny lobster from which eggs or pleopods (swimmerets) have been removed or stripped. Pleopods (swimmerets) are the first five pairs of abdominal appendages.

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### 5.7.4 Coral Reef Resources

#### 5.7.4.1 Corals

No person may sell or purchase a Caribbean coral harvested in the St. Croix EEZ.

A Caribbean coral that is sold in St. Croix will be presumed to have been harvested in the St. Croix EEZ, unless it is accompanied by documentation showing that it was harvested elsewhere. Such documentation must contain:

The information specified in subpart K of part 300 of 50 CFR for marking containers or packages of fish or wildlife that are imported, exported, or transported in interstate commerce; the name and home port of the vessel, or the name and address of the individual, harvesting the Caribbean coral; the port and date of landing the Caribbean coral; and a statement signed by the person selling the Caribbean coral attesting that, to the best of his or her knowledge, information, and belief, such Caribbean coral was harvested other than in the St. Croix EEZ or the waters of St. Croix.

#### 5.7.4.2 Sea Urchins and Sea Cucumbers

No person may sell or purchase a Caribbean sea urchin or a sea cucumber harvested in the St. Croix EEZ.

### 5.7.5 Queen Conch

No person may sell or purchase a Caribbean queen conch harvested in the St. Croix EEZ.

## 5.8 Anchoring Restrictions

### 5.8.1 General

There are no areas in the St. Croix EEZ where anchoring is prohibited.

### 5.8.2 Reef Fish

The owner or operator of any fishing vessel, recreational or commercial that fishes for or possesses Caribbean reef fish in or from the St. Croix EEZ must ensure that the vessel uses only an anchor retrieval system that recovers the anchor by its crown, thereby preventing the anchor from dragging along the bottom during recovery. For a grapnel hook, this could include an incorporated anchor rode reversal bar that runs parallel along the shank, which allows the rode to

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reverse and slip back toward the crown. For a fluke or plow type anchor, a trip line consisting of a line from the crown of the anchor to a surface buoy would be required.

## 5.9 Seasonal Species Closures Applicable to Certain Species

The seasonal closures applicable to fishing for the species listed below apply to all fishing activities.

### 5.9.1 Seasonal Closures Applicable to Reef Fish

No person may fish for or possess the following species in or from the St. Croix EEZ (unless another area is specified) during the closed time period (Table 5.9.1). The prohibition on possession does not apply to the species harvested and landed ashore prior to the closure.

**Table 5.9.1.** Species in the St. Croix EEZ with seasonal closures and dates when season is closed and open for fishing for these species.

| Species | Open Season | Closed Season |
|---|---|---|
| Silk snapper<br>Black snapper<br>Blackfin snapper<br>Vermillion snapper | January 1 – September 30 | October 1 – December 31 |
| Mutton snapper<br>Lane snapper | July 1 – March 31 | April 1 – June 30 |
| Yellowfin grouper<br>Red grouper<br>Tiger grouper<br>Black grouper<br>Yellowedge grouper | May 1 – January 31 | February 1 - April 30 |

### 5.9.2 Seasonal Closures Applicable to Queen Conch

No person may fish for or possess on board a fishing vessel a Caribbean queen conch in or from the Caribbean EEZ, except from November 1 through May 31 in the area east of 64°34′ W. longitude which includes Lang Bank east of St. Croix, USVI.

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## 5.10 Seasonal Area Closures

### 5.10.1 Seasonal Area Closures Applicable to Reef Fish

Seasonal prohibitions listed below (Table 5.10.1) do not apply to fish harvested and landed ashore prior to the closure.

**Table 5.10.1**. Areas in the St. Croix EEZ with seasonal area closures and dates when the area is closed and open for specific fishing activities.

| **Red Hind Spawning Aggregation Area[1] (Lang Bank)** | **Open Season** | **Closed Season** |
|---|---|---|
| - No fishing for or possession of any species of fish[65] (including HMS and spiny lobster) during the closure. The prohibition on possession does not apply to such fish harvested and landed ashore prior to the closure.<br>- The use of pots, traps, bottom longlines, gill or trammel nets is prohibited year round. | March 1 – November 30 | December 1 – February 28 |
| **Mutton Snapper Spawning Aggregation Area[1]** | **Open Season** | **Closed Season** |
| - No fishing for or possession of any species of fish (including HMS and spiny lobster) during the closure. The prohibition on possession does not apply to such fish harvested and landed ashore prior to the closure.<br>- The use of pots, traps, bottom longlines, gill or trammel nets is prohibited year-round. | July 1 – last day of February | March 1 – June 30 |

[1]Closures cover any newly managed fish in the St. Croix FMP.

### 5.10.2 Seasonal Area Closures Applicable to Queen Conch

Queen conch harvest is prohibited in the St. Croix EEZ east of 64° 34’ W, which includes Lang Bank, St. Croix, USVI, from June 1 to October 31 (open season November 1 – May 31).

[65] “*Fish*” means finfish, mollusks, crustaceans, and all other forms of marine animal and plant life other than marine mammals and birds.

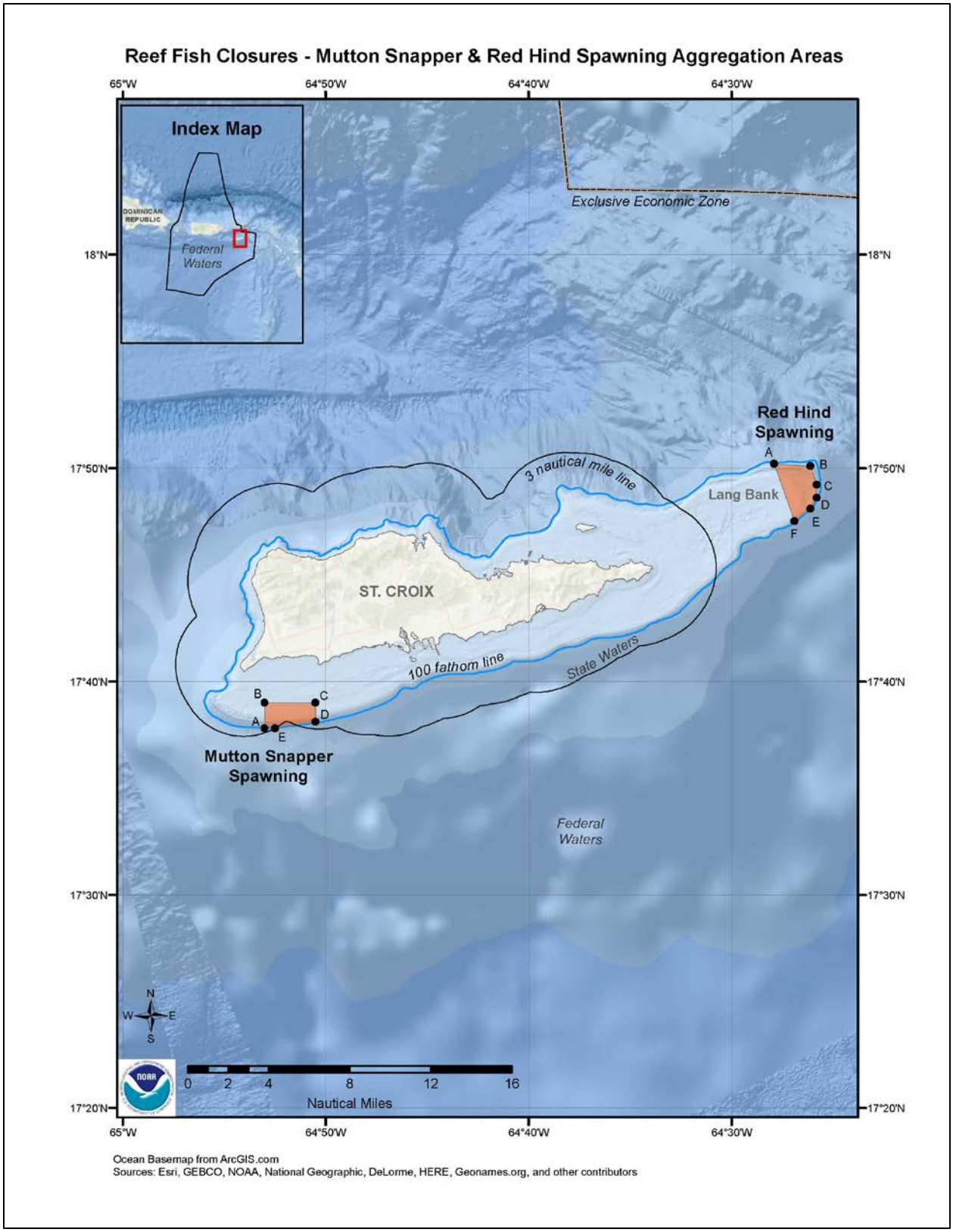


**Figure 5.10.1**. Map of seasonally closed areas off St. Croix.

## 5.11 Permitting and Reporting

### 5.11.1 General

Federal permits are not needed for the harvest of Council-managed species.

## 5.12 Adjustment of Management Measures

The following table lists the framework procedure established in the St. Croix FMP and lists the situations when management measures can be adjusted through framework. The framework procedure was selected by the Council and analyzed in Section 2.7 of the EA within this document.

**Table 5.12.1**. Framework procedure in the St. Croix FMP.

| **OPEN FRAMEWORK** | |
|---|---|
| **1. Situations under which this open framework procedure can be used:**<br>**A. A new stock assessment or other information indicates changes should be made to: MSY, OFL, ABC, or other related management reference points and status determination criteria (SDC).** | |
| **B. New information or circumstances indicates management measures should be changed.**<br>- The Council will, as part of a proposed framework action, identify the new information and provide rationale as to why this new information indicates that management measures should be changed. | |
| **C. Changes are required to comply with applicable laws such as MSA, ESA, MMPA, or are required as a result of a court order.**<br>- In such instances, the RA will notify the Council in writing of the issue and the action that is required. If there is a legal deadline for taking action, the deadline will be included in the notification. | |
| **2. Types of Open Frameworks:** | |
| **Abbreviated Framework** | **Standard Framework** |
| Can be used for routine or insignificant changes | Changes that do not qualify as routine or insignificant. |
| Request is made with letter or memo from the Council to the RA with supporting analyses (biological, social, economic).<br>If RA concurs and approves action, it will be implemented through publication of FR Notice. | Requires a completed framework document with supporting analyses. |
| **Actions that can be taken under each Framework** | |
| **Abbreviated Framework** | **Standard Framework** |
| ix. Gear marking requirements<br>x. Vessel marking requirements | In addition to making changes specified under Abbreviated Framework (left column) that exceed the established thresholds, the following actions can be completed via a standard framework: |

| | |
|---|---|
| xi. Restrictions related to maintaining fish in a specific condition (whole condition, filleting, use as bait, etc.)<br>xii. Recreational bag and possession limit changes of not more than 1 fish per boat<br>xiii. Size limit changes of not more than one inch of the prior size limit for reef fish.<br>xiv. Commercial vessel trip limit changes of not more than 10% of the prior trip limit<br>xv. Changes to the length of an established closed season by no more than 1 day of the existing season.<br>xvi. Minor changes to gear modifications to address conservation issues including to respond to interactions with listed species. | x. Re-specify ABC<br>xi. Re-specify MSY and OY, and SDC<br>xii. Re-specify SYL<br>xiii. Re-specify ACLs<br>xiv. Re-specify ACTs<br>xv. Rebuilding plans and revisions to approved rebuilding plans<br>xvi. Revise accountability measures (e.g., change AM triggers and AM timing)<br>xvii. Modify reporting and monitoring requirements<br>xviii. Modify seasonal or year-round closures and closure procedures<br>xix. Modify area closures and closure procedures |
| **7.** The Council will initiate the open framework process to inform the public of the issues and develop potential alternatives to address the issues. The framework process will include the development of documentation and public discussion during at least one council meeting. | |
| **8.** Prior to taking final action on the proposed framework action, the Council may convene its Scientific and Statistical Committee (SSC) or applicable Advisory Panel (AP), as appropriate, to provide recommendations on the proposed actions. | |
| **9.** For all framework actions, the Council will provide the letter, memo, or the completed framework document along with proposed regulations to the Regional Administrator in a timely manner following final action by the Council. | |
| **10.** For all framework action requests, the Regional Administrator will review the Council's recommendations and supporting information and notify the Council of the determinations, in accordance with the MSA and other applicable law. | |
| **CLOSED FRAMEWORK** | |
| Consistent with existing requirements in the FMP and implementing regulations, the RA is authorized to conduct the following closed framework actions through appropriate notification in the Federal Register:<br>d. Reopen any sector of the fishery that had been prematurely closed.<br>e. Implement AMs, either in-season or post-season. Implement an in-season AM for a sector that has reached or is projected to reach, or is approaching or is projected to approach its ACL according to the process established in the FMP, or implement a post-season AM for a sector that exceeded its ACL according to the process established in the FMP, or any other established AM. | |

## 5.13 Application of National Standard 1 and Management Reference Points

### 5.13.1 Stock Status Determination Process

National Standard 1 of the Magnuson-Stevens Act establishes maximum sustainable yield (MSY) is the basis for fishery management (§600.310(b)(2). When data are insufficient to

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estimate MSY directly, Councils should adopt other measures of reproductive potential that can serve as a reasonable proxy for MSY (§600.310(e)(1)(v)). In the Caribbean region, scientific assessments from which MSY and SDC (SDC = maximum fishing mortality threshold (MFMT), overfishing limit (OFL), and minimum stock size threshold (MSST) are derived are not available due to data limitations. As a result, the Council and their Scientific and Statistical Committee (SSC) has chosen to adopt the sustainable yield level (SYL) as their alternative measure of reproductive potential for stocks, stock complexes, and indicator stocks identified in Chapter 5 of this document.

### 5.13.2 Sustainable Yield Level

The SYL would serve the Council as a guidepost, alerting the Council there is a need to reconsider their approach to managing a stock or stock complex. As discussed in Section 2.4, the SYL is an equilibrium concept, in contrast to the non-equilibrium OFL. The SYL is considered to be a proxy for OFL and a minimum estimate of MSY (where MSY $\geq$ SYL). The SYL is not intended as a metric for reporting stock status in terms of overfishing or overfished. Instead, the SYL is intended to ensure a stock or stock complex is maintained at a sustainable level, and serves to maintain the stock/stock complex at a sustainable level until the stock's status relative to MSY-relative reference points can be determined. In the present plan, acquiring data adequate to move the stock from Tier 4 to Tier 3, 2, or 1 in the acceptable biological catch (ABC) control rule (CR) is a necessary precursor to establishing a scientifically defensible MSY and to deriving reference points from that MSY.

To evaluate the status of a stock or stock complex relative to the SYL, the commonplace approach would be to compare the most recent three years of adjusted landings. However, during the first few years following implementation of the St. Croix FMP, the landings data would be acquired from a stepped series of fishing years as described for the ACL approach in Section 2.4 of this FMP. In the initial year following FMP implementation, only the single most recently available year of landings would be compared against the SYL, and similarly for the second year following implementation. In the third year following implementation, the average of the two most recent years of available landings would be compared to the SYL. In the fourth year and for all subsequent years, the average of the most recent three years of available landings would be compared to the SYL. This approach maintains consistency with the approach used to evaluate fishery landings relative to the ACL, thereby ensuring management responses to fishing activity act in concert rather than in potential opposition.

In the event the appropriate landings benchmark exceeds the established SYL for a stock, stock complex, or indicator stock representing a stock complex, the Council would evaluate their management of that stock or stock complex, identify factors contributing to the SYL exceedance, and revise their management regime accordingly. Revisions to the Council's management

regime could include (but are not limited to) reductions in the allowable catch, implementation of size or bag limits, or expansion or establishment of seasonal or areal closures.

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

The methods for setting ACLs for stocks/stock complexes in the St. Croix FMP are discussed in detail in Section 2.4. Table 5.13.1 lists the ACLs (= OY) established for stocks and stock complexes in the St. Croix FMP.

Evaluating landings relative to the ACL, and the status of a stock or stock complex relative to OY, follows the process described above for evaluating stock status relative to the SYL. During the first few years following implementation of the St. Croix FMP, the landings data would be acquired from a stepped series of fishing years as described in Section 2.4. In the initial year following FMP implementation, only the single most recently available year of landings would be compared against the ACL, and similarly for the second year following implementation. In the third year following implementation, the average of the two most recent years of available landings would be compared to the ACL. In the fourth year and for all subsequent years, the average of the most recent three years of available landings would be compared to the ACL. As noted in the SYL description above, this approach maintains consistency between SYL and ACL with the approach used to evaluate fishery landings relative to the ACL, thereby ensuring management responses to fishing activity act in concert rather than in potential opposition.

#### 5.13.3.1 Annual Catch Limits for Finfish

In St. Croix, only commercial harvest data are collected for Council-managed finfish. However, the commercial ACLs and AMs (discussed in Section 5.13.4 below) for Council-managed finfish governs all harvest of Council-managed finfish, whether commercial or recreational. With the exceptions of goliath grouper, Nassau grouper, midnight parrotfish, blue parrotfish, and rainbow parrotfish (discussed below), ACLs are based on the combined St. Croix EEZ and territorial landings reported for St. Croix. For all finfish stocks, OY would equate to the commercial ACL (Table 5.13.1).

#### 5.13.3.2 Annual Catch Limits for Spiny Lobster

In St. Croix, only commercial harvest data are collected for spiny lobster (recreational landings are not available). However, the ACL and the AM (discussed below) for spiny lobster governs all harvest of spiny lobster, whether commercial or recreational. The ACL is based on available landings information, whether reported as landed from federal or territorial waters. For the spiny lobster, OY would equate to the commercial ACL (Table 5.13.1).

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#### 5.13.3.3 Annual Catch Limits for Queen Conch

In St. Croix, only commercial harvest data are collected for queen conch (recreational landings are not available). However, the ACL and the AM (discussed below) for queen conch governs all harvest of queen conch, whether commercial or recreational. The ACL is based on available landings information, whether reported as landed from federal or territorial waters. For the queen conch, OY would equate to the commercial ACL (Table 5.13.1).

#### 5.13.3.4 Annual Catch Limits for Stocks with Harvest Prohibitions

Harvest for the following stocks/stock complexes would be prohibited in the St. Croix EEZ: Nassau grouper, goliath grouper, midnight parrotfish, rainbow parrotfish, blue parrotfish, sea cucumbers, sea urchins, and corals. The ACL and the OY for each one of these stocks/stock complexes is zero. The ACL and the OY for each one of these stocks/stock complexes would be equal to zero (Table 5.13.1).

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**Table 5.13.1.** Annual catch limits (= Optimum yield) for commercial harvest of stocks/stocks complexes in the St. Croix FMP. Values are in pounds (lbs) of whole weight (ww). Indicator stocks are marked in bold text.

| Stock/Stock Complex | Annual Catch Limit (lbs) |
|---|---|
| Spiny Lobster | 197,529 |
| Queen conch | 50,000 |
| Snapper 1 (black, **blackfin**, **silk**, vermilion) | 61,455 |
| Snapper 2 (queen) | 7,911 |
| Snapper 3 (lane, gray) | 14,156 |
| Snapper 4 (mutton) | 8,513 |
| Snapper 5 (schoolmaster) | 22,879 |
| Snapper 6 (yellowtail) | 15,670 |
| Grouper 1 (Nassau) | 0 |
| Grouper 2 (goliath) | 0 |
| Grouper 3 (**coney**, graysby) | 13,529 |
| Grouper 4 (**red hind**, rock hind) | 11,848 |
| Grouper 5 (black, red, tiger, yellowfin) | 701 |
| Grouper 6 (misty) | 77 |
| Parrotfish 1 (midnight, blue, rainbow) | 0 |
| Parrotfish 2 (queen, princess, **redtail**, **stoplight**, redband, striped, redfin | 72,365 |
| Grunts (white, bluestriped) | 27,169 |
| Squirrelfish (longspine) | 3,514 |
| Surgeonfish (blue tang, ocean surgeonfish, doctorfish) | 39,061 |
| Triggerfish (queen) | 21,450 |
| Angelfish (queen, gray, French) | 6,412 |
| Dolphinfish (dolphin) | 86,633 |
| Wahoo (wahoo) | 27,260 |
| Sea cucumbers (all species) | 0 |
| Sea urchins (all species) | 0 |
| Corals (all species) | 0 |

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## 5.13.4 Accountability Measures (AMs) and Closure Provisions

Accountability measures, including methods to identify ACL exceedance and performance standards are discussed in Section 2.5. This section lists the outcomes from the preferred alternatives, which establishes how AMs are triggered and implemented and the closure provisions associated to the AMs.

#### 5.13.4.1 General

Accountability measures require the NMFS Assistant Administrator (AA) to reduce the length of the fishing season for a given stock/stock complex in the year following a determination that prior year(s) landings exceeded the respective ACL. If NMFS determines the ACL for a particular stock/stock complex has been exceeded, the Southeast Fisheries Science Center (SEFSC) would evaluate whether the reported overage represents an actual increase in landings or reflects improved data collection and monitoring. If the SEFSC determines the overage reflects improved data collection and monitoring, an AM would not be applied. The intent of this approach is to eliminate any incentive for fishermen to under-report or misreport catches to avoid exceeding ACLs and triggering associated AMs (CFMC 2016).

The extent to which the fishing season for a stock/stock complex would be shortened to account for a landings overage equates to the amount of time necessary to constrain landings to the ACL in the closure year. The length of an AM-based season reduction would be determined using an estimate of the landings rate for each month of the closure year. The monthly landings rate would be estimated based on either the most recent year for which data are available or an average of recent available data. Once determined, each monthly landings rate would be used, in a stepwise fashion, to calculate the number of months (or fraction thereof) for which harvest of a stock or stock complex must be prohibited in EEZ waters during the AM application year.

#### 5.13.4.2 Accountability Measures for Reef Fish and Spiny Lobster

For all reef fish for which harvest is allowed and for spiny lobster, landings would be evaluated relative to the applicable ACL based on annual or average landings, as described below.

<u>Process for Triggering an AM for Reef Fish and Spiny Lobster</u>
An AM would be triggered if commercial landings exceed the established ACL for that stock/stock complex, unless NMFS' SEFSC determines the overage occurred because data collection/monitoring improved rather than because catch increased.

Commercial landings from the following years, in order, would be used to evaluate an exceedance of the applicable ACL:

(1) Landings from 2018
(2) Landings from 2019
(3) Two-year average of landings from 2019 and 2020
(4) Three-year average of landings from 2019, 2020, and 2021
(5) Thereafter, a progressive running three-year average (2020-2022, 2021-2023, etc.).

The Regional Administrator in consultation with the Council may deviate from the specific time sequences based on data availability.

Process for Applying an AM for Reef Fish and Spiny Lobster

If an AM is triggered, NMFS would reduce the length of the fishing season for the applicable stock/stock complex for the applicable sector(s) the year following the overage determination by the amount necessary to ensure (to the greatest practicable extent) landings do not again exceed the ACL in the year of application. Any fishing season reduction resulting from an AM application would be applied from September 30 backward, toward the beginning of the fishing year. If the length of the required fishing season reduction exceeds the time period of January 1 through September 30, any additional fishing season reduction would be applied from October 1 forward, toward the end of the fishing year.

The Council would revisit the use of September 30 as the end date for AM-based closures every two years.

#### 5.13.4.3 Closure Provisions for Reef Fish and Spiny Lobster

*Restrictions applicable after a St. Croix EEZ closure for reef fish stock or stock complexes and spiny lobster:* During the closure period announced in the *Federal Register*, such stocks or stock complexes in or from the St. Croix EEZ may not be harvested, purchased, or sold and the bag and possession limits for such stocks or stock complexes in or from the St. Croix EEZ are zero.

#### 5.13.4.4 Accountability Measures for Pelagic Stocks

For pelagic stocks, which include dolphin and wahoo, an AM-based season length reduction in the event of an ACL overage would not be applied. Instead, the Council would establish an ACT as a percentage of the ACL that would serve as the AM (See Section 5.13.5 below).

Process for Triggering an AM for Pelagic Stocks

An AM would be triggered if the commercial landings exceed the ACT for the stock.

Commercial landings from the following years, in order, would be used to evaluate an exceedance of the ACT:

(1) Landings from 2018
(2) Landings from 2019
(3) Two-year average of landings from 2019 and 2020
(4) Three-year average of landings from 2019, 2020, and 2021
(5) Thereafter, a progressive running three-year average (2020-2022, 2021-2023, etc.).

The Regional Administrator in consultation with the Council may deviate from the specific time sequences based on data availability.

Process for Applying an AM for Pelagic Stocks

If an AM is triggered, the Council in consultation with the SEFSC would assess whether corrective action is needed.

#### 5.13.4.5 Accountability Measures for Queen Conch

In both territorial and federal waters around St. Croix, queen conch would continue to be managed based on both an ACL and a defined fishing season (November 1 of each year to May 31 of the following year [See Section 5.9.2]). If, based on in-season monitoring, the ACL is reached prior to the end of the fishing season, an AM is applied and harvest is closed.

#### 5.13.4.6 Closure Provisions for Queen Conch

When the ACL, as specified in Table 5.13.1, is reached or projected to be reached, the Regional Administrator will close the Caribbean EEZ to the harvest and possession of queen conch, in the area east of 64°34′ W. longitude which includes Lang Bank, east of St. Croix, USVI, by filing a notification of closure with the Office of the *Federal Register*. During the closure, no person may fish for or possess on board a fishing vessel, a Caribbean queen conch, in or from the Caribbean EEZ, in the area east of 64°34′ W. longitude.

#### 5.13.4.5 Accountability Measures for Stocks with Prohibited Harvest

The harvest prohibition for Nassau grouper, goliath grouper, midnight parrotfish, rainbow parrotfish, blue parrotfish, sea cucumbers, sea urchins, and corals would serve as the AM.

### 5.13.5 Annual Catch Target

Annual catch targets are discussed in Section 2.5. The following ACTs apply to pelagic stocks included in the St. Croix FMP. The ACTs were set at 90% of the ACL.

**Table 5.13.2.** Annual catch targets (ACT) for pelagic stocks in the St. Croix FMP.

| Stock/Stock Complex | ACT |
|---|---|
| Dolphin | 77,970 |
| Wahoo | 24,534 |

### 5.13.6 Stocks Under Rebuilding Plans

Three stocks and one stock complex were identified in the Caribbean SFA Amendment (CFMC 2005) as in need of rebuilding. The three stocks included queen conch (15-year plan), Nassau grouper (25-year plan), and goliath grouper (30-year plan). Each of those three stocks remains in a rebuilding status, and all provisions designed to ensure rebuilding within the defined time frames remain in place. Specifically, harvest of all three stocks remains prohibited in St. Croix EEZ waters. The rebuilding plan for the stock complex, Grouper Unit 4 (yellowfin, red, tiger, black), lasted ten years and ended in 2015. The rebuilding plans for these stocks are listed in the Caribbean SFA Amendment and are incorporated in here by reference (CFMC 2005).

Rebuilding plan for Nassau grouper: Rebuild Nassau grouper to BMSY in 25 years, using the formula TMIN (10 years) + one generation (15 years) = 25 years.

- 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.

- 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 Council's Reef Fish FMP in USVI and federal waters of the U.S. Caribbean.

Rebuilding plan for goliath grouper: Rebuild goliath grouper to BMSY in 30 years, using the formula TMIN (10 years) + one generation (20 years) = 30 years.

- 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.

Rebuilding plan for queen conch: Rebuild queen conch to BMSY in 15 years, using the formula TMIN (10 years) + one generation (5 years) = 15 years.

- 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.

- Develop a memorandum of understanding (MOU) between NMFS and the state governments to develop compatible regulations to achieve the management objectives set forth in the Council's Queen Conch FMP in state and federal waters of the U.S. Caribbean.

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# Chapter 6. Fishery Impact Statement

## 6.1 Cost of the Management Program Statement

TBD

Include factors affecting overall cost of implementing the FMP, not necessarily just a dollar amount. Include the fact that enforcement costs would be less as fishermen recognized role of stewardship results in fishermen help in conserving and managing the fisheries and habitats.

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# Chapter 7. Regulatory Impact Review

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# Chapter 8. List of Preparers

List of personnel that assisted with development of the St. Croix draft environmental assessment and fishery management plan.

**Table 8.1.** List of interdisciplinary plan team members.

| Name | Agency | Title |
|---|---|---|
| Bill Arnold | NMFS/SFD | Caribbean Branch Chief / Fishery Biologist |
| María del Mar López | NMFS/SFD | Co-lead / Fishery Biologist |
| Sarah Stephenson | NMFS/SFD | Fishery Biologist |
| Graciela García-Moliner | CFMC | Co-lead / Fishery Biologist |
| Miguel Lugo | NMFS/SFD | Fishery Biologist (Former Co-lead) |
| Michael Jepson | NMFS/SFD | Anthropologist |
| David Dale | NMFS/HCD | EFH Specialist |
| Kate Quigley | CFMC[66] | Economist |
| Karla Gore | NMFS/SFD | Fishery Biologist |
| Denise Johnson | NMFS/SFD | Economist |
| Jennifer Lee | NMFS/PRD | Fishery Biologist |
| Pat O'Brian | NMFS/PRD | Fishery Biologist |
| Michael Larkin | NMFS/SFD | Data Analyst |
| Shannon Cass-Calay | NMFS/SEFSC | Fishery Biologist |
| Jocelyn D'Ambrosio | NOAA/GC | Attorney |
| Iris Lowery | NOAA/GC | Attorney |
| Shepherd Grimes | NOAA/GC | Attorney |
| Adam Bailey | NMFS/SFD | Technical Writer |
| Jose Rivera | NMFS/HCD | EFH Specialist |
| Brent Stoffle | NMFS/SEFSC | Anthropologist |
| Lynn Rios | NOAA/OLE | Enforcement Officer |
| Noah Silverman | NMFS/SERO | Regional NEPA Coordinator |
| Nancie Cummings | NMFS/SEFSC | Biologist |
| Pace Wilber | NMFS | Habitat Specialist |
| Peggy Overbey | Contractor | Social Sciences |
| Walter R Keithly | CFMC | Economist |

NMFS = National Marine Fisheries Service, CFMC = Caribbean Fishery Management Council, SFD = Sustainable Fisheries Division, PRD = Protected Resources Division, SERO = Southeast Regional Office, HCD = Habitat Conservation Division, GC = General Counsel, SEFSC = Southeast Fisheries Science Center, OLE= Office of Law Enforcement

[66] Currently at NOAA Office for Coastal Management, South Carolina

# Chapter 9. List of Agencies, Organizations, and Persons Consulted

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 Southeast Division
United States Coast Guard
United States Department of the Interior
U.S. Virgin Islands Department of Planning and Natural Resources
Puerto Rico Department of Natural and Environmental Resources
Puerto Rico Junta de Calidad Ambiental (Puerto Rico Environmental Quality Board)

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# Appendices

## Appendix A. Outcomes from Scoping Hearings and Other National Environmental Policy Act Related Actions

The National Environmental Policy Act (NEPA) requires federal agencies to conduct an environmental review when proposing major federal actions. The environmental review is a multi-step process that involves (a) defining the proposed action, (b) determining the nature and significance of potential consequences of the action on the human environment, which guides the choice as to whether the action requires an Environmental Assessment (EA) or an Environmental Impact Statement (EIS), (c) completing an EA and publishing a Finding of No Significant Impact (FONSI), or (d) where there are the potential for significant impacts, meaning an EIS is required, publishing a Notice of Intent (NOI) to prepare an EIS, then (e) conducting initial scoping to determine relevant issues to be evaluated in the EIS, and (f) preparing the EIS. The EIS development process itself has two-steps, first requiring the preparation of a Draft EIS (DEIS) and the presentation of that DEIS to the public for comment, followed by a Final EIS (FEIS) that addresses as appropriate those public comments. The following paragraphs describe the process that the Council and NMFS used leading up to the preparation of this integrated DEIS/FMP, which evaluates alternative approaches for implementing island-based fishery management in the St. Croix EEZ and translates the Councils preferred solutions into a revised plan to manage those resources.

To initiate public discussion of the island-based approach to management in accordance with NOAA Administrative Order NAO 216-6 regarding compliance with NEPA[67], Council and NMFS staff prepared a scoping document for consideration by the Council at their April 2012 meeting. The scoping document included draft language regarding the purpose and need for shifting from species-based to island-based management, as well as alternative approaches to subdividing the island management zones (two, three, or four island approach) and other considerations for and implications of making the shift. The Council directed staff to conduct initial scoping hearings regarding the general concepts of island-based management throughout Puerto Rico and the USVI, during July 2012, and to inform the Council at their August 2012 meeting of the outcomes from those scoping hearings. Scoping hearings were held at various sites throughout Puerto Rico on July 23 (San Juan), July 24 (Naguabo), July 25 (Mayagüez) and July 26 (Ponce), and in the USVI on July 24 (St. Thomas) and July 25 (St. Croix).

[67] On April 22, 2016, NOAA issued NAO 216-6A, which supersedes NAO 216-6 and, together with the Companion Manual to NAO 216-6A, provides NOAA's policies and procedures for compliance with NEPA.

At their August 2012 meeting, the Council was informed of perspectives and concerns regarding island-based management obtained at the July 2012 scoping hearings. There was consensus support for the management transition at all scoping hearings, and a clear preference for subdividing the islands into three management groups (Puerto Rico, St. Thomas/St. John, St. Croix) as opposed to the two island (Puerto Rico/St. Thomas/St. John, St. Croix) or four island (Puerto Rico, St. Thomas, St. John, St. Croix) options. Based on that public response, the Council directed staff to prepare an EA titled: *Development of Island-Based FMPs in the U.S. Caribbean: Transition from Species Based FMPs to Island Based FMPs* (NMFS 2014) to thoroughly analyze the issues associated with transitioning from species-based to island-based management, to evaluate the impact of incorporating most current regulations under the Reef Fish, Spiny Lobster, Queen Conch, and Coral FMPs into each of the FMPs for Puerto Rico, St. Thomas/St. John, and St. Croix, and to provide the public with a full and formal evaluation of the impacts of such a shift in federal fisheries management in the U.S. Caribbean region. The Council and NMFS provided an opportunity to submit verbal or written comments on the proposed action. Soliciting public comment ensured the public was provided a thorough and transparent opportunity to comment on the basic concept of an island-based management approach prior to committing Council and NMFS resources to the substantial job of preparing the requisite EISs and FMPs. A draft EA was presented to the Council at their March 2013 meeting. At that meeting, the Council formally decided to initiate the transition from species-based fisheries management to island-based fisheries management.

As a first step in developing the island-based FMPs, at their March 2013 meeting, the Council directed staff to prepare three island-specific scoping documents and to hold a second round of scoping hearings in summer 2013 to receive public feedback on possible actions and alternatives to consider while developing each of the Puerto Rico, St. Thomas/St. John, and St. Croix FMPs. The pertinent scoping document was presented at scoping hearings throughout Puerto Rico (Vieques on July 8, San Juan on July 9, Naguabo on July 11, Arecibo on July 12, Mayagüez on August 5, and Ponce on August 6), on St. Croix (July 9), and on St. Thomas (August 5). Of the roughly 150 total attendees across these eight hearings, only one attendee expressed any opposition to the proposed alternative approaches to development of island-based management. Though supportive of the approach, the attendees provided numerous suggestions as to how fishery management in the U.S. Caribbean EEZ could be enhanced. Ideas ranged from better use of marine protected areas to better management of recreational fisheries.

Coincident with the 2013 scoping hearings, and to ensure broad and substantial public input on this proposed change in U.S. Caribbean fisheries management, NMFS published an initial NOI to prepare an EIS evaluating alternative approaches to developing island-based management of U.S. Caribbean fisheries. The NOI published in June 2013 with a 30-day comment period,

during which nine written comments were received. All expressed general support for transitioning from species-based to island-based management.

In response to public comments submitted at the July 2013 scoping hearings and via written response to the initial NOI, the Council at their December 2013 meeting reviewed and approved a preliminary list of actions and alternatives designed to form the foundation of the shift to island-based management. The Council then directed staff to hold a third round of scoping hearings during spring 2014 to obtain comments on this more robust set of actions and alternatives. Scoping hearings were held in the Puerto Rico municipalities of Hatillo (April 7), Mayaguez (April 8), Naguabo (April 9), San Juan (April 10) and Ponce (April 11), and on both St. Thomas (April 7) and St. Croix (April 8). Much of the input received at these hearings was outside the scope of the island-based FMP development process. Pertinent comments focused on the need to enhance management of recreational fisheries, add species such as octopus and sea urchins to the management regime, and manage Puerto Rico by coast rather than as a single entity.

A Supplemental NOI was published contemporaneous with the 2014 scoping hearings, once again to ensure broad and substantial public input on the complex topic of island-based fishery management. Four comments were received during the 30-day comment period, including one comment requesting that a longer comment period be provided. In response to that comment, a second Supplemental NOI was published in May 2014. Fourteen written comments were submitted during the 90-day comment period. The majority of the 18 total written comments supported island-based management, although some comments disagreed with the approach. Most of the comments in disagreement opined that stocks should be managed at a species rather than stock level, but such comments represented a minority of the total. Supportive comments noted that island-based management would provide an opportunity to implement an ecosystem-based fishery management approach, and offered suggestions for improving on island-based management, including developing and relying on better data and better science and more effectively using local knowledge.

Since March 2013, the Council has been developing a *Comprehensive Fishery Management Plan for the St. Croix Exclusive Economic Zone* (St. Croix FMP) to implement island-based fishery management in St. Croix. At the same time, the Council and NMFS developed a DEIS to describe alternative solutions and compare the direct, indirect, and cumulative environmental impacts of those alternative approaches proposed for inclusion in the St. Croix FMP, on the social, biological, economic, ecological, and administrative environments. The new St. Croix FMP would then apply the Council's preferred solution, applying the best available scientific information regarding the management of fisheries in St. Croix EEZ waters, within the context of federal fisheries management in the U.S. Caribbean. Alternatives considered in the DEIS

analyzing the St. Croix FMP include a “no action” alternative, which essentially maintains provisions established in the species-based FMPs, as well as a range of viable alternative approaches for revising the management of U.S. Caribbean fisheries.

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# Appendix B. Other Applicable Law

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

**Administrative Procedures Act (APA)**

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

**Coastal Zone Management Act (CZMA)**

The 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, NMFS 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. NMFS may presume State agency concurrence if the State agency's response is not received within 60 days from receipt of the agency's consistency determination and supporting information as required by 15 C.F.R. §930.41(a).

**Data Quality Act**

The Data Quality Act (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

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

**Endangered Species Act (ESA)**

The ESA of 1973 (16 U.S.C. Section 1531 et seq.) requires federal agencies to ensure actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of threatened or endangered species or the habitat designated as critical to their survival and recovery. The ESA requires federal agencies to consult with the appropriate administrative agency (NMFS for most marine species, and the U.S. Fish and Wildlife Service for all remaining species) when proposing an action that may jeopardize the continued existence of threatened or endangered species or destroy or adversely modify critical habitat. Consultations are necessary to determine the potential impacts of the proposed action. They are concluded informally when proposed actions may affect but are "not likely to adversely affect" threatened or endangered species or designated critical habitat. Formal consultations, resulting in a biological opinion, are required when proposed actions may affect and are "likely to adversely affect" threatened or endangered species or designated critical habitat.

A summary of recent completed consultations of the Council's previous FMPs can be found in Appendix D.

**Marine Mammal Protection Act (MMPA)**

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

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.
This section will be updated soon.

**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 NMFS to obtain approval from the Office of Management and Budget before requesting most types of fishery information from the public. This action does not contain a collection-of-information requirement for purposes of the PRA.

**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. 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 assess how those regulations will affect small businesses.

**Magnuson-Stevens Fishery Conservation and Management 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

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effects on that EFH caused by fishing, and identify other actions to encourage the conservation and enhancement of that EFH.

The areas affected by the proposed action have been identified as EFH for queen conch, spiny lobster, corals, and reef fish. As specified in the Magnuson-Stevens Act, EFH consultation is required for federal actions which may adversely affect EFH.

**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 Purpose and Need can be found in Section 1.2, Alternatives are found in Chapters 4-8, the Environmental Consequences are also found in Chapters 4-8, the List of Preparers is in Chapter 14, and a list of the agencies/people consulted is found in Chapter 15.

**Regulatory Flexibility Act (RFA)**

The purpose of the Regulatory Flexibility Act (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 (Initial Regulatory Flexibility Analysis [IRFA] and Final Regulatory Flexibility Analysis [FRFA]) 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 the 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.

## Executive Orders

### 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. The NOAA Office of General Counsel will determine whether a Takings Implication Assessment is necessary for this amendment.

### E.O. 12866: Regulatory Planning and Review

Executive Order 12866, signed in 1993, requires federal agencies to assess the costs and benefits of their proposed regulations, including distributional impacts, and to select alternatives that maximize net benefits to society. To comply with E.O. 12866, NMFS prepares a Regulatory Impact Review (RIR) for all fishery regulatory actions that 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 analysis.

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

This Executive Order mandates that each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions. See Section 3.11 for Environmental Justice considerations as they relate to this fishery management plan.

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**E.O. 12962: Recreational Fisheries**

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

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

**E.O. 13089: Coral Reef Protection**

The Executive Order on Coral Reef Protection (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).

The actions in this FMP/DEIS will have no direct impacts on coral reefs. Regulations are already in place to limit or reduce impacts to coral reef habitat in the U.S. Caribbean EEZ. In addition, NMFS approved and implemented the 2011 Annual Catch Limit (ACL) Amendment, which established ACLs and accountability measures for species within the Corals and Reef Associated Plants and Invertebrates FMP. These actions aim to prevent overfishing of coral reef resources, which contain species that play important roles on coral reef ecosystems of the U.S. Caribbean.

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**E.O. 13132: Federalism**

The Executive Order on Federalism requires agencies, when formulating and implementing policies, to be guided by the fundamental Federalism principles. The Order serves to guarantee the division of governmental responsibilities between the national government and the states that was intended by the framers of the Constitution. Federalism is rooted in the belief that issues not national in scope or significance are most appropriately addressed by the level of government closest to the people. This Order is relevant to FMPs and amendments given the overlapping authorities of NMFS, the states, and local authorities in managing coastal resources, including fisheries, and the need for a clear definition of responsibilities. It is important to recognize those components of the ecosystem over which fishery managers have no direct control and to develop strategies to address them in conjunction with appropriate international, State, Tribal, and local entities. No Federalism issues have been identified relative to the action proposed in this regulatory amendment. Therefore, consultation with state officials under Executive Order 13132 is not necessary.

**E.O. 13112: Invasive Species**

This Executive Order requires agencies to use their authority 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 FMP 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. 13158: Marine Protected Areas (MPA)**

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. This action is not expected to affect any MPA in federal waters of the U.S. Caribbean.

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# Appendix C. History of Federal Fisheries Management

Tables C.1-C.4 summarize actions in the Caribbean Fishery Management Council's (Council) four species-based fishery management plans (FMP): FMP for the Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands (USVI) (Reef Fish FMP), FMP for the Spiny Lobster Fishery of Puerto Rico and the USVI (Spiny Lobster FMP), FMP for the Queen Conch Resources of Puerto Rico and the USVI (Queen Conch FMP), and the FMP for Corals and Reef Associated Plants and Invertebrates of Puerto Rico and the USVI (Coral FMP), and their respective amendments. Not all details are included in the tables. Please refer to the respective proposed and final rules to obtain more information.

## C.1 Reef Fish FMP

**Table C.1**. History of management for the Reef Fish FMP and subsequent amendments and regulatory actions.

| Fishery Management Plan (FMP) or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| FMP for the Shallow-water Reef Fish Fishery (1985) | 9/22/1985; except *669.24(a)(1) which became effective on 9/22/1986 | FR: 50 FR 34850 (8/28/1985) | - Identified the fishery management unit (FMU) to include 64 shallow water reef fish distributed among 14 families as the most commonly landed species in Puerto Rico and the USVI. These 64 species accounted for 60% of the total finfish landings in the area extending from shoreline to the edge of the insular platform;<br>- Identified the maximum sustainable yield (MSY) and the optimum yield (OY) to be 7.7 million pounds (mp) for the entire shallow-water reef fish FMU;<br>- Concluded that local fishermen were harvesting 100% of the OY. Therefore, there was no remaining harvest identified for foreign fishing;<br>- Established a minimum mesh size for fish traps of 1 ¼ to allow for the escape of juvenile fish;<br>- Required a self-destruct panel (not smaller than the funnel opening of the trap) and/or self-destruct door fastening in fish traps;<br>- Required owner identification and marking of traps, buoys, and boats in |

| Fishery Management Plan (FMP) or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| *(Cont. FMP for the Shallow-water Reef Fish Fishery)* | | | the EEZ. Marking/identification systems required by the Puerto Rico and USVI management agencies can be used by fishermen of those states to meet the federal marking requirements;<br>- If the state(s) eliminates the marking system or a fisherman will fish only in the U.S. Caribbean EEZ, an identification number and color code will be assigned by the NMFS Southeast Regional Director upon application;<br>- Prohibited the hauling or tampering of another person's traps without the owner's written permission, except by authorized enforcement officer to alleviate the theft of fish traps.<br>- Prohibited the use of poisons, drugs, other chemicals, and explosives for fishing in the management area as these practices do not discriminate between species or species sizes and are detrimental to the environment;<br>- Required a minimum size for yellowtail snapper of eight inches total length (TL) the first year following implementation, increasing one inch per year until reaching 12 inches TL;<br>- Required a minimum size for Nassau grouper of 12 inches TL the first year following implementation, increasing one inch per year until reaching 24 inches TL;<br>- Established a closed season for Nassau grouper to protect their spawning aggregations. Landings were prohibited from January 1 to March 31 of each calendar year; fish of this species caught during the closed season had to be returned to the sea immediately with minimum injury in such a manner as to ensure maximum probability of survival;<br>- Increased the collection of catch/effort and length/frequency data, as well as any necessary biological information, |

| Fishery Management Plan (FMP) or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| | | | through improvement of the existing state-federal agreements formulated by NMFS/Puerto Rico (PR)/USVI and/or Council's own data gathering program;<br>- Described the characteristics of the habitat used by the stocks in the shallow water reef fish FMU.<br>- *669.24 - Fish traps must have a minimum mesh size of 1 ¼ inches in the smallest dimension of the opening. |
| Emergency Interim Rule | | | - To close fishing in area in St. Thomas |
| Amendment #1 to the Reef Fish FMP 1990 | 11/29/1990, except 669.24(a)(1), which became effective on 9.14.1991 | FR: 55FR 46214 | - Increased the minimum mesh size from 1 ¼ in to 2 in to further reduce bycatch of juveniles and herbivorous fish essential to the maintenance of the reef ecosystem balance;<br>- Prohibited the harvest and possession of Nassau grouper due to low abundance;<br>- Revised the data collection efforts to include the collection of socioeconomic information on the different managed fisheries;<br>- Per request of the St. Thomas and St. John fishermen, the Council established an annual December 1 through February 28 closed area (Hind Bank) southwest of St. Thomas where the use of any fishing gear capable of capturing reef fish, such as fish traps, hook and line, and spear is prohibited during this time[68].<br>- Defined overfishing (OF) and overfished conditions for shallow water reef fish;<br>- Established management measures, which the Council could implement via the framework process. |

[68] The Hind Bank Marine Conservation District was established through Amendment 1 to the Coral FMP in 1999. This amendment established the current fishing (all) and anchoring prohibitions year-round.

| Fishery Management Plan (FMP) or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| Regulatory Amendment #1 to the Reef Fish FMP (1991) | 9/20/1991, except that 669.24(a)(3) is effective 09/20/1991 through 09/13/1993 | FR: 56 FR 48755 | - Modified the minimum mesh size and degradable panel requirements for fish traps: Minimum allowable mesh sizes for fish traps:<br>▪ 1.5 inches (3.8 centimeters) for hexagonal mesh;<br>▪ 1.5 inches for square mesh through September 13, 1993; and<br>▪ 2.0 inches (5.1 centimeters) for square mesh, effective September 14, 1993.<br>- Added more specific requirements for degradable panel on fish traps. |
| Amendment #2 to the Reef Fish FMP (1993)<br><br>*(Cont. Amendment #2)* | 11/15/1993 | FR: 58 FR 53145 | - Expanded the existing FMU to include the following deep-water reef fish to address their decline in landings: tiger grouper, black snapper, queen snapper, blackfin snapper, silk snapper, wenchman, vermilion snapper, yellowedge grouper, red grouper, misty grouper, tiger grouper, greater amberjack, almaco jack, blackline tilefish, and sand tilefish;<br>- Extended protection to the aquarium trade finfish species (included them in the FMU);<br>- Prohibited the use of chemical substances or other destructive devices to harvest aquarium trade species, limited gear to hand-held dip nets and slurp guns;<br>- Prohibited the harvest and possession of certain aquarium trade species:<br>▪ Live red hind (*Epinephelus guttatus*) and mutton snapper (*Lutjanus analis*) juveniles to allow for the recovery of these rebuilding species;<br>▪ Seahorses (*Hippocampu*s spp.) and basslets (*Liopropom*a) due to their scarcity;<br>▪ Coney (*Epinephelus fulvus*) and queen triggerfish (*Balistes vetula*) juveniles to avoid over harvest and user conflict as these were important |

| Fishery Management Plan (FMP) or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| *(Cont. Amendment #2)* | | | species both commercially and recreationally;<br>▪ Foureye butterflyfish (*Chaetodon capistratus*), banded butterflyfish (*C. striatus*) longsnout butterlfyfish (*C. aculeatus*), due to their high mortality in captivity;<br>▪ Certain species of wrasses, basslets, and angelfishes notably *Thalassoma bifasciatum*, *Bodianus rufus*, *Gamma loreto*, and *Pomacanthus paru* due to their impotance to the reef ecosystem.<br>- Recommended continued assessments of heavily fished aquarium trade species such as royal gramma (*Gramma loreto)*, rock beauty (*Holacanthus tricolor)*, yellowhead jawfish (*Opistognathus aurifrons)*, french angelfish (*Pomacanthus paru)*, queen angelfish *(Holacanthus ciliaris)*, pygmy angelfish *Centropyge argi)*, bluehead wrasse *(Thalassoma bifasciatum)*, puddingwife wrasse Halichoeres radiatus), blue chromis (*Chromis cyanea)*, and redlip blenny (*Ophioblennius atlanticus)*.<br>- Retitled the FMP from the Shallow Water Reef Fish FMP to the FMP for the Reef Fish Fishery of Puerto Rico and the USVI;<br>- 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;<br>- Required that the fish traps be constructed as follows:<br>▪ Basic construction material must be 1.5-in hexagonal mesh wire or 2.0-in square mesh wire;<br>▪ Escape openings in the trap must be at least 8x8 in and located on any two |

| Fishery Management Plan (FMP) or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| | | | sides (except top, bottom, or side containing the funnel);<br>▪ Access door may serve as an escape opening provided it meets all the requirements for size and location, and is fastened in such a manner that the door will fall open when the fasteners degrade;<br>▪ Panels covering escape openings must be of a mesh at least as large as the mesh used in constructing the trap, and fastened with untreated jute twine 1/8-in or less in diameter when traps are fitted with zinc anodes; or fastened with 18-gauge ungalvanized wire or 1/8-in untreated just twine (maximum diameter) if anodes are not used;<br>- Prohibited the harvest of Goliath grouper in the U.S. Caribbean EEZ;<br>- Established prohibitions on red hind harvest to protect spawning aggregations from December 1 through February 28 each year within the Tourmaline Bank area off the west coast of Puerto Rico and the Lang Bank area off the east coast of St. Croix;<br>- Prohibited all fishing from March 1 through June 30 of each year within the Mutton Snapper Spawning Aggregation Area southwest of St. Croix. |
| Technical Amendment to the Reef Fish FMP (1994) | 3/11/1994 | 59 FR 11560 | - Modified the regulations regarding minimum allowable mesh size to be the distance between the centers of strands rather than the smallest dimension of the opening, consistent with industry standards. |
| Regulatory Amendment #2 to the Reef Fish FMP (1996) | January 1997 | 61 FR 64485 | - Reduced the size of the Tourmaline Bank closed area originally implemented in 1993;<br>- Established seasonal closures in two additional areas off the west coast of Puerto Rico (Abrir La Sierra Bank and Bajo de Sico); |

| Fishery Management Plan (FMP) or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| | | | - Closed the EEZ portions in three areas to all fishing between December 1 and February 28, each year:<br>▪ 1.5 mile radius centered around a buoy to be deployed in the area known as Bajo de Sico;<br>▪ 1.5 mile radius around Buoy 8 at Tourmaline Bank (this is part of the area already closed but it allows for the use of the sandy area where red hind are not found);<br>▪ 1.5 mile radius around Buoy 6 at Abrir La Sierra Bank. |
| Amendment #3 to the Reef Fish FMP (2005)<br><br>Part of the Caribbean Sustainable Fisheries Act Amendment | 11/28/2005 | PR:70 FR 53979<br>FR:70 FR 62073 | - Amended current requirements for trap construction such that only one escape panel is required, which could be the trap door (modifying the regulation implemented through Regulatory Amendment 1, which required that each fish trap contained two degradable (escape) panels in addition to a self-destruct door fastening);<br>▪ The degradable panel must be at least 8 x 8 in and with mesh not smaller than the mesh of the trap;<br>- Individual traps or pots must have at least one buoy attached that floats on the surface;<br>- 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;<br>- Prohibited the use of gillnets and trammel nets in the EEZ, with the exception of those nets used for catching ballyhoo, gar, and flying fish. Nets used for the harvest of these species must be tended at all times;<br>- Prohibited the use of bottom tending gear (traps, pots, gillnets, trammel nets, bottom longlines) in the seasonally closed areas of Tourmaline, Bajo de Sico, Abrir la Sierra, Lang Bank, the |

| Fishery Management Plan (FMP) or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| *(Cont. Amendment #3 [SFA Amendment 2005])* | | | Mutton Snapper Spawning Aggregation Area, and Grammanik Bank.<br>- Required an anchor retrieval system for anyone fishing for or possessing reef fish species;<br>- Prohibited the filleting of fish at sea;<br>- Established a seasonal closure in the area known as Grammanik Bank south of St. Thomas prohibiting all fishing from February 1 – April 30 of each year<br>- Established seasonal closures (no fishing or possession), every year during the specified months, for:<br>▪ Silk, black, blackfin and vermillion snapper from October 1 through December 31;<br>▪ Tiger, yellowfin, yellowedge, red and black from February 1 through April 30;<br>▪ Red hind from December 1 through the last day of February;<br>▪ Lane and mutton snapper from April 1 through June 30.<br>- In the absence of MSY estimates, 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 was 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.<br>- For each FMU sub-unit for which $B_{CURR}/B_{MSY}$ and $F_{CURR}/F_{MSY}$ had 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: 1) For species believed not to be "at risk" based on the best available information, |

| Fishery Management Plan (FMP) or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| *(Cont. Amendment #3 [SFA Amendment 2005])* | | | the $F_{CURR}/F_{MSY}$ proxy was estimated as 0.75 and the $B_{CURR}/B_{MSY}$ proxy estimated as 1.25; 2) For species for which no positive or negative determination could be made on the status of their condition, the default proxies for $F_{CURR}/F_{MSY}$ and $B_{CURR}/B_{MSY}$ were estimated as 1.00; and 3) For species that were believed to be "at risk" based on the best available information, the $F_{CURR}/F_{MSY}$ proxy was estimated as 1.50 and the $B_{CURR}/B_{MSY}$ proxy estimated as 0.75.<br>- Defined OY equal to the average yield associated with fishing on a continuing basis at $F_{OY}$; where $F_{OY} = 0.75F_{MSY}$.<br>- Defined MSST = $B_{MSY}(1-c)$; where c = the natural mortality rate (M) or 0.50, whichever is smaller.<br>- Specified an MSY control rule to define ABC = $F_{MSY}(B)$. When the data needed to determine $F_{MSY}$ were not available, use natural mortality (M) as a proxy for $F_{MSY}$.<br>- Specified an OY control rule to define target catch limits such that they equal $F_{OY}(B)$.<br>- In the case of a sub-unit with multiple M values, the lowest documented M value would be used in this formula to reduce the risk that the most vulnerable species in a particular sub-unit would be overexploited. The specific MSST values that would be defined by this alternative in accordance with the preferred MSY alternatives are presented for each stock or complex;<br>- Rebuild Nassau grouper to $B_{MSY}$ in 25 years, using the formula $T_{MIN}$ (10 years) + one generation (15 years) = 25 years.<br>- Rebuild Goliath grouper to $B_{MSY}$ in 30 years, using the formula $T_{MIN}$ (10 years) + one generation (20 years) = 30 years. |

| Fishery Management Plan (FMP) or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| *(Cont. Amendment #3 [SFA Amendment 2005])* | | | - Rebuild grouper unit 4 to $B_{MSY}$ in 10 years;<br>- Eliminated existing regulations defining a marine aquarium fish as "a Caribbean reef fish that is smaller than 5.5 inches (14.0 cm) TL" and restricting the harvest gear for marine aquarium fish to hand-held dip nets or hand-held slurp guns (50 CFR 622.41§(b));<br>- Eliminated the regulation prohibiting the harvest and possession of butterflyfish and seahorses from federal waters of the U.S. Caribbean (50 CFR §622.32(b)(1)(ii));<br>- Described and identified essential fish habitat (EFH) according to functional relationships between life history stages of Council managed species and Caribbean marine and estuarine habitats;<br>- Designated habitat areas of particular concern (HAPCs) in the Reef Fish FMP based on confirmed spawning locations and on areas or sites identified as having particular ecological importance to managed species. |
| Amendment #4 to the Reef Fish FMP (started in 1997, but postponed)<br><br>To implement escape vents in the trap fishery | POSTPONED | N/A<br><br>NOI:72 FR 57307 | N/A |
| Regulatory Amendment #3 to the Reef Fish FMP (2010)<br><br>To address management in Bajo de Sico, Puerto Rico<br><br>*The Final rule included other management measures not part of the amendment. | 12/2/2010 | PR: 75 FR 44209 (7/28/2010)<br>FR: 75 FR 67247 | - Extended the original length of the yearly seasonal closure for Bajo de Sico from December 1 through February 28 (3-months) to October 1 through March 31 (6-months);<br>- Prohibited fishing for or possession of Council-managed reef fish species in Bajo de Sico;<br>- Prohibited anchoring year-round within the Bajo de Sico closed area. Fishing for highly migratory species (HMS), coastal migratory pelagics (dolphin, |

| Fishery Management Plan (FMP) or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| | | | wahoo, jacks, and mackerel) and spiny lobster would be allowed all year.<br>- *The final rule added spear to the list of allowable gear in the commercial sector of the Caribbean reef fish fishery and revised the title of the FMP in the list of authorized fisheries and gear. |
| Amendment #5 to the Reef Fish FMP (2011)<br><br>Part of the 2010 Caribbean Annual Catch Limit (ACL) Amendment | 1/30/2012 | PR: 76 FR 66675<br>FR: 76 FR 82404 | - Prohibited harvest of midnight, blue, and rainbow parrotfish to address potential overharvest of these species due to their combination of large body size, a high susceptibility to spear gear and fish traps, relatively low resilience in comparison with other Caribbean parrotfish species, and lack of abundance compared with most parrotfish occupying U.S. Caribbean waters;<br>- Amended the stock complexes in the Reef Fish FMUs:<br>▪ Separated grouper unit (GU) 4 into GU4 (yellowfin, red, tiger [black grouper was added to GU4]) and GU5 (yellowedge, misty).<br>▪ Removed creole fish from GU3 and fisheries management<br>▪ Modified the snapper FMU by adding cardinal snapper to snapper unit (SU) 2 and moved wenchman to SU1;<br>- Specified ACLs and accountability measures (AMs) for species undergoing overfishing (snappers, groupers, parrotfish, and queen conch) to end and prevent overfishing of species considered overfished or undergoing overfishing.<br>- Established or redefined management reference points, including a proxy for maximum sustainable yield (MSY proxy) and an estimate of OY, OFLs, for species undergoing overfishing (snappers, groupers, queen conch, parrotfish). Established ABCs for parrotfish and queen conch. |

| Fishery Management Plan (FMP) or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| *(Cont. Amendment #5 to the Reef Fish FMP 2011)* | | | - Modified existing management measures as needed to constrain harvest to specified ACLs.<br>- Specified separate commercial and recreational ACLs in Puerto Rico based on the preferred management reference point time series;<br>- Allocated the ACLs in the U.S. Caribbean EEZ by island groups (i.e. Puerto Rico, St. Thomas/St. John, and St. Croix) according to the subzones established in the 2010 Caribbean ACL amendment;<br>- Established a recreational aggregate bag limit for snapper, grouper, and parrotfish of five per fisher per day including not more than two parrotfish per fisher per day. A vessel limit was also established, limiting recreational harvest to an aggregate of 15 snapper, grouper, and parrotfish per day of which no more than six can be parrotfish;<br>- Modified framework measures for the Reef Fish FMP established in Amendment 1. |
| Amendment #6 to the Reef Fish FMP (2011)<br><br>Part of the 2011 Caribbean ACL Amendment | 1/30/2012 | PR: 76 FR 68711<br>FR: 76 FR 82414 | - For the reef fish species that were not determined to be undergoing overfishing and therefore not included in Amendment 5, redefined management reference points, including MSY, OFL, ABC, and established ACLs and AMs.<br>- For those species included in Amendment 6, allocated ACLs among island management areas;<br>- Established aggregate recreational bag limits for angelfish, boxfish, goatfish, grunts, wrasses, jacks, scups and porgies, squirrelfish, triggerfish and filefish, tilefish:<br>▪ 5 fish per person/day or, if 3 or more persons are aboard, 15 fish from aggregate per vessel/day, but not to |

| Fishery Management Plan (FMP) or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| | | | exceed: 1 surgeonfish per person/day or 4 surgeonfish per vessel/day.<br>- Redefined management reference points, including MSY, OFL, ABC, ACL, AMs;<br>- Allocated the ACLs for the 2011 species by each island's subzone;<br>- Aquarium trade species listed in both the Coral FMP and the Reef Fish FMP into a new FMP specific to aquarium trade species would be moved into a new FMP, however this is still pending. |
| Regulatory Amendment #4 to the Reef Fish FMP (2013)<br><br>Addressed parrotfish in St. Croix, USVI | 8/29/2013 | PR:78 FR 15338<br>FR:78 FR 45894 | - Established a commercial and recreational minimum size limit for parrotfish harvest in the federal waters off St. Croix, USVI:<br>▪ Minimum size limit of 8 inches (20.3 cm), fork length, for redband parrotfish (*Sparisoma aurofrenatum*)<br>▪ Minimum size limit of 9 inches (22.9 cm), fork length, for all other parrotfish: princess, queen, striped, redtail, stoplight, redfin.<br>- The current harvest prohibition for midnight, blue, and rainbow parrotfish remains in effect. |
| Amendment #7 to the Reef Fish FMP (2016)<br><br>Revised language to reflect current regulatory language | 06/10/2016 | NOA: 81 FR 5978<br>PR: 81 FR 9800<br>FR: 81 FR 29166 | - Revised language within the Reef Fish FMP to be consistent with language in the implementing regulations at 50 CFR Part 622 describing the application of AMs in the U.S. Caribbean EEZ |
| Amendment #8 to the Reef Fish FMP (2016)<br><br>Modified date of implementation of AM-based closures | 06/08/2017 | NOA: 82 FR 1308<br>PR: 82 FR 10324<br>FR: 82 FR 21475 | - Modified the date for implementation of an AM-based closure in the event of an ACL overage for a species/species group managed by the Council in Puerto Rico, St. Thomas/St. John, and St. Croix under the Reef Fish, Coral, and Spiny Lobster FMPs. An AM-based closure will be implemented from September 30 of the closure year backward, toward the beginning of the fishing year, for the number of days necessary to achieve the reduction in |

| Fishery Management Plan (FMP) or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| | | | landings required to ensure landings do not exceed the applicable ACL.<br>- Required that the Council revisit using September 30 as the end date for AM-based closures no longer than 2 years from the implementation of the amendment and no longer than every 2 years thereafter. |
| Regulatory Amendment #6 to the Reef Fish FMP(2017)<br><br>Revised the method used to trigger the application of AMs for Council managed-reef fish species/species groups in the Puerto Rico EEZ | 1/2/2018 | PR: 82 FR 43733<br>FR: 82 FR 56917 | - Applies only to reef fish stocks and stock complexes in the EEZ off Puerto Rico, as these are the only stocks/stock complexes currently managed by separate commercial and recreational sector ACLs in U.S. Caribbean federal waters.<br>- Revised method used to trigger the application. Required application of an AM to either the recreational or commercial sector of a stock/stock complex only if NMFS determines that both the sector-specific ACL and the total (combined recreational and commercial) ACL were exceeded, and the exceedance is not the result of enhanced data collection and monitoring efforts.<br>- The purpose of this final rule is to increase the likelihood that OY is achieved on a continuing basis and to minimize, to the extent practicable, adverse socioeconomic effects of AM-based closures. |

## C.2 Spiny Lobster FMP

**Table C.2**. History of management for the Spiny Lobster FMP and subsequent amendments and regulatory actions.

| Fishery Management Plan or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| Spiny Lobster FMP (1981) | 1/1981 | FR: 49 FR 50049 | - Defined the Caribbean spiny lobster fishery management unit (FMU) to include *Panulirus argus*, described objectives for the management of the spiny lobster fishery, and established management measures to achieve those objectives.<br>- Defined the maximum sustainable yield (MSY) for the spiny lobster fishery at 830,000 pounds (lbs) per year, which is the greatest amount or yield that can be sustainably harvested under prevailing environmental conditions;<br>- Defined the U.S. Caribbean-wide optimum yield (OY) as "all the non-egg-bearing spiny lobsters in the management area having a carapace length (CL) of 3.5 inches (in) or greater, that can be harvested on an annual basis;"<br>- Established a domestic annual harvest under the proposed CL of 3.5 in;<br>- Size and harvest requirements included:<br>▪ Land lobster whole and with a CL equal or larger than 3.5 in;<br>▪ No retention of egg-bearing (berried) lobsters (berried female lobsters may be kept in pots or traps until the eggs are shed), no stripping or removing the eggs from a lobster, undersized lobster may be kept in the fish pots as attractors but may not be harvested;<br>- Gear requirements included:<br>▪ Include a self-destruct panel |

| Fishery Management Plan or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| *(Cont. Spiny Lobster FMP)* | | | and/or self-destruct door fastenings on traps and pots to eliminate "ghost traps;"<br>▪ Identify and mark traps, pots, buoys, and boat;<br>▪ Prohibit the use of poisons, drugs, or other chemicals, and use of spears, hooks, explosives, or similar devices to take spiny lobsters, reducing injury to lobsters that if landed would be illegal to retain;<br>▪ Report catch and effort information through improvement of the existing data collection systems.<br>- Defined the U.S. Caribbean spiny lobster stock, although the question of whether or not biologically distinct sub-stocks of *P. argus* may be identified was not resolved. For the purpose of the Spiny Lobster FMP, three biological assessments areas (distinguished by their user groups and geography) were assumed: (1) Puerto Rico, (2) St. Thomas and St. John, and (3) St. Croix. A single OY was established. |
| Amendment #1 to the Spiny Lobster FMP (1990) (addressing overfishing) | May 1991 | FR: 56 FR 19098 | - Implemented definitions for overfished and overfishing, outlined framework actions that could be taken by the Council should overfishing occur, and better described the habitat for the spiny lobster;<br>- Defined "overfished" as a biomass level below 20 percent of the spawning potential ratio (SPR) and defined "overfishing" as a harvest rate that is not consistent with a program implemented to rebuild the stock to the 20% SPR.<br>- Established management measures to halt overfishing should overfishing |

| Fishery Management Plan or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| | | | occur. |
| Amendment #2 to the Spiny Lobster FMP (2005)<br><br>Part of the Caribbean Sustainable Fisheries (SFA) Act | 11/28/2005 | PR: 70 FR 53979<br>FR: 70 FR 62073 | - Redefined the MSY from 830,000 lbs to 547,000 lbs per year; OY to 513,000 lbs, ABC/MFMT = 547,000 lbs, defined the MSST = $B_{MSY}(1-c)$; where c = the natural mortality rate (M) or 0.50, whichever is smaller.<br>- Minimized bycatch and bycatch mortality to the extent practicable;<br>- Described and identified essential fish habitat (EFH) and habitat areas of particular concern for the spiny lobster;<br>- Established modifications to anchoring techniques, modified construction specifications for pots/traps, and closed areas to certain recreational and commercial fishing gear (i.e., pots /traps, gill/trammel nets, bottom longlines) to prevent, mitigate, or minimize adverse fishing impacts to EFH in the U.S. Caribbean EEZ. Including:<br>▪ Require at least one buoy that floats on the surface on all individual traps/pots;<br>▪ Require at least one buoy at each end of trap lines linking traps/pots, for all fishing vessels that fish for or possess spiny lobster (or reef fish species) in or from the EEZ;<br>▪ Require an anchor retrieval system that ensures the anchor is recovered by its crown in order to prevent the anchor from dragging along the bottom during recovery.<br>- Prohibited the use of pots/traps, gill/trammel nets, and bottom longlines on coral or hard bottom habitat year-round in the existing seasonally closed areas and Grammanik Bank in the U.S. Caribbean EEZ under the Spiny Lobster (and Reef Fish FMPs). |

| Fishery Management Plan or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| Amendment #3 to the Spiny Lobster FMP (started in 2007, not finalized) (Escape vents) | Postponed | N/A<br>NOI: 72 FR 57307 | N/A |
| Amendment #4 to the Spiny Lobster FMP (2008) | 2/11/2009 | NOA: 73 FR 61015<br>PR: 73 FR 64295<br>FR: 74 FR 1148 | - Restricted spiny lobster imports into the U.S.;<br>- Established conservation standards to achieve an increase in spawning stock biomass and increase the long-term yield of the fishery;<br>- Prohibited any person from importing spiny lobster less than 6.0 ounces tail weight to Puerto Rico or the USVI. |
| Amendment #5 to the Spiny Lobster FMP (2011)<br><br>Part of the 2011 Caribbean Annual Catch Limit (ACL) Amendment | 1/30/2012 | NOA: 76 FR 59377<br>PR: 76 FR 68711<br>FR: 76 FR 82414 | - Revised the management reference points and status determination criteria established in Amendment 2 (i.e, SFA Amendment);<br>- Established ACLs and accountability measures (AMs) for spiny lobster;<br>- Allocated spiny lobster ACLs among island management areas: PR ACL (all sectors) = 327,920; St. Croix ACL (all sectors) = 107,307; St. Thomas/St. John ACL = 104,199.<br>- Established recreational bag limits for spiny lobster of 3 spiny lobsters per fisher/day, and no more than 10 spiny lobsters per vessel/day.<br>- Revised framework procedures for the spiny lobster. |
| Amendment #6 to the Spiny Lobster FMP (2015)<br><br>Part of the Comprehensive Amendment to the U.S. Caribbean Fishery Management Plans: Application of Accountability Measures | 6/10/2016 | NOA: 81 FR 5978<br>PR: 81 FR 9800<br>FR: 81 FR 29166 | - Revised language within the FMP to be consistent with language in the implementing regulations at 50 CFR Part 622 describing the application of AMs in the U.S. Caribbean EEZ.<br>- Clarified that any AM-based closure would only apply for the fishing year for which it was implemented, consistent with the Council's intent.<br>- The final rule (not included in the amendment) clarified that:<br>▪ The spiny lobster ACL in Puerto Rico management area is applied |

| Fishery Management Plan or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| *(Cont. Amendment #6 to the Spiny Lobster FMP)* | | | as a single ACL for both the commercial and recreational sectors, consistent with the Council's intent. If the AM is triggered due to an ACL overage, the commercial and recreational fishing seasons are reduced. During such a closure, spiny lobster may not be harvested, possessed, purchased, or sold, and the bag and possession limits for spiny lobster would be zero.<br>▪ For spiny lobster in the St. Croix and St. Thomas/St. John island management areas, if AMs are triggered due to an ACL overage and the fishing season is reduced, spiny lobster in or from the applicable management area may not be harvested, possessed, purchased, or sold, and the bag and possession limits would be zero. |
| Amendment #7 to the Spiny Lobster FMP (2016)<br><br>Part of the Amendments to the U.S. Caribbean Reef Fish, Spiny Lobster, and Corals and Reef Associated Parts and Invertebrates FMP: Timing of Accountability-Measure-Based Closures | 6/08/2017 | NOA: 82 FR 1308<br>PR: 82 FR 10324<br>FR: 82 FR 21475 | - Modified the implementation date for AM-based closures. Specifically:<br>▪ Instead of using December 31st as the implementation date, an AM-based closure will be implemented from September 30 of the closure year backward, toward the beginning of the fishing year, for the number of days necessary to achieve the reduction in landings required to ensure landings do not exceed the applicable ACL.<br>▪ If the length of the required fishing season reduction exceeds the period of January 1-September 30, any additional reduction required will be applied from October 1 forward, toward the December 31.<br>- Requires that the Council revisit the use of September 30th as the end date for AM-based closures no longer than 2 years from implementation of |

| Fishery Management Plan or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| | | | the amendment and no longer than every 2 years thereafter. |

## C.3 Queen Conch FMP

Table C.3. History of management for the Queen Conch FMP and subsequent amendments and regulatory actions.

| Fishery Management Plan or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| Queen Conch FMP (1996) | 1/13/1997 | PR: 61 FR 45395<br>FR: 61 FR 65481 | - Defined the maximum sustainable yield (MSY) of queen conch as 738,000 lbs per year;<br>- Defined the optimum yield (OY) as "all queen conch commercially and recreationally harvested from the exclusive economic zone (EEZ) and landed consistent with the management measures set forth in this FMP under a goal of allowing 20% of the spawning stock biomass to remain intact;"<br>- Required that all conch species in the fishery management unit be landed in the shell;<br>- Prohibited the sale of undersized queen conch and queen conch shells;<br>- Implemented a recreational bag limit of three queen conch per day, not to exceed 12 per boat;<br>- Prohibited the possession of queen conch that measured less than 9 in total length or that have a shell lip thickness of less than 3/8 in;<br>- Implemented a commercial catch limit of 150 queen conch per day:<br>▪ The commercial fishermen' daily quota will be lowered to one hundred (100) queen conch for |

| Fishery Management Plan or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| *(Cont. Queen Conch FMP)* | | | the second year and to seventy-five (75) the third year;<br>▪ The quota reduction is subject to review upon receipt of empirical information on which to base the decisions for new limits;<br>- All conch harvested under these provisions must conform to minimum size specifications and be landed still attached to the shell;<br>- Implemented an annual spawning season closure that extended from July 1 through September 30;<br>- Prohibited the use of hookah gear to harvest queen conch;<br>- Established the following framework measures:<br>▪ Establish closed areas, and address significant changes in fishing practices or environmental disasters;<br>▪ Other available framework adjustments include changes to the Fishery Management Unit (FMU), harvest limitations (including quotas, trip or daily landing limits), gear restrictions, and closed seasons or areas. |
| Amendment #1 to the Queen Conch FMP (2005)<br><br>Part of the Caribbean Sustainable Fisheries Act (SFA) Amendment | 11/28/2005 | NOA: 70 FR 35053<br>PR: 70 FR 53979<br>FR: 70 FR 62073 | - Established a new FMU for the queen conch by removing the Caribbean helmet (*Cassis tuberosa*), Caribbean vase (*Vasum muricatum*), flame helmet (*Cassis flammea*), and whelk (West Indian top shell, *Cittarium pica*);<br>- Nine species remained in the FMU;<br>- Prohibited commercial and recreational catch and possession of queen conch in federal waters of the U.S. Caribbean, with the exception of Lang Bank east of St. Croix. Lang Bank consists of federal waters east of 64° 34' W longitude; |

| Fishery Management Plan or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| | | | - Where fishing was allowed in the EEZ, conch must be maintained intact and all other regulations of bag limits, gear restrictions, and minimum size apply;<br>- Moved all species in the Caribbean conch resource FMU, with the exception of queen conch, to a data collection only category (removed all species except queen conch from federal regulation);<br>▪ Consequently, existing regulations requiring that all species in the Caribbean conch resource FMU taken from the U.S. EEZ be maintained with meat and shell intact (50 CFR §622.38(f)) would no longer apply to these species, and would instead only apply to queen conch;<br>▪ Inclusion in a data collection only category would result in no specification of MSY, OY, or other stock status determination criteria for these species |
| Regulatory Amendment #1 to the Queen Conch FMP: Establishing Compatible Closures (2010) | 5/31/2011 | PR: 76 FR 3596<br>FR: 76 FR 23907 | Established a quota and seasonal closures compatible with the USVI:<br>▪ Modified the Lang Bank seasonal closure from the previous yearly closure of July 1 through September 30 (3-months), to the new closure of June 1 through October 31 (5-months).<br>▪ Prohibited fishing for and possession of queen conch in or from the Caribbean EEZ east of 64°34′ W. longitude, which includes Lang Bank east of St. Croix, USVI, when harvest and possession of queen conch is prohibited in St. Croix territorial |

| Fishery Management Plan or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| | | | waters as a result of a territorial quota closure. |
| Amendment #2 to the Queen Conch FMP (2010)<br><br>Part of the 2010 Caribbean Annual Catch Limit Amendment | 1/30/2012 | NOA: 76 FR 59375<br>PR: 76 FR 66675<br>FR: 76 FR 82404 | - Revised the management reference points (i.e., MSY, overfishing limit (OFL), OY, acceptable biological catch (ABC)) for the queen conch FMU previously established in the 2005 Caribbean SFA Amendment (i.e. Amendment 1 to the Queen Conch FMP);<br>- Redefined the management reference points or proxies for queen conch based on the longest time series of pre-Caribbean SFA Amendment landings data considered consistently reliable across all islands.<br>- Established the MSY proxy based on the average annual commercial landings from 1999-2005 for Puerto Rico and St. Croix and from 2000-2005 for St. Thomas/St. John;<br>▪ Established the OFL equal to the MSY proxy with overfishing occurring when annual catches exceed the OFL, unless NMFS' Southeast Fisheries Science Center (SEFSC) (in consultation with the Council and its Scientific and Statistical Committee (SSC)) determined the overage occurred because data collection/monitoring improved, rather than because catches actually increased.<br>▪ The SSC recommended an ACL of 50,000 lbs equal to OY and ABC. |
| Amendment #3 to the Queen Conch FMP (2012) | 1/30/2012 | NOA: 76 FR 53977<br>PR: 76 FR 68711<br>FR: 76 FR 82414 | - Removed eight conch species from the Queen Conch FMU: Milk conch (*Strombus costatus)*, West Indian Fighting Conch *(S. pugilis)*, Roostertail Conch (*S. gallus)*, |

| Fishery Management Plan or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| Part of the 2011 Caribbean Annual Catch Limit Amendment | | | Hawkwing Conch (*S. raninus)*, True Tulip (*Fasciolaria tulipa)*, Atlantic Triton's Trumpet (*Charonia variegate)*, Cameo Helmet (*Cassis madagascarensis)*, and Green Start Shell (*Astrea tuber).* The queen conch, *Strombus gigas* is the only species in the FMU. |

## C.4 Coral FMP

Table C.4. History of management for the Coral FMP and subsequent amendments and regulatory actions.

| Fishery Management Plan or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| Coral FMP (1994) | Effective 12/27/1995, except for §670.23(b) (Restrictions on sale or purchase), which became effective 3/1/1996 | PR: 60 FR 46806<br>FR: 60 FR 58221 | - Prohibited the take or possession, whether dead or alive, of gorgonians, stony corals, and any species in the fishery management unit (FMU) if attached or existing upon live rock;<br>- Prohibited the sale or possession of any prohibited coral unless fully documented as to point of origin;<br>- Prohibited the use of chemicals, plants, or plant-derived toxins, and explosives to take species in the coral FMU;<br>- Required that dip nets, slurp guns, hands, and other non-habitat destructive gear types be used to harvest allowable corals;<br>- Required that harvesters of allowable corals obtain a permit from the local or federal government;<br>- Framework measures allowed NMFS Southeast Regional Administrator (RA) to modify management measures, including the establishment of marine conservation districts, changes to the list of prohibited species, changes to the FMU, harvest limitations, including quotas, trip or |

| Fishery Management Plan or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| | | | daily landing limits, and gear restrictions. |
| Amendment #1 to the Coral FMP establishing a Marine Conservation District (MCD) (1999) | 12/6/1999 | PR: 64 FR 42068<br>FR: 64 FR 60132 | Established a no-take MCD in the U.S. exclusive economic zone (EEZ) southwest of St. Thomas, USVI, including:<br>- No anchoring by fishing vessels, no fishing of any kind (including no bottom fishing and no spear fishing), and no removal of any organism in the MCD (including, but not limited to, those organisms listed in the FMUs of the Coral FMP, Reef Fish FMP, Queen Conch FMP, and Spiny Lobster FMP).<br>- Scientific research would be allowed as long as it fits under the proper definition and guidance of "scientific research" under the Magnuson-Stevens Act. |

| Fishery Management Plan or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| Amendment #2 to the Coral FMP (2005)<br><br>(Part of the Caribbean Sustainable Fisheries Act Amendment) | 11/28/2005 | PR: 70 FR 53979<br>FR: 70 FR 62073 | - Moved the aquarium trade species in both the Reef Fish and Coral FMPs into a 'data collection only' category. Inclusion in the data collection only category resulted in no specification of maximum sustainable yield (MSY), optimum yield (OY), or other stock status determination criteria (i.e., fishing mortality, biomass, minimum stock size threshold, maximum fishing mortality threshold) for these species due to no real need for federal conservation and management of these species. Consequently, existing regulations defining a marine aquarium fish as "a Caribbean reef fish that is smaller than 5.5 inches (14.0 cm) total length" and restricting the harvest of a marine aquarium fish to hand-held dip nets or hand-held slurp guns (50 CFR 622.41§(b)) were eliminated.<br>- Described and identified essential fish habitat (EFH) according to functional relationships between life history stages of federally managed species and Caribbean marine and estuarine habitats. The EFH for the coral fishery in the U.S. Caribbean consists of all waters from mean low water to the outer boundary of the EEZ – habitats used by larvae – and coral and hard bottom substrates from mean low water to 100 fathoms depth – used by other life stages. |
| Amendment #3 to the Coral FMP (2011)<br><br>(Part of the 2011 Caribbean Annual Catch Limit [ACL] Amendment) | 1/30/2012 | PR: 76 FR 68711<br>FR: 76 FR 82414 | - Established management reference points, ACLs, and accountability measures (AMs) for species in the Coral FMP, including aquarium trade species, which were not determined to be undergoing overfishing. The ACL for aquarium trade species is a U.S. Caribbean-wide ACL. The U.S. Caribbean-wide ACL for the aquarium trade species was established using landings data from |

| Fishery Management Plan or Amendment | Final Rule Effective Date | Proposed Rule (PR) Final Rule (FR) | Major Actions |
|---|---|---|---|
| | | | the Puerto Rico commercial and recreational sectors.<br>- Established framework measures for species in the Coral FMP. |
| Amendment #4 to the Coral FMP: Seagrass Management (2013) | 7/5/2013 | PR: 78 FR 14503<br>FR: 78 FR 33255 | - Removed seagrass species from the Coral FMP as there was no known targeted or indirect harvest of any seagrass species from the EEZ or from Puerto Rico or USVI state waters, and future harvest was not anticipated. |
| Amendment #5 to the Coral FMP (2015)<br><br>Part of the Comprehensive Amendment to the U.S. Caribbean Fishery Management Plans: Application of Accountability Measures | 6/10/2016 | NOA: 81 FR 5978<br>PR: 81 FR 9800<br>FR: 81 FR 29166 | - Revised language within the FMP to be consistent with language in the implementing regulations at 50 CFR Part 622 describing the application of AMs in the U.S. Caribbean EEZ.<br>- Clarified that any AM-based closure would only apply for the fishing year for which it was implemented, consistent with the Council's intent. |

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# Appendix D. Universe of Species Considered for the St. Croix Fishery Management Plan

Table D1 lists the species for which landings data were available that were considered for management by the Caribbean Fishery Management Council (Council) for St. Croix.

| Group | Scientific name | Common name | Previously Managed | Applicable Criterion |
|---|---|---|---|---|
| Lobster | *Panulirus argus* | Caribbean spiny lobster | Yes | A |
| Conch | *Lobatus gigas* | Queen conch | Yes | A |
| Angelfishes | *Holacanthus ciliaris* | Queen angelfish | Yes | C |
| Angelfishes | *Pomacanthus arcuatus* | Gray angelfish | Yes | C |
| Angelfishes | *Pomacanthus paru* | French angelfish | Yes | C |
| Boxfishes | *Lactophrys polygonia* | Honeycomb cowfish | Yes | B |
| Boxfishes | *Lactophrys quadricornis* | Scrawled cowfish | Yes | B |
| Boxfishes | *Lactophrys trigonus* | Trunkfish | Yes | B |
| Boxfishes | *Lactophrys bicaudalis* | Spotted trunkfish | Yes | B |
| Boxfishes | *Lactophrys triqueter* | Smooth trunkfish | Yes | B |
| Filefishes | *Aluterus scriptus* | Scrawled filefish | Yes | B |
| Filefishes | *Cantherhines macrocerus* | Whitespotted filefish | Yes | B |
| Filefishes | *Melichthys niger* | Black durgon | Yes | B |
| Goatfishes | *Pseudupeneus maculatus* | Spotted goatfish | Yes | B |
| Goatfishes | *Mulloidichthys martinicus* | Yellow goatfish | Yes | B |
| Groupers | *Epinephelus striatus* | Nassau Grouper | Yes | A |
| Groupers | *Epinephelus itajara* | Goliath grouper | Yes | A |
| Groupers | *Epinephelus fulvus* | Coney | Yes | C |
| Groupers | *Epinephelus cruentatus* | Graysby | Yes | C |
| Groupers | *Epinephelus guttatus* | Red hind | Yes | A |
| Groupers | *Epinephelus adscensionis* | Rock hind | Yes | C |
| Groupers | *Mycteroperca bonaci* | Black grouper | Yes | A |
| Groupers | *Epinephelus morio* | Red grouper | Yes | A |
| Groupers | *Mycteroperca tigris* | Tiger grouper | Yes | A |
| Groupers | *Mycteroperca venenosa* | Yellowfin grouper | Yes | A |
| Groupers | *Epinephelus mystacinus* | Misty grouper | Yes | C |
| Groupers | *Epinephelus flavolimbatus* | Yellowedge grouper | Yes | B |
| Grunts | *Haemulon plumieri* | White grunt | Yes | D |
| Grunts | *Haemulon album* | Margate | Yes | B |
| Grunts | *Haemulon aurolineatum* | Tomtate | Yes | B |
| Grunts | *Haemulon sciurus* | Bluestriped grunt | Yes | C |
| Grunts | *Haemulon flavolineatum* | French grunt | Yes | B |
| Grunts | *Anisotremus virginicus* | Porkfish | Yes | B |
| Jacks | *Caranx crysos* | Blue runner | Yes | B |
| Jacks | *Caranx latus* | Horse-eye jack | Yes | B |
| Jacks | *Caranx lugubris* | Black jack | Yes | B |
| Jacks | *Seriola rivoliana* | Almaco jack | Yes | B |
| Jacks | *Caranx ruber* | Bar jack | Yes | B |
| Jacks | *Seriola dumerili* | Greater amberjack | Yes | B |
| Jacks | *Caranx bartholomaei* | Yellow jack | Yes | B |
| Parrotfishes | *Scarus coeruleus* | Blue parrotfish | Yes | A |

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| Group | Scientific name | Common name | Previously Managed | Applicable Criterion |
|---|---|---|---|---|
| Parrotfishes | *Scarus coelestinus* | Midnight parrotfish | Yes | A |
| Parrotfishes | *Scarus taeniopterus* | Princess parrotfish | Yes | A |
| Parrotfishes | *Scarus vetula* | Queen parrotfish | Yes | A |
| Parrotfishes | *Scarus guacamaia* | Rainbow parrotfish | Yes | A |
| Parrotfishes | *Sparisoma rubripinne* | Redfin parrotfish | Yes | A |
| Parrotfishes | *Sparisoma chrysopterum* | Redtail parrotfish | Yes | A |
| Parrotfishes | *Sparisoma viride* | Stoplight parrotfish | Yes | A |
| Parrotfishes | *Sparisoma aurofrenatum* | Redband parrotfish | Yes | A |
| Parrotfishes | *Scarus croicensis* | Striped parrotfish | Yes | A |
| Porgies | *Calamus bajonado* | Jolthead porgy | Yes | B |
| Porgies | *Archosargus rhomboidalis* | Sea bream | Yes | B |
| Porgies | *Calamus penna* | Sheepshead porgy | Yes | B |
| Porgies | *Calamus pennatula* | Pluma | Yes | B |
| Snappers | *Apsilus dentatus* | Black snapper | Yes | A |
| Snappers | *Lutjanus buccanella* | Blackfin snapper | Yes | A |
| Snappers | *Lutjanus vivanus* | Silk snapper | Yes | A |
| Snappers | *Rhomboplites aurorubens* | Vermilion snapper | Yes | A |
| Snappers | *Pristipomoides aquilonaris* | Wenchman | Yes | B |
| Snappers | *Pristipomoides macrophthalmus* | Cardinal snapper | Yes | B |
| Snappers | *Etelis oculatus* | Queen snapper | Yes | D |
| Snappers | *Lutjanus griseus* | Gray snapper | Yes | D |
| Snappers | *Lutjanus synagris* | Lane snapper | Yes | A |
| Snappers | *Lutjanus analis* | Mutton snapper | Yes | A |
| Snappers | *Lutjanus jocu* | Dog snapper | Yes | B |
| Snappers | *Lutjanus apodus* | Schoolmaster | Yes | D |
| Snappers | *Lutjanus mahogani* | Mahogany snapper | Yes | B |
| Snappers | *Ocyurus chrysurus* | Yellowtail snapper | Yes | A |
| Squirrelfishes | *Myripristis jacobus* | Blackbar soldierfish | Yes | B |
| Squirrelfishes | *Priacanthus arenatus* | Bigeye | Yes | B |
| Squirrelfishes | *Holocentrus rufus* | Longspine squirrelfish | Yes | C |
| Squirrelfishes | *Holocentrus adscensionis* | Squirrelfish | Yes | B |
| Surgeonfishes | *Acanthurus coeruleus* | Blue tang | Yes | C |
| Surgeonfishes | *Acanthurus bahianus* | Ocean surgeonfish | Yes | C |
| Surgeonfishes | *Acanthurus chirurgus* | Doctorfish | Yes | C |
| Tilefishes | *Caulolatilus cyanops* | Blackline tilefish | Yes | B |
| Tilefishes | *Malacanthus plumieri* | Sand tilefish | Yes | B |
| Triggerfishes | *Canthidermis sufflamen* | Ocean triggerfish | Yes | B |
| Triggerfishes | *Balistes vetula* | Queen triggerfish | Yes | D |
| Triggerfishes | *Xanthichthys rigens* | Sargassum triggerfish | Yes | B |
| Wrasses | *Lachnolaimus maximus* | Hogfish | Yes | B |
| Wrasses | *Halichoeres radiatus* | Puddingwife | Yes | B |
| Wrasses | *Bodianus rufus* | Spanish hogfish | Yes | B |
| Aquarium Trade Reef Fish | *Antennarius spp.* | Frogfish | Yes | B |
| Aquarium Trade Reef Fish | *Apogon maculatus* | Flamefish | Yes | B |
| Aquarium Trade Reef Fish | *Astrapogen stellatus* | Conchfish | Yes | B |
| Aquarium Trade Reef Fish | *Ophioblennius atlanticus* | Redlip blenny | Yes | B |
| Aquarium Trade Reef Fish | *Bothus lunatus* | Peacock flounder | Yes | B |
| Aquarium Trade Reef Fish | *Chaetodon aculeatus* | Longsnout butterflyfish | Yes | B |
| Aquarium Trade Reef Fish | *Chaetodon capistratus* | Foureye butterflyfish | Yes | B |
| Aquarium Trade Reef Fish | *Chaetodon ocellatus* | Spotfin butterflyfish | Yes | B |

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| Group | Scientific name | Common name | Previously Managed | Applicable Criterion |
|---|---|---|---|---|
| Aquarium Trade Reef Fish | *Chaetodon striatus* | Banded butterflyfish | Yes | B |
| Aquarium Trade Reef Fish | *Amblycirrhitus pinos* | Redspotted hawkfish | Yes | B |
| Aquarium Trade Reef Fish | *Dactylopterus volitans* | Flying gurnard | Yes | B |
| Aquarium Trade Reef Fish | *Chaetodipterus faber* | Atlantic spadefish | Yes | B |
| Aquarium Trade Reef Fish | *Gobiosoma oceanops* | Neon goby | Yes | B |
| Aquarium Trade Reef Fish | *Priolepis hipoliti* | Rusty goby | Yes | B |
| Aquarium Trade Reef Fish | *Gramma loreto* | Royal gramma | Yes | B |
| Aquarium Trade Reef Fish | *Clepticus parrae* | Creole wrasse | Yes | B |
| Aquarium Trade Reef Fish | *Halichoeres cyanocephalus* | Yellowcheek wrasse | Yes | B |
| Aquarium Trade Reef Fish | *Halichoeres garnoti* | Yellowhead wrasse | Yes | B |
| Aquarium Trade Reef Fish | *Halichoeres maculipinna* | Clown wrasse | Yes | B |
| Aquarium Trade Reef Fish | *Hemipteronotus novacula* | Pearly razorfish | Yes | B |
| Aquarium Trade Reef Fish | *Hemipteronotus splendens* | Green razorfish | Yes | B |
| Aquarium Trade Reef Fish | *Thalassoma bifasciatum* | Bluehead wrasse | Yes | B |
| Aquarium Trade Reef Fish | *Echidna catenata* | Chain moray | Yes | B |
| Aquarium Trade Reef Fish | *Gymnothorax funebris* | Green moray | Yes | B |
| Aquarium Trade Reef Fish | *Gymnothorax miliaris* | Goldentail moray | Yes | B |
| Aquarium Trade Reef Fish | *Ogcocepahalus spp.* | Batfish | Yes | B |
| Aquarium Trade Reef Fish | *Myrichthys ocellatus* | Goldspotted eel | Yes | B |
| Aquarium Trade Reef Fish | *Opistognathus aurifrons* | Yellowhead jawfish | Yes | B |
| Aquarium Trade Reef Fish | *Opistognathus whitehursti* | Dusky jawfish | Yes | B |
| Aquarium Trade Reef Fish | *Centropyge argi* | Cherubfish | Yes | B |
| Aquarium Trade Reef Fish | *Holacanthus tricolor* | Rock beauty | Yes | B |
| Aquarium Trade Reef Fish | *Abudefduf saxatilis* | Sergeant major | Yes | B |
| Aquarium Trade Reef Fish | *Chromis cyanea* | Blue chromis | Yes | B |
| Aquarium Trade Reef Fish | *Chromis insolata* | Sunshinefish | Yes | B |
| Aquarium Trade Reef Fish | *Microspathodon chrysurus* | Yellowtail damselfish | Yes | B |
| Aquarium Trade Reef Fish | *Pomacentrus fuscus* | Dusky damselfish | Yes | B |
| Aquarium Trade Reef Fish | *Pomacentrus leucostictus* | Beaugregory | Yes | B |
| Aquarium Trade Reef Fish | *Pomacentrus partitus* | Bicolor damselfish | Yes | B |
| Aquarium Trade Reef Fish | *Pomacentrus planifrons* | Threespot damselfish | Yes | B |
| Aquarium Trade Reef Fish | *Priacanthus cruentatus* | Glasseye snapper | Yes | B |
| Aquarium Trade Reef Fish | *Equetus acuminatus* | High-hat | Yes | B |
| Aquarium Trade Reef Fish | *Equetus lanceolatus* | Jackknife-fish | Yes | B |
| Aquarium Trade Reef Fish | *Equetus punctatus* | Spotted drum | Yes | B |
| Aquarium Trade Reef Fish | *Scorpaenidae* | Scorpionfishes | Yes | B |
| Aquarium Trade Reef Fish | *Hypoplectrus unicolor* | Butter hamlet | Yes | B |
| Aquarium Trade Reef Fish | *Liopropoma rubre* | Swissguard basslet | Yes | B |
| Aquarium Trade Reef Fish | *Rypticus saponaceus* | Greater soapfish | Yes | B |
| Aquarium Trade Reef Fish | *Serranus annularis* | Orangeback bass | Yes | B |
| Aquarium Trade Reef Fish | *Serranus baldwini* | Lantern bass | Yes | B |
| Aquarium Trade Reef Fish | *Serranus tabacarius* | Tobaccofish | Yes | B |
| Aquarium Trade Reef Fish | *Serranus tigrinus* | Harlequin bass | Yes | B |
| Aquarium Trade Reef Fish | *Serranus tortugarum* | Chalk bass | Yes | B |
| Aquarium Trade Reef Fish | *Symphurus arawak* | Caribbean tonguefish | Yes | B |
| Aquarium Trade Reef Fish | *Hippocampus spp.* | Seahorses | Yes | B |
| Aquarium Trade Reef Fish | *Syngnathus spp.* | Pipefishes | Yes | B |
| Aquarium Trade Reef Fish | *Synodus intermedius* | Sand diver | Yes | B |
| Aquarium Trade Reef Fish | *Canthigaster rostrata* | Sharpnose puffer | Yes | B |
| Aquarium Trade Reef Fish | *Diodon hystrix* | Porcupinefish | Yes | B |

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| Group | Scientific name | Common name | Previously Managed | Applicable Criterion |
|---|---|---|---|---|
| Hydrocorals | *Millepora* spp. | Fire corals | Yes | A |
| Hydrocorals | *Stylaster roseus* | Rose lace corals | Yes | A |
| Soft corals | *Erythropodium caribaeorum* | Encrusting gorgonian | Yes | A |
| Soft corals | *Iciligorgia schrammi* | Deepwater sea fan | Yes | A |
| Soft corals | *Briareum asbestinum* | Corky sea finger | Yes | A |
| Soft corals | *Carijoa riisei* | Snowflake coral | Yes | A |
| Soft corals | *Telesto* spp. | - | Yes | A |
| Gorgonian corals | *Ellisella* spp. | Sea whips | Yes | A |
| Gorgonian corals | *Gorgonia flabellum* | Venus sea fan | Yes | A |
| Gorgonian corals | *G. mariae* | Venus sea fan | Yes | A |
| Gorgonian corals | *G. ventalina* | Common sea fan | Yes | A |
| Gorgonian corals | *Pseudopterogorgia acerosa* | Venus sea fan | Yes | A |
| Gorgonian corals | *P. albatrossae* | - | Yes | A |
| Gorgonian corals | *P. americana* | Slimy sea plume | Yes | A |
| Gorgonian corals | *P. bipinnata* | Bipinnate plume | Yes | A |
| Gorgonian corals | *P. rigida* | - | Yes | A |
| Gorgonian corals | *Pterogorgia anceps* | Angular sea whip | Yes | A |
| Gorgonian corals | *P. citrina* | Yellow sea whip | Yes | A |
| Gorgonian corals | *Eunicea calyculata* | Warty sea rod | Yes | A |
| Gorgonian corals | *E. clavigera* | Knobby candelabra | Yes | A |
| Gorgonian corals | *E. fusca* | Doughnut sea rod | Yes | A |
| Gorgonian corals | *E. knighti* | Knight's flexible sea rod | Yes | A |
| Gorgonian corals | *E. laciniata* | Black sausage coral | Yes | A |
| Gorgonian corals | *E. laxispica* | Tube-knob candelabrum | Yes | A |
| Gorgonian corals | *E. mammosa* | Swollen-knob | Yes | A |
| Gorgonian corals | *E. succinea* | Shelf-knob sea rod | Yes | A |
| Gorgonian corals | *E. touneforti* | - | Yes | A |
| Gorgonian corals | *Muricea atlantica* | - | Yes | A |
| Gorgonian corals | *M. elongata* | Orange spiny rod | Yes | A |
| Gorgonian corals | *M. laxa* | Delicate spiny rod | Yes | A |
| Gorgonian corals | *M. muricata* | Spiny sea fan | Yes | A |
| Gorgonian corals | *M. pinnata* | Long spine sea fan | Yes | A |
| Gorgonian corals | *Muriceopsis* spp. | - | Yes | A |
| Gorgonian corals | *M. flavida* | Rough sea plume | Yes | A |
| Gorgonian corals | *M. sulphurea* | Spiny Gorgonian, Sulfur soft coral | Yes | A |
| Gorgonian corals | *Plexaura flexuosa* | Bent sea rod | Yes | A |
| Gorgonian corals | *P. homomalla* | Black sea rod | Yes | A |
| Gorgonian corals | *Plexaurella dichotoma* | Slit-pore sea rod | Yes | A |
| Gorgonian corals | *P. fusifera* | Sea rod | Yes | A |
| Gorgonian corals | *P. grandiflora* | Slit-pore sea rod | Yes | A |
| Gorgonian corals | *P. grisea* | Gray sea rod | Yes | A |
| Gorgonian corals | *P. nutans* | Giant slit-pore | Yes | A |
| Gorgonian corals | *Pseudoplexaura crucis* | False cross plexaura | Yes | A |
| Gorgonian corals | *P. flagellosa* | - | Yes | A |
| Gorgonian corals | *P. porosa* | Porous sea rod | Yes | A |
| Gorgonian corals | *P. wagenaari* | - | Yes | A |
| Hard corals | *Acropora cervicornis* | Staghorn coral | Yes | A |
| Hard corals | *A. palmata* | Elkhorn coral | Yes | A |
| Hard corals | *A. prolifera* | Fused staghorn | Yes | A |

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| Group | Scientific name | Common name | Previously Managed | Applicable Criterion |
|---|---|---|---|---|
| Hard corals | *Agaricia agaricities* | Lettuce leaf coral | Yes | A |
| Hard corals | *A. fragilis* | Fragile saucer | Yes | A |
| Hard corals | *A. lamarcki* | Lamarck's sheet | Yes | A |
| Hard corals | *A. tenuifolia* | Thin leaf lettuce | Yes | A |
| Hard corals | *Leptoseris cucullata* | Sunray lettuce | Yes | A |
| Hard corals | *Stephanocoenia michelinii* | Blushing star | Yes | A |
| Hard corals | *Eusmilia fastigiata* | Flower coral | Yes | A |
| Hard corals | *Tubastrea aurea* | Cup coral | Yes | A |
| Hard corals | *Cladocora arbuscula* | Tube coral | Yes | A |
| Hard corals | *Colpophyllia natans* | Boulder coral | Yes | A |
| Hard corals | *Diploria clivosa* | Knobby brain coral | Yes | A |
| Hard corals | *D. labyrinthiformis* | Grooved brain | Yes | A |
| Hard corals | *D. strigosa* | Symmetrical brain | Yes | A |
| Hard corals | *Favia fragum* | Golfball coral | Yes | A |
| Hard corals | *Manicina areolata* | Rose coral | Yes | A |
| Hard corals | *M. mayori* | Tortugas rose coral | Yes | A |
| Hard corals | *Montastrea annularis* | Boulder star coral | Yes | A |
| Hard corals | *M. cavernosa* | Great star coral | Yes | A |
| Hard corals | *Solenastrea bournoni* | Smooth star coral | Yes | A |
| Hard corals | *Dendrogyra cylindrus* | Pillar coral | Yes | A |
| Hard corals | *Dichocoenia stellaris* | Pancake star | Yes | A |
| Hard corals | *D. stokesi* | Elliptical star | Yes | A |
| Hard corals | *Meandrina meandrites* | Maze coral | Yes | A |
| Hard corals | *Isophyllastrea rigida* | Rough star coral | Yes | A |
| Hard corals | *Isophyllia sinuosa* | Sinuous cactus | Yes | A |
| Hard corals | *Mussa angulosa* | Large flower coral | Yes | A |
| Hard corals | *Mycetophyllia aliciae* | Thin fungus coral | Yes | A |
| Hard corals | *M. danae* | Fat fungus coral | Yes | A |
| Hard corals | *M. ferox* | Grooved fungus | Yes | A |
| Hard corals | *M. lamarckiana* | Fungus coral | Yes | A |
| Hard corals | *Scolymia cubensis* | Artichoke coral | Yes | A |
| Hard corals | *S. lacera* | Solitary disk | Yes | A |
| Hard corals | *Oculina diffusa* | Ivory bush coral | Yes | A |
| Hard corals | *Madracis decactis* | Ten-ray star coral | Yes | A |
| Hard corals | *M. mirabilis* | Yellow pencil | Yes | A |
| Hard corals | *Porites astreoides* | Mustard hill coral | Yes | A |
| Hard corals | *P. branneri* | Blue crust coral | Yes | A |
| Hard corals | *P. divaricata* | Small finger coral | Yes | A |
| Hard corals | *P. porites* | Finger coral | Yes | A |
| Hard corals | *Astrangia solitaria* | Dwarf cup coral | Yes | A |
| Hard corals | *Phyllangia americana* | Hidden cup coral | Yes | A |
| Hard corals | *Siderastrea radians* | Lesser starlet | Yes | A |
| Hard corals | *S. siderea* | Massive starlet | Yes | A |
| Black corals | *Antipathes spp.* | Bushy black coral | Yes | A |
| Black corals | *Stichopathes spp.* | Wire coral | Yes | A |
| Aquarium Trade Invertebrates | *Aphimedon compressa* | Erect rope sponge | Yes | B |
| Aquarium Trade Invertebrates | *Chondrilla nucula* | Chicken liver sponge | Yes | B |

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| Group | Scientific name | Common name | Previously Managed | Applicable Criterion |
|---|---|---|---|---|
| Aquarium Trade Invertebrates | *Cynachirella alloclada* | - | Yes | B |
| Aquarium Trade Invertebrates | *Geodia neptuni* | Potato sponge | Yes | B |
| Aquarium Trade Invertebrates | *Haliclona* spp. | Finger sponge | Yes | B |
| Aquarium Trade Invertebrates | *Myriastra* spp. | - | Yes | B |
| Aquarium Trade Invertebrates | *Niphates digitalis* | Pink vase sponge | Yes | B |
| Aquarium Trade Invertebrates | *N. erecta* | Lavender rope sponge | Yes | B |
| Aquarium Trade Invertebrates | *Spinosella policifera* | - | Yes | B |
| Aquarium Trade Invertebrates | *S. vaginalis* | Branching vase sponge | Yes | B |
| Aquarium Trade Invertebrates | *Tethya crypta* | - | Yes | B |
| Aquarium Trade Invertebrates | *Aiptasia tagetes* | Pale anemone | Yes | B |
| Aquarium Trade Invertebrates | *Bartholomea annulata* | Corkscrew anemone | Yes | B |
| Aquarium Trade Invertebrates | *Condylactis gigantea* | Giant pink-tipped anemone | Yes | B |
| Aquarium Trade Invertebrates | *Hereractis lucida* | Knobby anemone | Yes | B |
| Aquarium Trade Invertebrates | *Lebrunia* spp. | Staghorn anemone | Yes | B |
| Aquarium Trade Invertebrates | *Stichodactyla helianthus* | Sun anemone | Yes | B |
| Aquarium Trade Invertebrates | *Zoanthus* spp. | Sea mat | Yes | B |
| Aquarium Trade Invertebrates | *Discosoma* spp. (formerly Rhodactis) | False coral | Yes | B |
| Aquarium Trade Invertebrates | *Ricordia florida* | Florida false coral | Yes | B |
| Aquarium Trade Invertebrates | *Sabellastarte* spp. | Tube worms | Yes | B |
| Aquarium Trade Invertebrates | *S. magnifica* | Magnificent duster | Yes | B |
| Aquarium Trade Invertebrates | *Spirobranchus giganteus* | Christmas tree worm | Yes | B |
| Aquarium Trade Invertebrates | *Tridachia crispata* | Lettuce sea slug | Yes | B |
| Aquarium Trade Invertebrates | *Oliva reticularis* | Netted olive | Yes | B |
| Aquarium Trade Invertebrates | *Cyphoma gibbosum* | Flamingo tongue | Yes | B |
| Aquarium Trade Invertebrates | *Lima* spp. | Fileclams | Yes | B |

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| Group | Scientific name | Common name | Previously Managed | Applicable Criterion |
|---|---|---|---|---|
| Aquarium Trade Invertebrates | *L. scabra* | Rough fileclam | Yes | B |
| Aquarium Trade Invertebrates | *Spondylus americanus* | Atlantic thorny oyster | Yes | B |
| Aquarium Trade Invertebrates | *Octopus* spp. (except the Common octopus, O.vulgaris) | - | Yes | B |
| Aquarium Trade Invertebrates | *Alpheaus armatus* | Snapping shrimp | Yes | B |
| Aquarium Trade Invertebrates | *Paguristes* spp. | Hermit crabs | Yes | B |
| Aquarium Trade Invertebrates | *P. cadenati* | Red reef hermit | Yes | B |
| Aquarium Trade Invertebrates | *Percnon gibbesi* | Nimble spray crab | Yes | B |
| Aquarium Trade Invertebrates | *Lysmata* spp. | Peppermint shrimp | Yes | B |
| Aquarium Trade Invertebrates | *Thor amboinensis* | Anemone shrimp | Yes | B |
| Aquarium Trade Invertebrates | *Mithrax* spp. | Clinging crabs | Yes | B |
| Aquarium Trade Invertebrates | *M. cinctimanus* | Banded clinging | Yes | B |
| Aquarium Trade Invertebrates | *M. sculptus* | Green clinging | Yes | B |
| Aquarium Trade Invertebrates | *Stenorhynchus seticornis* | Yellowline arrow | Yes | B |
| Aquarium Trade Invertebrates | *Periclimenes* spp. | Cleaner shrimp | Yes | B |
| Aquarium Trade Invertebrates | *Gonodactylus* spp. | - | Yes | B |
| Aquarium Trade Invertebrates | *Lysiosquilla* spp. | - | Yes | B |
| Aquarium Trade Invertebrates | *Stenopus hispidus* | Banded shrimp | Yes | B |
| Aquarium Trade Invertebrates | *S. scutellatus* | Golden shrimp | Yes | B |
| Aquarium Trade Invertebrates | *Analcidometra armata* | Swimming crinoid | Yes | B |
| Aquarium Trade Invertebrates | *Davidaster* spp. | Crinoids | Yes | B |
| Aquarium Trade Invertebrates | *Nemaster* spp. | Crinoids | Yes | B |
| Aquarium Trade Invertebrates | *Astropecten* spp. | Sand stars | Yes | B |
| Aquarium Trade Invertebrates | *Linckia guildingii* | Common comet star | Yes | B |
| Aquarium Trade Invertebrates | *Ophidiaster guildingii* | Comet star | Yes | B |
| Aquarium Trade Invertebrates | *Oreaster reticulatus* | Cushion sea star | Yes | B |

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| Group | Scientific name | Common name | Previously Managed | Applicable Criterion |
|---|---|---|---|---|
| Aquarium Trade Invertebrates | *Astrophyton muricatum* | Giant basket star | Yes | B |
| Aquarium Trade Invertebrates | *Ophiocoma* spp. | Brittlestars | Yes | B |
| Aquarium Trade Invertebrates | *Ophioderma* spp. | Brittlestars | Yes | B |
| Aquarium Trade Invertebrates | *O. rubicundum* | Ruby brittlestar | Yes | B |
| Aquarium Trade Invertebrates | *Diadema antillarum* | Long-spined urchin | Yes | E |
| Aquarium Trade Invertebrates | *Echinometra* spp. | Purple urchin | Yes | E |
| Aquarium Trade Invertebrates | *Eucidaris tribuloides* | Pencil urchin | Yes | E |
| Aquarium Trade Invertebrates | *Lytechinus* spp. | Pin cushion urchin | Yes | E |
| Aquarium Trade Invertebrates | *Tripneustes ventricosus* | Sea egg | Yes | E |
| Aquarium Trade Invertebrates | *Holothuria* spp. | Sea cucumbers | Yes | E |
| Aquarium Trade Invertebrates | Subphylum Urochordata | Tunicates | Yes | B |
| Barracuda | *Sphyraena barracuda* | Great barracuda | No | B |
| Dolphinfish | *Coryphaena hippurus* | Dolphin | No | D |
| Grunts | *Haemulon carbonarium* | Caeser grunt | No | |
| Grunts | *Haemulon melanurum* | Cottonwick | No | |
| Halfbeak | *Hemiramphus brasiliensis* | Ballyhoo | No | |
| Jacks | *Selar crumenophthalmus* | Bigeye scad | No | |
| Jacks | *Decapterus macarellus* | Mackerel scad | No | |
| Jacks | *Decapterus punctatus* | Round scad | No | |
| Jacks | *Elagatis bipinnulata* | Rainbow runner | No | B |
| Porgies | *Calamus calamus* | Saucereye porgy | No | |
| Sharks | *Ginglymostoma cirratum* | Nurse shark | No | |
| Sharks | *Galeocerdo cuvier* | Tiger shark | No | |
| Sharks | *Sphyrna mokarran* | Great hammerhead shark | No | |
| Shellfish | *Cittarium pica* | West Indian topsnail | No | |
| Swordfish | *Xiphias gladius* | Swordfish | No | |
| Tunas and Mackerels | *Euthynnus pelamis* | Skipjack tuna | No | |
| Tunas and Mackerels | *Euthynnus alletteratus* | Little tunny | No | |
| Tunas and Mackerels | *Thunnus alalunga* | Albacore | No | |
| Tunas and Mackerels | *Thunnus albacares* | Yellowfin tuna | No | |
| Tunas and Mackerels | *Thunnus atlanticus* | Blackfin tuna | No | |
| Tunas and Mackerels | *Thunnus obesus* | Bigeye tuna | No | |
| Tunas and Mackerels | *Scomberomorus cavalla* | King mackerel | No | |
| Tunas and Mackerels | *Scomberomorus regalis* | Cero | No | |
| Tunas and Mackerels | *Acanthocybium solandri* | Wahoo | No | D |

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# Appendix E. Alternatives Considered but Rejected

The Caribbean Fishery Management Council (Council) often considers a number of alternatives for a particular purpose and need. Some of these alternatives could be considered reasonable while others are unlikely to accomplish the stated purpose and need. The Council on Environmental Quality guidelines state that if alternatives are eliminated from further analysis, then the supporting document, *i.e.* this draft environmental impact statement, should briefly discuss the reasons for their elimination (40 CFR 1502.14(a)).

The Council did not reject a complete alternative, but it rejected a component of two alternatives considered under Action 2 (Stocks Managed under the St. Croix Fishery Management Plan [FMP]). As mentioned in the Action 2 discussion, Criterion E was originally considered under Preferred Alternative 2 and Alternative 3 as the final criterion for selecting stocks for inclusion in the St. Croix FMP. This criterion would exclude from management species with a level of landings considered to be *de minimis*[69]. No stocks were excluded from management under this criterion during the stock selection process or during subsequent meetings.

<u>Rejected</u>:
Criterion E in Action 2, Preferred Alternative 2 and Alternative 3, would remove from management any stocks for which the total of average reported landings (recreational and commercial) during a pre-defined reporting period were less than X[70] pounds, indicating the fishery is "*de minimis*", unless conservation and management is otherwise required because of the factors identified in Criterion A. Stocks identified for removal under Criterion E would instead be classified as Ecosystem Component species.

<u>Rationale</u>:
At the 163rd Council meeting in August 2018, National Marine Fisheries Service (NMFS) staff recommended to the Council that they consider but reject Criterion E described above. The Council's Scientific and Statistical Committee and NMFS were not ready at that time to define that X level of landings, especially for stocks new to management. Defining that *de minimus* landings level, and ensuring the level was not indicative of a stock or stock complex in need of conservation and management, would require substantial analysis of landings and socioeconomic data. The Council will therefore not address *de minimus* landings until the new FMPs are in place and allowed to perform for a period of time adequate to determine that level of landings.

[69]As defined in the Merriam-Webster online dictionary, *de minimus* refers to a quantity lacking significance or importance, or so minor as to merit disregard.
[70] Threshold of landings yet to be determined below which the fishery for stock or stock complex was considered to be *de minimis.*

# Appendix F. Description of the Species in the St. Croix FMP

This appendix summarizes the available information on the biology and life history for stocks/stock complexes (e.g., finfish, spiny lobster, queen conch, corals, sea cucumbers, sea urchins, and corals) managed in the St. Croix FMP. A complete description of the life history characteristics and ecology of all species previously-managed by the Caribbean Fishery Management Council (Council) can be found in the Caribbean Sustainable Fisheries Act Amendment (CFMC 2005), the 2010 Caribbean Annual Catch Limit (ACL) Amendment (CFMC 2011a), and the 2011 Caribbean ACL Amendment (CFMC 2011b), and is incorporated herein by reference. Regulatory Amendment 4 to the Reef Fish FMP (CFMC 2013c) has the recent description of the biology and ecology of parrotfish, and Regulatory Amendment 2 to the Queen Conch FMP has the most updated information for queen conch in federal waters (CFMC 2013b). The biology and ecology of managed corals and reef associated plants and invertebrates were updated through Amendment 4 to the Coral FMP (CFMC 2013a).

## Black snapper, *Apsilus dentatus*

### Distribution and Habitat

Black snapper occurs in the Western Central Atlantic, off the Florida Keys (USA), and in the western Gulf of Mexico and Caribbean Sea. A demersal species, the black snapper is primarily found over rocky bottom habitat, although juveniles are sometimes found near the surface (Allen 1985 in Froese and Pauly 2002). It moves offshore to deep-water reefs and rocky ledges as it grows and matures (SAFMC 1999). Allen (1985), in Froese and Pauly (2002) reports depth range as 100-300 m. The findings of a Caribbean study indicate that it is most abundant at depths of 60-100 m off Jamaica (Thompson and Munro 1974a).

### Life History

Maximum reported size is 65 cm TL (male). Maximum reported weight is 3,170 g (Allen 1985 in Froese and Pauly 2002). Size at maturity and age at first maturity estimated in Froese and Pauly (2002) are 34.9 cm TL and 1 year, respectively. Observed maximum fork lengths of catches taken in a Jamaican study were 56 cm FL and 54 cm FL for males and females, respectively; estimated mean sizes of maturity, 43-45 cm FL and 39-41 cm FL for males and females, respectively (Thompson and Munro 1974a). 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 1974a).

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Diet

Prey includes fishes and benthic organisms, including cephalopods, tunicates (Allen 1985 in Froese and Pauly 2002), and crustaceans (Thompson and Munro 1974a). Halstead (1970), in Froese and Pauly (2002), report that it can be ciguatoxic.

Reproduction and Spawning

Aida Rosario (unpublished data; personal communication) 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 (1974a) reports that, off Jamaica, the greatest proportions of ripe fishes were found in JanuaryApril and September-November (Thompson and Munro 1974a).

## Blackfin snapper, *Lutjanus buccanella*

Distribution and Habitat

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 in Froese and Pauly 2002). This species is very common in the Caribbean, particularly in the Antilles. The blackfin snapper is a demersal species, found from 20-200 m 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 (Allen 1985 in Froese and Pauly 2002), and sometimes in small schools (Thompson and Munro 1974a). 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 depth (Boardman and Weiler 1979).

Life History

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 TL (male); maximum weight, 14 kg (Allen 1985 in Froese and Pauly 2002). The modal lengths for male and female blackfins taken in the Puerto Rican survey were 26 cm FL and 23 cm FL, respectively. Maximum size was 47 cm FL. Estimated lengths of maturity for females and males were 20 cm FL and 38 cm FL, respectively (Boardman and Weiler 1979). Size at maturity and age at first maturity are estimated in Froese and Pauly (2002) as 34 cm TL and 1.9 years, respectively. Approximate life span is 8.2 years; natural mortality rate, 0.23 (Ault et al. 1998).

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Diet

Allen (1985), in Froese and Pauly (2002) identify fishes as the primary prey. Thompson and Munro (1974a) 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 1974a). It can be ciguatoxic (Allen 1985 in Froese and Pauly 2002).

Reproduction and Spawning

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 1974a).

## Silk snapper, *Lutjanus vivanus*

Distribution and Habitat

Silk snapper are found in western Atlantic waters, as far north as Cape Hatteras, North Carolina and Bermuda and as far south as Brazil (Bohlke and Chaplin 1967, Froese and Pauly 2011, Figure 2.8.1). They are also found in the Gulf of Mexico along the continental shelf (Bohlke and Chaplin 1967, Boardman and Weiler 1980, Sylvester et al. 1980). The reported depth range for silk snapper is 64m – 300m (Sylvester et al. 1980, Parker and Mays 1998, Cummings 2003). Depth distribution and ontogenetic stage are positively correlated, where younger, smaller fish are generally found in shallower depths than older and larger individuals (Boardman and Weiler 1980). 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. The silk snapper is mainly found from 90-140 m depth, commonly near the edge of the continental and island shelves, but also beyond the shelf edge to depths of 300 m. Adults are generally distributed further offshore than juveniles (SAFMC 1999), and usually ascend to shallow water at night (Allen 1985 in Froese and Pauly 2002). 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 snappers 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 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.

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Life History

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 TL (male); maximum weight, 8,320 g (Allen 1985 in Froese and Pauly 2002). The predominant lengths for males and females surveyed with trap gear in Puerto Rican waters were 29 cm FL and 26 cm 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 FL. Females and males appeared to mature at 50 cm FL and 38 cm 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 TL and 6.3 years, respectively. A Jamaican study estimates mean sizes of maturity as 55-60 cm FL (males) and 50-55 cm FL (females) (Thompson and Munro 1974a). 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 range of published natural mortality estimates was large, ranging from 0.19 and 0.86 per year. Martinez-Andrade (2003) estimated natural mortality to be between 0.54 and 0.56 per year using the equation published in the FishBase manual (Froese and Pauly 2011). The reported ranges for Linf, K, and t0 were 600 -1170 mm total length (TL), 0.051-0.32 per year, and - 2.309 - -0.04 years, respectively. The reported range for the allometric growth parameter, b, was 2.86 - 3.1 and the range for the scaling parameter, a, was 1e-5 - 0.117. Estimates of length-at-maturity, Lmat, from the literature varied. The lowest estimates of Lmat were 296mm fork length (FL) and 267mm FL for males and females, respectively (Rosario et al. 2006). The remaining estimates ranged between 340mm TL and 600mm TL. Lmat was generally determined by macroscopic inspection of the gonads. Rosario et al. (2006), however, conducted a histological investigation, which may more accurately represent Lmat. Estimates of age-at-maturity, tmat, were also discussed. The range for tmat was between two and six years.

Diet

Prey items include mainly fishes, shrimps, crabs, gastropods, cephalopods, tunicates and some pelagic items, including urochordates (Allen 1985 in Froese and Pauly 2002). 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 1974a). It can be ciguatoxic (Allen 1985 in Froese and Pauly 2002).

Reproduction and Spawning

Silk snapper are gonochronistic (i.e., sexes are distinct; Sylvester et al. 1980). Silk are thought to spawn year round (Sylvester et al. 1980). Peak spawning months for silk in the USVI are April-

June and October-December (Sylvester 1974). Parker and Mays (1998) have suggested that peak spawning months in the southeast USA are July-September and again in October-December. 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 1974a).

## Vermilion snapper, Rhomboplites aurorubens

### Distribution and Habitat

Vermilion snapper occur in the Western Atlantic from Bermuda and North Carolina (USA) to Brazil, including the Gulf of Mexico and Caribbean Sea (Allen 1985 in Froese and Pauly 2002). Vermilion snapper are demersal, commonly found over rock, gravel, or sand bottoms near the edge of the continental and island shelves (Allen 1985 in Froese and Pauly 2002). Suitable bottom type is probably more important than depth in influencing the distribution of this species (Boardman and Weiler 1979). According to Allen (1985), in Froese and Pauly (2002), this fish is found in moderately deep waters from 180-300 m. But most fish taken in fish traps during a 1978 survey off Puerto Rico were captured at 75-110 m depth (Boardman and Weiler 1979). Vermilions often form large schools; particularly the young, which generally occur at shallower depths (Allen 1985 in Froese and Pauly 2002).

### Life History

This fish is moderately resilient, with a minimum population doubling time of 1.4 - 4.4 years (K = 0.20; tm = 3; tmax = 10) (Allen 1985 in Froese and Pauly 2002). Maximum size and weight reported by Allen (1985), in Froese and Pauly (2002), is 60 cm TL (male) and 3,170 g, respectively. The modal length of both males and females collected in a three-year fish trap survey in Puerto Rican waters was 23 cm FL; maximum size, 38 cm. Size at maturity was 14 cm FL (males) and 20 cm 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 TL and 3.3 years, respectively. Maximum reported age is 10 years (Allen 1985 in Froese and Pauly 2002); natural mortality rate, 0.23 (Ault et al. 1998).

Diet

Prey items include fishes, shrimps, crabs, polychaetes, other benthic invertebrates, cephalopods, and planktonic organisms (Allen 1985 in Froese and Pauly 2002).

Reproduction and Spawning

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 1974a).

## Queen snapper, *Etelis oculatus*

Distribution and Habitat

Queen snapper occur in the Western Atlantic from Bermuda and North Carolina (USA) to Brazil, including the Gulf of Mexico and Caribbean Sea. It is commonly found near oceanic islands, and is particularly abundant in the Bahamas and the Antilles. Queen snapper are bathydemersal (Allen 1985 in Froese and Pauly 2002) and move offshore to deep-water reefs and rocky ledges as they grow and mature (SAFMC 1999). Allen (1985), in Froese and Pauly (2002) indicate queen snapper are primarily found over rocky bottom habitats, in depths of 100-450 m. Gobert et al. (2005) fished for and found queen snapper at depths between 100m and 500m. This was the widest depth distribution found reported in the literature, however, video taken during recent surveys in deep water habitats observed a queen snapper at 539m.

Life History

This fish is a moderately resilient species, with a minimum population doubling time 1.4-4.4 years (K = 0.29 - 0.61). Maximum reported size is 100 cm TL (male). Maximum reported weight is 5,300 g (Allen 1985 in Froese and Pauly 2002). Size at maturity and age at first maturity are estimated as 53.6 cm TL and 1 year, respectively. Approximate life span is 4.7 years; natural mortality rate, 0.76 (Froese and Pauly 2002). The reported estimates for Linf and K, were 1020 mm TL and 1030 mm TL, and 0.29-0.621 per year, respectively (Murray and Moore 1992, Murray et al. 1992, Murray and Neilson 2000). The reported range for the allometric growth parameter was 2.55-2.908 and the range for the scaling parameter was 0.012-0.0632 (Bohnsack and Harper 1988, Murray and Moore 1992, Rosario et al. 2006). Estimates of Lmat from the literature ranged from 230mm and 536mm. Rosario et al. (2006) provided lower estimates, which were measured in millimeters fork length, than Martinez-Andrade (2003). Estimates of age-at-maturity ranged between one and two years.

Diet

Primary prey items include small fishes and squids (Allen 1985 in Froese and Pauly 2002).

Reproduction and Spawning

Queen snapper are gonochronistic (i.e., sexes are distinct) and thought to spawn year round (Rosario et al. 2006). Spawning is thought to peak during October and November in Puerto Rico (Rosario et al. 2006).

## Lane snapper, *Lutjanus synagris*

Distribution and Habitat

Lane snapper occur in the Western Atlantic from Bermuda and North Carolina (USA) to southeastern Brazil, including the Gulf of Mexico and Caribbean Sea. It is most common around the Antilles, on the Campeche Bank, off Panama, and the northern coast of South America. Lane snapper are found over all bottom types, but are usually encountered around coral reefs and on vegetated sandy areas, in turbid as well as clear water, from 10-400 m depth (Allen 1985 in Froese and Pauly 2002).

Life History

This species is moderately resilient, with a minimum population doubling time of 1.4-4.4 years (K = 0.13-0.26; tm = 2; tmax = 10). Maximum reported size is 60 cm TL (male); maximum weight, 3,530 g (Allen 1985 in Froese and Pauly 2002). Size at maturity and age at first maturity are estimated in Froese and Pauly (2002) as 26.9 cm TL and 3 years, respectively. Figuerola and Torres (1997) estimate size at 50% maturity as 14.7 cm FL (males) and 18.5 cm FL (females) based on fishery dependent and independent data collected in the U.S. Caribbean. Allen (1985), in Froese and Pauly (2002), report maximum age as 10 years. Studies from northeast Brazil and Cuba used otoliths to estimate ages of this species up to 6 years (Thompson and Munro 1974a). Estimated natural mortality rate is 0.30 (Ault et al. 1998).

Diet

This species feeds at night on small fishes, bottom-living crabs, shrimps, worms, gastropods and cephalopods (Allen 1985 in Froese and Pauly 2002). According to Olsen et al. (1984), in Froese and Pauly (2002), it can be ciguatoxic.

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Reproduction and Spawning

This fish often forms large aggregations, especially during the spawning season (Allen 1985 in Froese and Pauly 2002). Spawning season is protracted, with some degree of reproductive activity occurring practically year-round (Figuerola and Torres 1997). Most spawning occurs from March to September in the U.S. Caribbean (Erdman 1976; Figuerola and Torres 1997) and, with greater intensity, between April and July. Spawning is believed to peak in June and July around the full moon (Figuerola and Torres 1997). Fecundity ranged from 347,000 to 995,000 eggs per fish in a study of six individuals captured off Cuba (Thompson and Munro 1974a).

## Gray snapper, *Lutjanus griseus*

Distribution and Habitat

Gray snapper occur in the Western Atlantic from Massachusetts (USA) to Brazil, including the Gulf of Mexico and Caribbean Sea. Gray snapper occur from 5-180 m depth, in coral reef habitat, rocky areas, estuaries, mangrove areas, and sometimes in the lower reaches of rivers (especially the young). It often forms large aggregations (Allen 1985 in Froese and Pauly 2002).

Life History

This fish is moderately resilient, with a minimum population doubling time of 1.4-4.4 years (K = 0.10; tm = 2-3; tmax = 21). Maximum reported size is 89 cm TL (male); maximum weight, 20 kg (Allen 1985 in Froese and Pauly 2002). Size at maturity and age at first maturity are estimated as 47 cm TL and 6.2 years (Froese and Pauly 2002). Maximum age is 21 years (Allen 1985 in Froese and Pauly 2002). Estimated natural mortality rate is 0.30 (Ault et al. 1998).

Diet

Gray snapper feed mainly at night on small fishes, shrimps, crabs, gastropods, cephalopods, and some planktonic items (Allen 1985 in Froese and Pauly 2002). The stomachs of 18 juveniles collected off the south coast of Jamaica contained 60% by volume of larval fish and 40% crabs and shrimp (Thompson and Munro 1974a). Halstead (1970), in Froese and Pauly (2002), report that it can be ciguatoxic.

Reproduction and Spawning

Thompson and Munro (1974a) report that this species spawned at the Florida Cays in July and August. In the northeastern Caribbean, individuals in spawning condition have been observed in May, August, and September (Erdman 1976). Off Cuba, Garcia-Cagide et al.(1994) reported that gray snapper spawn during June through October with a peak in July. In Key West, FL, the

spawning season for female gray snapper ranges from June to September with a peak in July (Domeier et al. 1993).

## Mutton snapper, *Lutjanus analis*

### Distribution and Habitat

Mutton snapper occur in the Western Atlantic as far north as Massachusetts (USA), southward to southeastern Brazil, including the Caribbean Sea and the Gulf of Mexico. It is most abundant around the Antilles, the Bahamas, and off southern Florida (USA). According to Allen (1985), in Froese and Pauly (2002), mutton snapper can be found in both brackish and marine waters from 25-95 m depth. Thompson and Munro (1974a) report that this species was captured on mud slopes off the southeast coast of Jamaica at depths of 100-120 m (Thompson and Munro 1974a). Juveniles generally occur closer to shore, over sandy, vegetated (usually Thalassia) bottom habitats, while large adults are commonly found offshore among rocks and coral habitat (Allen 1985 in Froese and Pauly 2002).

### Life History

This fish is of low resilience, with a minimum population doubling time of 4.5-14 years (K = 0.13-0.25) (Allen 1985 in Froese and Pauly 2002). Allen (1985), in Froese and Pauly (2002), reports maximum size as 94 cm TL (male); maximum weight, 15.6 kg (Allen 1985 in Froese and Pauly 2002). The largest male and female observed in a study conducted in Puerto Rico between February 2000 and May 2001 measured 70 cm FL and 69 cm FL, respectively (Figuerola and Torres 2001). Approximate life span is 14 years (Allen 1985 in Froese and Pauly 2002); natural mortality rate, 0.214 (Ault et al. 1998). Maximum reported age is 17 years (Figuerola and Torres 2001). Size at maturity and age at first maturity are estimated in Froese and Pauly (2002) as 47.3 cm TL and 3.1 years, respectively. Figuerola and Torres (2001) estimate size at 50% maturity as 33 cm FL and 41.4 cm FL for males and females, respectively, based on the Puerto Rican survey. They indicate that all males and females are probably mature at 43.1 cm FL and 45 cm FL, respectively. That study, which was based on fishery dependent data, notes that 53% of males and 72% of females were taken prior to achieving sexual maturity. One study estimated that the ovary of an individual fish contained about 1,355,000 eggs (Thompson and Munro 1974a).

### Diet

It feeds both day and night on fishes, shrimps, crabs, cephalopods, and gastropods (Allen 1985 in Froese and Pauly 2002). According to Olsen et al. (1984), in Froese and Pauly (2002), it can be ciguatoxic.

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Reproduction and Spawning

Spawning occurs in aggregations (Figuerola and Torres 2001). Erdman (1976) reports that individuals have been observed in spawning condition in the U.S. Caribbean from February through July (Erdman 1976). Figuerola and Torres (2001) report that some degree of reproduction occurs from February to June, but that spawning activity generally peaks during the week following the full moon in the months of April and May. Spawning aggregations are known to occur north of St. Thomas and south of St. Croix, USVI in March, April, and May (Rielinger 1999).

## Schoolmaster snapper, *Lutjanus apodus*

Distribution and Habitat

Schoolmaster snapper occurs in the Western Atlantic as far north as Massachusetts (USA), southward to Trinidad and northern Brazil, including the Gulf of Mexico and Caribbean Sea. Schoolmaster snapper are found in shallow, clear, warm, coastal waters over coral reefs, from 2-63 m depth. Adults often seeks shelter near elkhorn corals and gorgonians. Juveniles are encountered over sand bottoms with or without seagrass (Thalassia), and over muddy bottoms of lagoons or mangrove areas. Young sometimes enter brackish waters (Allen 1985 in Froese and Pauly 2002).

Life History

Allen (1985), in Froese and Pauly (2002), reports maximum sizes as 67.2 cm TL and 75 cm FL for males and females, respectively. The maximum fork length of females captured in a Jamaican study was 57 cm (Thompson and Munro 1974a). Maximum reported weight is 10.8 kg (Allen 1985 in Froese and Pauly 2002). Size at maturity is estimated as 37.7 cm TL; natural mortality rate, 0.25 (Ault et al. 1998).

Diet

Prey items include fishes, shrimps, crabs, worms, gastropods and cephalopods (Allen 1985 in Froese and Pauly 2002). Dammann (1969), in Froese and Pauly (2002), report that it can be ciguatoxic.

Reproduction and Spawning

Ripe and/or recently spent fishes have been collected in nearshore and oceanic habitats off Jamaica in February-June and August-November (Thompson and Munro 1974a). Erdman (1976) reports the occurrence of ripe males and females in September. Schoolmaster are reported to spawn during April-June off Cuba (Garcia-Cagide et al. 1994).

## Yellowtail snapper, *Ocyurus chrysurus*

### Distribution and Habitat

Yellowtail snapper occur in the Western Atlantic from Massachusetts (USA) to southeastern Brazil, including the Gulf of Mexico and Caribbean Sea. This species is most common in the Bahamas, off south Florida, and throughout the Caribbean. Yellowtail snapper inhabit waters to 180 m depth, and usually occur well above the bottom (Allen 1985 in Froese and Pauly 2002). A Jamaican study reports this species was most abundant at depths of 20-40 m near the edges of shelves and banks (Thompson and Munro 1974a). Early juveniles are usually found over seagrass beds (Allen 1985 in Froese and Pauly 2002; Thompson and Munro 1974a). Later juveniles inhabit shallow reef areas. Adults are found on deeper reefs (Thompson and Munro 1974a). This fish wanders a bit more than other snapper species (SAFMC 1999). But the extent of its movement is unknown. It also exhibits schooling behavior (Thompson and Munro 1974a).

### Life History

This species is of low resilience, with a minimum population doubling time of 4.5-14 years (K = 0.10-0.16; tm = 2; tmax = 14). Maximum reported size is 86.3 cm TL (male); maximum weight, 4,070 g (Allen 1985 in Froese and Pauly 2002). Size at maturity and age at first maturity are estimated in Froese and Pauly (2002) as 42.5 cm TL and 4 years, respectively. Figuerola and Torres (1997) estimate size at 50% maturity as 22.4 cm FL (males) and 24.8 cm FL (females), based on fishery independent and dependent data collected off Puerto Rico. Maximum reported age is 14 years (Allen 1985 in Froese and Pauly 2002); estimated natural mortality rate, 0.21 (Ault et al. 2002).

### Diet

Juvenile yellowtail snappers feed primarily on plankton (Allen 1985 in Froese and Pauly 2002; Thompson and Munro 1974a). Adults feed mainly at night on a combination of planktonic (Allen 1985 in Froese and Pauly 2002), pelagic (Thompson and Munro 1974a), and benthic organisms, including fishes, crustaceans, worms, gastropods and cephalopods (Allen 1985 in Froese and Pauly 2002). Dammann (1969), in Froese and Pauly (2002), reports that it can be ciguatoxic.

### Reproduction and Spawning

Spawning extends over a protracted period (Allen 1985 in Froese and Pauly 2002; Figuerola and Torres 1997), peaking at different times in different areas (Allen 1985 in Froese and Pauly 2002). Figuerola and Torres (1997) report that, in the U.S. Caribbean, the reproductive season of

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this fish extends from February to October, with a peak from April to July. Erdman (1976) reports that 80% of adult yellowtails captured off San Juan from March through May, and over Silver Bank in early September, had ripe or sub-ripe gonads. Evidence indicates that spawning occurs in offshore waters (Figuerola and Torres 1997; Thompson and Munro 1974a) and during the new moon (Figuerola and Torres 1997). Fecundity ranged from 100,000 to 1,473,000 eggs per fish in four individuals captured off Cuba (Thompson and Munro 1974a).

## Nassau grouper, Epinephelus striatus

### Distribution and Habitat

Nassau grouper occur in the tropical Western Atlantic, ranging from Bermuda, the Bahamas, and Florida (USA) to southern Brazil. Take and possession of Nassau grouper is prohibited in federal waters and Puerto Rico implemented new regulations on March 12, 2004, to prohibit the possession or sale of Nassau grouper. 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 in Froese and Pauly 2002).

### Life History

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 TL (male); maximum weight, 25 kg (Heemstra and Randall 1993 in Froese and Pauly 2002). Size at maturity and age at first maturity are estimated as 47.5 cm 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 in Froese and Pauly 2002). Ault et al. (1998) estimate natural mortality rate to be 0.18.

### Diet

Nassau grouper are top-level predators. Juveniles feed mostly on crustaceans, while adults (>30 cm) forage alone, mainly on fish (NMFS 2001b), but also on crabs and, to a lesser extent, other crustaceans and mollusks (Heemstra and Randall 1993 in Froese and Pauly 2002). Olsen et al. (1984), in Froese and Pauly (2002), report that it can be ciguatoxic.

### Reproduction and Spawning

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

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(separate sexes), with a potential for sex change (NMFS 2001b). One study reported 785,101 eggs for a specimen of 35.8 cm SL (Thompson and Munro 1974b). Nassau grouper aggregate 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 groupers (Sadovy et al. 1994). Concentrated aggregations of a few dozen (NMFS 2001b) up to 30,000 Nassau groupers have been reported from the Bahamas, Jamaica, Cayman Islands, Belize, and the Virgin Islands (Heemstra and Randall 1993 in Froese and Pauly 2002). Spawning aggregations composed of about 2000 individuals have been documented north and south of St. Thomas, USVI, at 10-40 m 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 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 Celsius. Thompson and Munro (1974b) 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 1974b). In the northeastern Caribbean, individuals in spawning condition have been observed in March (Erdman 1976).

## Goliath grouper, Epinephelus itajara

### Distribution and Habitat

Goliath grouper, occur 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. Take and possession of Goliath grouper is prohibited in both federal and Puerto Rico implemented new regulations on March 12, 2004, to prohibit the possession or sale of Goliath grouper. A solitary species, Goliath grouper inhabit rock, coral, and mud bottom habitats, from shallow, inshore areas to depths of 100 m (Heemstra and Randall 1993 in Froese and Pauly 2002) or 150 m (NMFS 2001a). Juveniles are generally found in mangrove areas and brackish estuaries. Large adults also may be found in estuaries. T hey appear to occupy limited home ranges with little inter-reef movement (Heemstra and Randall 1993 in Froese and Pauly 2002).

### Life History

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 (male); maximum weight, 455 kg (Heemstra and Randall 1993 in Froese and Pauly 2002). NMFS (2001a) reports that males generally range in size between 80-210 cm TL; females, from 30-220 cm. 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 TL, and females at 120-135 cm 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).

Diet

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

Reproduction and Spawning

This species exhibits definite or strongly suggestive indications of sex reversal (protogynous hermaphrodite) (Thompson and Munro 1974b). 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.

## Coney, Epinephelus fulvus

Distribution and Habitat

Coney occur in the Western Atlantic, ranging from South Carolina (USA) and Bermuda to southern Brazil, including Atol das Rocas. Wary, but approachable, this species is taken in commercial fisheries and also is utilized in the aquarium trade (Heemstra and Randall 1993 in Froese and Pauly 2002). Coney are sedentary and prefer coral reefs and clear water. They can be found to depths of 150 m.

Life History

This fish is moderately resilient, with a minimum population doubling time of 1.4 - 4.4 years (K=0.14-0.63; Fec=67,000). Maximum reported size is 41 cm TL (male). It is a protogynous

hermaphrodite (Heemstra and Randall 1993 in Froese and Pauly 2002). Size at maturity and age at first maturity estimated in Froese and Pauly (2002) is 19.8 cm TL and 1.1 years, respectively. Size at 50% maturity for female coneys sampled off the west coast of Puerto Rico is 13 cm FL (Figuerola and Torres 2000). Heemstra and Randall (1993), in Froese and Pauly (2002), report that females mature at 16 cm TL and transform to males at about 20 cm TL. The approximate life span of this fish is 4.5 years; natural mortality rate, 0.18 (Ault et al. 1998).

### Diet

The diet of this fish is composed primarily of small fishes and crustaceans. It may follow morays and snake eels to feed on flushed preys (Heemstra and Randall 1993 in Froese and Pauly 2002). Olsen et al. (1984), in Froese and Pauly (2002), report that it can be ciguatoxic.

### Reproduction and Spawning

Several studies have indicated that coney do not form spawning aggregations. Spawning occurs in pairs within small groups composed of one male and multiple females. Although ripe ovaries are found from November to March off the west coast of Puerto Rico, spawning activity appears to be limited to several days around the last quarter and new moon phases during January and February (Figuerola and Torres 2000).

## Graysby, Epinephelus cruentatus

### Distribution and Habitat

Graysby occur in the Western Central Atlantic, from North Carolina to southern Florida (USA), off Bermuda, and in the Gulf of Mexico and Caribbean Sea. Its small size generally makes it of minor importance to commercial fisheries (Heemstra and Randall 1993 in Froese and Pauly 2002). The graysby inhabits seagrass (Thalassia) beds and coral reefs, and can be found to 170 m depth.

### Life History

This fish is moderately resilient, with a minimum population doubling time of 1.4 - 4.4 years (K=0.34-0.35; tm=3.5-5.5; tmax=9; Fec=260,000). Maximum reported size is 42.6 cm TL (male); maximum weight, 1,130 g. The graysby is hermaphroditic (Heemstra and Randall 1993 in Froese and Pauly 2002). Size at maturity and age at first maturity are estimated as 19.8 cm TL and 2 years, respectively (Froese and Pauly 2002). Approximate life span is 8.1 years; natural mortality rate, 0.20 (Ault et al. 1998).

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Diet

The brown chromis, has been identified as a preferred food item (Heemstra and Randall 1993 in Froese and Pauly 2002). ). Juveniles feed on shrimp; adults, primarily on fishes. Olsen et al. (1984), in Froese and Pauly (2002), reports that it can be ciguatoxic.

Reproduction and Spawning

Graysby are sedentary, solitary, and secretive, usually hiding during the day, and feeding at night. In the northeastern Caribbean, individuals in spawning condition have been observed in March, and in May through July (Erdman 1976). Nagelkerken (1979) determined that graysby collected in the Caribbean were in spawning condition from July through October.

## Red hind, Epinephelus guttatus

Distribution and Habitat

Red hind occur in the Western Atlantic, ranging from North Carolina (USA) to Venezuela, including the Caribbean Sea. Red hind are found in shallow reefs and rocky bottoms, from 2-100 m depth. They are usually solitary and territorial.

Life History

This species is moderately resilient, with a minimum population doubling time of 1.4 - 4.4 years (K=0.12-0.24; tm=3; tmax=17; Fec=96,000). Maximum reported size is 76 cm TL (male); maximum weight, 25 kg (Heemstra and Randall 1993 in Froese and Pauly 2002). Size at maturity and age at first maturity are estimated in Froese and Pauly (2002) as 31.4 cm TL and 5.5 years, respectively. Figuerola and Torres (2000) estimate size at maturity as 21.7 cm FL based on data collected in a study conducted off the west coast of Puerto Rico. The approximate life span of this fish is 23.8 years; natural mortality rate, 0.18 (Ault et al. 1998).

Diet

Red hind feed mainly on crabs and other crustaceans, fishes, such as labrids and haemulids, and octopus (Heemstra and Randall 1993 in Froese and Pauly 2002). Halstead (1970), in Froese and Pauly (2002), reports that it can be ciguatoxic.

Reproduction and Spawning

Red hind are protogynous hermaphrodites and mean size at sex reversal appears to be in the region of 38 cm TL (Thompson and Munro 1974b). But, according to Heemstra and Randall (1993), in Froese and Pauly (2002), some individuals have been observed to undergo sexual

inversion at just 28 cm TL. CFMC (1985) reports size at sex reversal as 35 cm TL. Most fish larger than 40 cm are males, which is important in terms of numbers caught and total weight of landings in the Caribbean (Heemstra and Randall 1993 in Froese and Pauly 2002). One study showed 233,273 eggs for a specimen of 35.8 cm SL (Thompson and Munro 1974b).
This species aggregates in large numbers during the spawning season (Coleman et al. 2000; Sadovy et al. 1994). A number of spawning aggregation sites have been documented in the U.S. Caribbean. Three sites are located off the western coast of Puerto Rico. A fourth site is located near the shelf edge off the southwest coast of Puerto Rico, El Hoyo and La Laja, and is utilized by as many as 3,000 individuals at 20-30 m depth. A fifth site is located on the Lang Bank, north-northeast of St. Croix, and is characterized by aggregations from 38-48 m depth. Finally, a sixth site is located south of St. Thomas, USVI. That aggregation also generally occurs at 38-48 m depth. The timing of aggregations is somewhat variable. Aggregations off Puerto Rico generally occur from January through March in association with the full moon, while those off the USVI generally occur from December through March in association with the full moon (Rielinger 1999).

## Rock hind, Epinephelus adscensionis

### Distribution and Habitat

Rock hind occur in the Western Atlantic from Massachusetts (USA) to southern Brazil, including the Gulf of Mexico and Caribbean Sea. Rock hind are demersal, inhabiting rocky reef habitats to depths of 120 m.

### Life History

This fish is of low resilience, with a minimum population doubling time of 4.5 - 14 years (K=0.11). Maximum reported size is 61 cm TL (male); maximum weight, 4,080 g (Heemstra and Randall 1993 in Froese and Pauly 2002). Size at maturity and age at first maturity are estimated as 28 cm TL and 6.1 years, respectively. Approximate life span is 25.9 years; natural mortality rate, 0.25 (Ault et al. 1998).

### Diet

Crabs comprise the majority of its diet, but it also has been observed to feed on fishes and young sea turtles (Heemstra and Randall 1993 in Froese and Pauly 2002). Halstead (1970), in Froese and Pauly (2002), reports that it can be ciguatoxic.

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Reproduction and Spawning

This fish has been observed to spawn in aggregations near the shelf edge off the southwest coast of Puerto Rico, at 20-30 m depth, in the month of January (Rielinger 1999). Off Cuba, rock hind have been reported to spawn during January through March (Garcia-Cagide et al. 1994).

## Black grouper, Mycteroperca bonaci

Distribution and Habitat

Life History

Diet

Reproduction and Spawning

## Red grouper, *Epinephelus morio*

Distribution and Habitat

Red grouper occur in the Western Atlantic, ranging as far north as Massachusetts (USA) to southern Brazil, including the Gulf of Mexico and Caribbean Sea. A sedentary species, red grouper are usually found resting on rocky and muddy bottoms, from 5-300 m 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.

Life History

This fish is of low resilience, with a minimum population doubling time of 4.5 - 14 years (K=0.1-0.18; tm=4-6; tmax=25; Fec=1.4 million). Maximum reported size is 125 cm TL (male); maximum weight, 23 kg. The world record for hook and line is 17.7 lbs, from Cape Canaveral, Florida (Heemstra and Randall 1993 in Froese and Pauly 2002). Size at maturity and age at first maturity are estimated as 47.1 cm TL and 5.2 years, respectively (Froese and Pauly 2002). Maximum reported age is 25 years (Heemstra and Randall 1993 in Froese and Pauly 2002). Estimated natural mortality rate is 0.18 (Ault et al. 1998).

Diet

It feeds on a wide variety of fishes and invertebrates (Heemstra and Randall 1993 in Froese and Pauly 2002).

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Reproduction and Spawning

Red grouper are protogynous hermaphrodites. Most females transform to males between ages 7 to 14. In the northeastern Caribbean, individuals in spawning condition have been observed from February through May (Erdman 1976).

## Tiger grouper, *Mycteroperca tigris*

Distribution and Habitat

Tiger grouper occur in the Western Atlantic, ranging from Bermuda and south Florida (USA) to Venezuela and, possibly, Brazil, including the Gulf of Mexico and Caribbean Sea. A solitary species, the tiger grouper inhabits coral reefs and rocky areas, from 10-40 m depth.

Life History

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 TL (male); maximum weight, 10,000 g (Heemstra and Randall 1993 in Froese and Pauly 2002). Size at maturity and age at first maturity are estimated as 39.9 cm TL and 5.8 years, respectively. Approximate life span is 26 years; natural mortality rate, 0.116 (Ault et al. 2002).

Diet

The tiger grouper ambushes a variety of fish species, and frequents cleaning stations (Heemstra and Randall 1993 in Froese and Pauly 2002). Off the island of Vieques, predation on tiger groupers 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 and Posada 1998). Dammann (1969), in Froese and Pauly (2002), reports that it can be ciguatoxic.

Reproduction and Spawning

The size-sex ratios described in a Bermuda study indicate this fish is probably a protogynous hermaphrodite (Heemstra and Randall 1993 in Froese and Pauly 2002). It forms aggregations at specific times and locations each year, but only during the spawning season (Coleman et al. 2000; Matos 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 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

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aggregation sites described for western Atlantic groupers 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 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 and Posada 1998). Females taken from the "El Seco" aggregation in 1997 and 1998 averaged 46.2 cm TL and 48.2 cm TL, respectively; males averaged 53.4 cm TL and 54.0 cm TL, respectively. The female to male ratio was 1:6.4 in 1997 and 1:12.0 in 1998 (Matos 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.

## Yellowfin grouper, *Mycteroperca venenosa*

### Distribution and Habitat

Yellowfin grouper occur in the Western Atlantic, ranging from Bermuda to Brazil and Guianas, including the Gulf of Mexico and Caribbean Sea. Yellowfin grouper inhabit waters from 2-137 m depth. Juveniles are commonly found in shallow turtle grass beds; adults, on rocky and coral reefs.

### Life History

This fish is of low resilience, with a minimum population doubling time of 4.5 - 14 years (K=0.09-0.17; tmax=15; Fec=400,000). Maximum reported size is 100 cm TL (male); maximum weight, 18.5 kg (Heemstra and Randall 1993 in Froese and Pauly 2002). Size at maturity and age at first maturity are estimated as 45.6 cm TL and 3.7 years, respectively. Approximate life span is 16.9 years; natural mortality rate, 0.18 (Ault et al. 1998).

### Diet

It feeds mainly on fishes (mostly on coral reef species) and squids (Heemstra and Randall 1993 in Froese and Pauly 2002).

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Reproduction and Spawning

This fish is believed to be a protogynous hermaphrodite. One studied specimen contained a total of 1,425,443 eggs (Thompson and Munro 1974b). Yellowfin grouper reportedly aggregate at some of the same sites utilized by the tiger, Nassau, and black groupers (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 1974b).

## Misty grouper, *Epinephelus mystacinus*

Distribution and Habitat

Misty grouper occur in Western Atlantic from Bermuda and North Carolina (USA) to Mexico, including the Gulf of Mexico and Caribbean Sea. The misty grouper is a solitary, bathydemersal, deep-water species, ranging from 30-400 m depth. Juveniles occur in shallower waters.

Life History

Virtually nothing is known about the age, growth, and reproduction of this species. Maximum reported sizes are 160 cm TL and 100 cm TL for males and females, respectively. Maximum reported weight is 107 kg (Heemstra and Randall 1993 in Froese and Pauly 2002). Estimated size at maturity is 81.1 cm TL; natural mortality rate, 0.14 (Froese and Pauly 2002).

Diet

Prey items include fishes, crustaceans, and squids (Heemstra and Randall 1993 in Froese and Pauly 2002).

Reproduction and Spawning

In the northeastern Caribbean, individuals in spawning condition have been observed in January, April, August, and November (Erdman 1976).

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## Blue parrotfish, *Scarus coeruleus*

### Distribution and Habitat

Blue parrotfish occur in the Western Atlantic, ranging from Maryland (USA) and Bermuda to Brazil, including the Caribbean Sea (Robins and Ray 1986 in Froese and Pauly 2002). Blue parrotfish inhabit coral reef habitat, occurring from 3-25 m depth. Juveniles are found on seagrass (Thalassia) beds.

### Life History

Maximum reported size is 120 cm TL (male) (Robins and Ray 1986 in Froese and Pauly 2002). Estimated size at maturity is 62.9 cm TL; natural mortality rate, 0.43 (Froese and Pauly 2002).

### Diet

Dietary items include benthic plants and small organisms in the sand (Robins and Ray 1986 in Froese and Pauly 2002).

### Reproduction and Spawning

This fish is known to form large spawning aggregations (Robins and Ray 1986 in Froese and Pauly 2002). In Jamaican waters, the highest proportion of active and ripe fishes occurs between January and May (Reeson 1975b).

## Midnight parrotfish, *Scarus coelestinus*

### Distribution and Habitat

Midnight parrotfish occur in the Western Atlantic, ranging from Bermuda to Brazil, including the Caribbean Sea (Robins and Ray 1986 in Froese and Pauly 2002). Midnight parrotfish occur from rocky coastal reefs to seaward reefs, in depths of 5-75 m.

### Life History

Maximum reported size is 77 cm TL (male); maximum weight, 7,000 g (Robins and Ray 1986 in Froese and Pauly 2002).

### Diet

It is often encountered in schools, feeding on algae along with surgeonfishes.

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Reproduction and Spawning

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 seems to be confined to the warmer months of the year in Bermuda (Reeson 1975b).

## Rainbow parrotfish, *Scarus guacamaia*

Distribution and Habitat

Rainbow parrotfish occurs in the Western Atlantic, ranging from Bermuda to Argentina, including the Caribbean Sea (Robins and Ray 1986 in Froese and Pauly 2002). Rainbow parrotfish are found from 3-25 m depth. Juveniles are commonly encountered in mangrove areas.

Life History

Maximum reported size is 120 cm TL (male); maximum weight, 20 kg (Robins and Ray 1986 in Froese and Pauly 2002). Estimated size at maturity is 62.9 cm TL; natural mortality rate, 0.43 (Froese and Pauly 2002).

Diet

This fish feeds primarily on benthic algae (Robins and Ray 1986 in Froese and Pauly 2002).

Reproduction and Spawning

In Jamaican waters, the highest proportion of active and ripe fishes appear to be confined to the period between January and May (Reeson 1975b). In the northeastern Caribbean, individuals in spawning condition have been observed in June and July (Erdman 1976).

## Princess parrotfish, *Scarus taeniopterus*

Distribution and Habitat

Princess parrotfish occur in the Western Atlantic, ranging from Bermuda to Brazil, and throughout the Caribbean Sea (Robins and Ray 1986 in Froese and Pauly 2002). Princess parrotfish are found on coral or rock bottoms, from 2-25 m depth. Juveniles often occur in association with seagrass(Thalassia).

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Life History

Maximum reported size is 35 cm TL (male) (Robins and Ray 1986 in Froese and Pauly 2002). Size at maturity is estimated as 21.2 cm TL; natural mortality rate, 0.88 (Froese and Pauly 2002).

Diet

It feeds on plants in large aggregations, and sleeps in a mucus cocoon (Robins and Ray 1986 in Froese and Pauly 2002).

Reproduction and Spawning

This species appears to spawn throughout the year in Jamaican waters, with the highest proportion of ripe fishes occurring in December and January (Reeson 1975b).

## Queen parrotfish, *Scarus vetula*

Distribution and Habitat

Queen parrotfish occur in the Western Central Atlantic, ranging from Bermuda to northern South America, and throughout the Caribbean Sea (Robins and Ray 1986 in Froese and Pauly 2002). Queen parrotfish inhabit coral reefs and adjacent habitats, from 3-25 m depth.

Life History

Maximum reported size is 61 cm TL (male) (Robins and Ray 1986 in Froese and Pauly 2002). Size at maturity and age at first maturity are estimated as 30.6 cm TL and 1.1 years, respectively. Approximate life span is 4.8 years; natural mortality rate, 1.05 (Froese and Pauly 2002).

Diet

Qqueen parrotfish feed on algae and sleeps in a mucus cocoon (Robins and Ray 1986 in Froese and Pauly 2002).

Reproduction and Spawning

It is often observed in groups of one supermale with several young adults, most of which are believed to be females. 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 1975b).

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## Redtail parrotfish, *Sparisoma chrysopterum*

### Distribution and Habitat

Redtail parrotfish occur in the Western Atlantic, ranging from southern Florida (USA) to Brazil, and throughout the Caribbean Sea (Robins and Ray 1986 in Froese and Pauly 2002). Redtail occur in coral reefs and adjacent habitats to depths of 15 m. Juveniles most commonly inhabit seagrass beds.

### Life History

Maximum reported size is 46 cm TL (male) (Robins and Ray 1986 in Froese and Pauly 2002). Size at maturity and age at first maturity are estimated in Froese and Pauly (2002) as 23.9 cm 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 FL (females). Transitional fish ranged from 20.1 cm FL to 24.8 cm FL (Figuerola and Torres 1997).

### Diet

Redtail parrotfish feed on benthic algae and seagrasses (Robins and Ray 1986 in Froese and Pauly 2002).

### Reproduction and Spawning

Spawning period is protracted. According to Figuerola and Torres (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 1975b).

## Stoplight parrotfish, *Sparisoma viride*

### Distribution and Habitat

The stoplight parrotfish occurs in the Western Atlantic, ranging from southern Florida (USA) to Brazil, and throughout the Caribbean Sea (Cervigón et al. 1992 in Froese and Pauly 2002). Stoplight parrotfish inhabit clear water coral reefs, occurring from 3-49 m 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.

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Life History

Maximum reported size is 64 cm TL (male); maximum weight, 1,600 g. Size at maturity is estimated in Froese and Pauly (2002) as 36.1 cm TL; natural mortality rate, 0.66. Size at 50% maturity estimated from a survey conducted off Puerto Rico is 20.5 cm FL (females) (Figuerola and Torres 1997) . A Bermuda study reports that males mature at 16-20 cm SL and females at 16.3 cm SL (Reeson 1975b).

Diet

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 in Froese and Pauly 2002).

Reproduction and Spawning

This fish is a protogynous hermaphrodite, functioning first as a female and, later, as a male (Cervigón et al. 1992 in Froese and Pauly 2002). Spawning period is protracted. According to Figuerola and Torres (1997), no peaks are apparent in the U.S. Caribbean, but spawning activity appears to decrease during the summer (May through August). Paired spawning has been observed in May off the Virgin Islands (Reeson 1975b).

## Redband parrotfish, *Sparisoma aurofrenatum*

Distribution and Habitat

Redband parrotfish occur in the Western Atlantic, ranging from Bermuda to Brazil, and throughout the Caribbean Sea (Robins and Ray 1986 in Froese and Pauly 2002). Redband parrotfish inhabit coral reefs, occurring from 2-20 m depth. Juveniles are usually found in adjacent seagrass beds. It is often observed resting on the sea bottom, either solitary or in small groups.

Life History

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 TL (male) (Robins and Ray 1986 in Froese and Pauly 2002). Size at maturity is estimated as 17.4 cm TL; natural mortality rate, 1.14 (Froese and Pauly 2002).

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Diet

It feeds on plants (Robins and Ray 1986 in Froese and Pauly 2002).

Reproduction and Spawning

Reeson (1975b) reports that spawning has been observed to occur off the Virgin Islands in the months of March, April, June, and August. Erdman (1976) reports that individuals also have been observed in spawning condition in the northeastern Caribbean in February and December (Erdman 1976). Ripe fishes have been caught in both the nearshore and offshore environment. Paired spawning has been observed (Reeson 1975b).

## Striped parrotfish, *Scarus croicensis*

Distribution and Habitat

Striped parrotfish occurs in the Western Atlantic, ranging from Bermuda to northern South America (and possibly Brazil), including the Gulf of Mexico and Caribbean Sea (Böhlke and Chaplin 1993). Striped parrotfish is found over shallow, clear waters, from 3-25 m depth. It is a schooling species, and generally occurs over seagrass (Thalassia) beds, but also is found in rocky or coral areas.

Life History

Maximum reported size is 35 cm TL (male) (Böhlke and Chaplin 1993). Size at maturity is estimated in Froese and Pauly (2002) as 21.2 cm TL; natural mortality rate, 0.61. A study conducted in Bermuda reports that males mature at 11-13 cm SL and females, at 9-10 cm SL (Reeson 1975b).

Diet

It feeds on plants (Böhlke and Chaplin 1993).

Reproduction and Spawning

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 1975b). 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 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) appear to be the focal

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points for spawning groups. It has been observed to migrate daily among specific routes (Reeson 1975b).

## Redfin parrotfish, *Sparisoma rubripinne*

### Distribution and Habitat

Redfin parrotfish occur in the Western Atlantic from Massachusetts (USA) to Brazil, and throughout the Caribbean Sea. Redfin parrotfish inhabit coral reefs and seagrass beds to depths of 15 m.

### Life History

Maximum reported size is 47.8 cm TL (male) (Randall 1990 in Froese and Pauly 2002). Size at maturity and age at first maturity are estimated as 28.3 cm TL and 1.2 years, respectively. Approximate life span is 4.9 years; natural mortality rate, 1.05 (Froese and Pauly 2002).

### Diet

The redfin parrotfish feeds on benthic algae and seagrasses (Randall 1990 in Froese and Pauly 2002).

### Reproduction and Spawning

Spawning usually occurs in small groups (Randall 1990 in Froese and Pauly 2002), but also in pairs. Deeper reef fronts (15-20 m) 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 1975b).

## White grunt, *Haemulon plumieri*

### Distribution and Habitat

Also known simply as, the "grunt," this species occurs in the Western Atlantic, ranging from Chesapeake Bay (USA) to Brazil, including the Gulf of Mexico and Caribbean Sea. White grunt are found from 3-40 m depth, in dense aggregations during the day on patch reefs, around coral formations, or on sandy bottoms. Juveniles commonly inhabit seagrass (Thalassia testudinum) beds.

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Life History

This fish is moderately resilient, with a minimum population doubling time of 1.4 - 4.4 years (K=0.16-0.35; tm=2; tmax=13; Fec=64,000). Maximum reported size is 53 cm TL (male); maximum weight, 4,380 g (Courtenay and Sahlman 1978 in Froese and Pauly 2002). Size at maturity and age at first maturity are estimated in Froese and Pauly (2002) as 27.2 cm TL and 2.6 years, respectively. A study in Jamaican waters reported mean size at maturity as about 20 cm FL and 22 cm FL for males and females, respectively. Males and females appeared to be fully mature at 24-24.9 cm FL and 26-27.9 cm FL, respectively (Gaut and Munro 1974). Approximate life span is 11 years; natural mortality rate, 0.375 (Ault et al. 1998).

Diet

White grunt feed on crustaceans, small mollusks, and small fishes.

Reproduction and Spawning

Peak breeding season appears to be between January and April in Jamaican waters, with a secondary, minor peak in September-November (Gaut and Munro 1974). In the northeastern Caribbean, individuals in spawning condition have been observed from February through April, and in September and November (Erdman 1976). Frequently exhibits a territorial "kissing" display, in which two contenders push each other on the lips with their mouths wide open (Courtenay and Sahlman 1978 in Froese and Pauly 2002).

## Bluestriped grunt, *Haemulon sciurus*

Distribution and Habitat

Bluestriped grunt occur in the Western Atlantic, ranging from Florida (USA) to Brazil, including the Gulf of Mexico and Caribbean Sea. Bluestriped grunt are found in small groups over coral and rocky reefs to 30 m depth. Juveniles are abundant in seagrass (Thalassia) beds.

Life History

This species is moderately resilient, with a minimum population doubling time of 1.4 - 4.4 years (K=0.22-0.30; tm=2; Fec=47,000). Maximum reported size is 46 cm TL (male); maximum reported weight, 750 g (Courtenay and Sahlman 1978 in Froese and Pauly 2002). Size at maturity and age at first maturity are estimated in Froese and Pauly (2002) as 23.6 cm TL and 2.3 years, respectively. A Jamaican study reported, based on a small sample size, that few fishes mature before 18 cm FL and that full maturity is probably at about 22 cm FL. For a sample size of just 3, mean length was 24.2 cm, mean weight was 283 g, and mean fecundity was 32,000

(Gaut and Munro 1974). Approximate life span is 9.5 years; natural mortality rate, 0.50 (Ault et al. 1998).

Diet

Bluestriped grunt feeds on crustaceans, bivalves and, occasionally, on small fishes (Courtenay and Sahlman 1978 in Froese and Pauly 2002).

Reproduction and Spawning

Peak breeding season in Jamaican waters appears to be between January and April, with a secondary, minor peak in September-November (Gaut and Munro 1974). In the northeastern Caribbean, individuals in spawning condition have been observed in January and March (Erdman 1976). Off Cuba, bluestriped grunt are reported to be in spawning condition during October through April with a peak during December and January (Garcia-Cagide et al. 1994).

## Ocean surgeonfish, *Acanthurus bahianus*

Distribution and Habitat

In the Western Atlantic, ocean surgeonfish range from Massachusetts (USA), southward to Brazil, including the Gulf of Mexico and Caribbean Sea. Ocean surgeonfish inhabit shallow bottom habitats with coral or rocky formations, in depths from 2-40 m (Robins and Ray 1986 in Froese and Pauly 2002). It also may be encountered over algal plains and seagrass beds that lie adjacent to reef habitats. Characterized as a benthic resident (Reeson 1975a), this species usually occurs in groups of five or more individuals (Robins and Ray 1986 in Froese and Pauly 2002), and commonly schools with the doctorfish, Acanthurus chirurgus (Reeson 1975a).

Life History

Maximum reported size is 38.1 cm SL (male) (Robins and Ray 1986 in Froese and Pauly 2002). Size at first maturity is estimated in Froese and Pauly (2002) as 22.8 cm SL. But Reeson (1975b) provides a smaller estimate of 11 cm FL based on a study conducted in Jamaican waters.

Diet

This fish feeds primarily on algae and seagrasses, but also consumes a great deal of inorganic material (e.g., sand, small shells, etc.), which is believed to aid in the digestive process. It also has been observed to feed on dead fish both in traps and in fish pens (Reeson 1975a).

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Reproduction and Spawning

Breeding is believed to occur year round off Jamaica, with peak spawning activity occurring from January to February and from August to September (Reeson 1975a). In the northeastern Caribbean, individuals in spawning condition have been observed in February, April, and November (Erdman 1976). One spawning aggregation composed of about 20,000 individuals has been documented south of Salinas de Ensenada and Guanica, Puerto Rico, at 15-18 m depth, from November through April (Rielinger 1999).

## Doctorfish, *Acanthurus chirurgus*

Distribution and Habitat

In the Western Atlantic, doctorfish range from Massachusetts (USA) to Brazil, including the Gulf of Mexico and Caribbean Sea. Doctorfish are generally found in loose aggregations from depths of 2-24 m in shallow reefs or rocky areas (Robins and Ray 1986 in Froese and Pauly 2002), but may also be encountered over adjacent algal plains and seagrass beds (Reeson 1975a). It is characterized as a suprabenthic nomad, and commonly schools with the ocean surgeonfish, Acanthurus bahianus (Reeson 1975a).

Life History

This fish is moderately resilient, with a minimum population doubling time of 1.4 - 4.4 years (K=0.25-0.50). Maximum reported size is 35 cm TL (male); maximum weight, 5,100 g (Robins and Ray 1986 in Froese and Pauly 2002). Length and age at first maturity is estimated as 19.4 cm TL and 2.7 years, respectively (Froese and Pauly 2002). The approximate life span of the doctorfish is 10.9 years. Estimated natural mortality rate is 0.64 (Froese and Pauly 2002).

Diet

It feeds primarily on algae but, like the ocean surgeonfish, ingests inorganic material in the process (Reeson 1975a; Robins and Ray 1986 in Froese and Pauly 2002).

Reproduction and Spawning

A study conducted in Jamaican waters observed the occurrence of ripe individuals in catches taken from September to November, and the highest proportions of active fish from January to May (Reeson 1975a). In the northeastern Caribbean, individuals in spawning condition have been observed in January, February, and June (Erdman 1976).

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## Blue tang, *Acanthurus coeruleus*

### Distribution and Habitat

In the Western Atlantic, blue tang range from New York (USA) to Brazil, including the Gulf of Mexico and Caribbean Sea. Blue tang are generally encountered in coral reef, or inshore grassy or rocky habitats, from 2-40 m depth (Robins and Ray 1986 in Froese and Pauly 2002). Characterized as a suprabenthic nomad, this species is generally solitary in the evening hours (Reeson 1975a), but also has been observed in small and large groups.

### Life History

This fish is moderately resilient, with a minimum population doubling time of 1.4 - 4.4 years (K=0.11-0.50). Maximum reported size is 39 cm TL (male) (Robins and Ray 1986 in Froese and Pauly 2002). Length and age at first maturity is estimated as 23.3 cm TL and 6.3 years, respectively. Approximate life span is 25.8 years; natural mortality rate, 0.32 (Froese and Pauly 2002).

### Diet

Blue tang feed almost entirely on algae (Robins and Ray 1986 in Froese and Pauly 2002), but also consumes organic detritus and seagrasses (Reeson 1975a).

### Reproduction and Spawning

A study conducted in Jamaican waters reported the occurrence of high proportions of active and/or ripe fishes during most months of the year on the oceanic banks, and few fishes with active gonads in the nearshore environment (Reeson 1975a). Rielinger (1999) describes one aggregation site documented off Puerto Rico, which is located south of Salinas de Ensenada & Guanica. About 6000-7000 individuals reportedly spawn at that site in association with the full to new moon. These aggregations occur at 10-30 m depth (Rielinger 1999). Studies in the Bahamas also have observed what appeared to be pre-spawning aggregations late in the day (Reeson 1975a).

## Queen triggerfish, *Balistes vetula*

### Distribution and Habitat

Queen triggerfish occur in the Western Atlantic from Massachusetts (USA) to southeastern Brazil, including the Gulf of Mexico and Caribbean Sea (Robins and Ray 1986 in Froese and Pauly 2002). Erdman (1976) reported that this species is commonly caught in fish pots in the

northeastern Caribbean. Queen triggerfish are generally found over rocky or coral areas, from depths of 2-275 m. It also has been observed over sand and grassy areas (Robins and Ray 1986 in Froese and Pauly 2002). There is some evidence that juveniles tend to inhabit shallower waters, then move into deeper water as they mature (Aiken 1975b). This fish may school, but also has been observed alone and in small groups (Aiken 1975b; Robins and Ray 1986 in Froese and Pauly 2002).

Life History

The queen triggerfish is reportedly moderately resilient, with a minimum population doubling time of 1.4 - 4.4 years (K=0.15-0.57). Maximum reported size is 60 cm TL (male); maximum weight is 5,440 g (Robins and Ray 1986 in Froese and Pauly 2002). Size at maturity, and age at first maturity, are estimated in Froese and Pauly (2002) as 40.8 cm TL and 2.8 years, respectively. Aiken (1975b) estimates mean size at maturity as 26.5 cm fork length (FL) and 23.5 cm for males and females, respectively, collected in a Jamaican study. Fecundity measured in 3 individuals averaged 73 eggs per gram body weight. Approximate life span is 12.5 years. Estimated natural mortality rate is 0.48 (Froese and Pauly 2002).

Diet

Approximate life span is 12.5 years. Estimated natural mortality rate is 0.48 (Froese and Pauly 2002). It is considered to be an excellent food fish, but its liver is poisonous (Robins and Ray 1986 in Froese and Pauly 2002).

Reproduction and Spawning

Peak spawning occurred from January to February and from August to October (Aiken 1975b). In the northeastern Caribbean, individuals in spawning condition have been observed from February through June (Erdman 1976). This fish primarily feeds on benthic invertebrates, such as sea urchins (Robins and Ray 1986 in Froese and Pauly 2002).

## Queen angelfish, *Holacanthus ciliaris*

Distribution and Habitat

The queen angelfish occurs in both the Western and Eastern Central Atlantic Oceans. In the Western Atlantic, its range extends from Florida (USA) and the Bahamas to Brazil, including the Gulf of Mexico and Caribbean Sea. Queen angelfish are found on coral reefs primarily in shallow waters, but have been observed at depths of 80 m (Humann and DeLoach 2014). Juveniles are solitary and live primarily in and around colonies of finger sponges and coral (Feddern 1968).

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Life History

Maximum reported size for the queen angelfish is 45 cm (18 in) (Humann and DeLoach 2014) and common length is 30 cm (12 in) TL (Carpenter 2002). Maximum weight reported is 1,600 g (Claro 1994 in Froese and Pauly 2017). Estimated size at maturity is 26.5 cm TL; natural mortality rate, 0.4; approximate life span 13 years (Froese and Pauly 2011). Based on empirical models, Froese and Pauly (2011) estimate the queen angelfish to be a medium resilience fish, with a minimum population doubling time of approximately 1.4 - 4.4 years.

Diet

The queen angelfish has been reported to prey almost exclusively on sponges, supplemented by small amounts of algae, tunicates, hydroids and bryozoans (Randall and Hartman 1968; Andrea et al. 2007). Juveniles eat algae until they reach sexual maturity (DeLoach 1999) and have been observed cleaning ectoparasites from other fishes (Randall 1967). This species poses a low risk for ciguatera poisoning (Olsen et al. 1984; Böhlke and Chaplin 1993) and recent surveys conducted in Puerto Rico do not list angelfish as fish species that induced ciguatera poisoning (Azziz-Baumgartner et al. 2012).

Reproduction and Spawning

Queen angelfish are protogynous hermaphrodites (Nottingham et al. 2003), meaning they are born male and at some point switch sexes to female. Their courtship structure consists of male-dominated harems, although spawning only occurs in pairs (Moyer et al. 1983) and no large spawning aggregations have been observed (Aiken 1975). Ripe queen angelfish were observed within one year from January to August with a peak in April (Munro et al. 1983) although Aiken (1975) observed over a 5-year period that the majority of ripe fish were observed in September-October and that all fish were inactive during November-December. Spawning occurs at sunset, and throughout the lunar cycle (DeLoach 1999; Moyer er al. 1983) and in Puerto Rico, spawning activity has been observed near the shelf edge (Moyer et al. 1983; Colin and Clavijo 1988). Queen Angelfish are pelagic spawners (Thresher 1984; Colin and Clavijo 1988), releasing their gametes into the water column. Larvae hatch after 15-20 hours and within three to four weeks the juveniles settle in the shallow water habitats (DeLoach 1999). Hybridization has been known to occur between *H. ciliaris* and *H. isabelita* (Feddern 1968).

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## Gray angelfish, *Pomacanthus arcuatus*

### Distribution and Habitat

The gray angelfish occurs in the Western Atlantic, ranging from New England (USA) to Brazil, including the Gulf of Mexico and Caribbean Sea. Gray angelfish swim about coral reefs, often in pairs, at depths ranging from 10 to 80 m and juveniles are usually found on shallow-water patch reef and grass flats (Humann and DeLoach 2014). Gray angelfish spend the day roaming their territories, with their mates at their side, and seldom take shelter (DeLoach 1999).

### Life History and Biology

Maximum reported size for the gray angelfish is 60 cm (24 in) TL (Humann and DeLoach 2014) and common length is 36 cm (14 in) TL (Carpenter 2002). Maximum weight reported is 2,550 g and a maximum observed age from otoliths was 24 years (Steward et al. 2009). Growth equations from that study indicated rapid growth during the first five years and estimated that females would reach their asymptotic length of 325mm TL at age six, and males would reach 388mm TL at age nine. Estimated size at maturity is 34.1 cm TL; natural mortality rate, 0.42 (Froese and Pauly 2002).

### Diet

Approximately 70% of gray angelfish diet is various species of sponges, followed by tunicates, algae, zoantharians, gorgonians, hydroids, byrozoans, and seagrasses (Randall and Hartman 1968). Visual feeding surveys reported gray angelfish eating small amounts of multiple sponges, moving to a new sponge after only 2.8 bites, notably selecting a different sponge species 92% of the time, indicating active diet diversification and suggesting that gray angelfish have the ability to distinguish sponge species from each other (Wulff 1994). Juveniles mostly eat algae, but they also act part-time as cleaner fish, picking ectoparasites off other reef fishes, until such a time that they reach three inches in length (DeLoach 1999). This species poses a low risk for ciguatera poisoning (Olsen et al. 1984; Böhlke and Chaplin 1993) and recent surveys conducted in Puerto Rico do not list angelfish as fish species that induced ciguatera poisoning (Azziz-Baumgartner et al. 2012).

### Reproduction and Spawning Characteristics

Gray angelfish are not believed to undergo any sex change during growth to maturity (DeLoach 1999). This species is generally observed in pairs, suggesting that they are monogamous (Thresher 1984), but polygamous activity has been reported by Moyer et al. (1983). Regardless of the reproductive orientation, spawning always occurs in pairs and at sunset (Moyer er al. 1983; Colin and Clavijo 1988; DeLoach 1999) and in Puerto Rico, spawning activity has been

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observed near the shelf edge (Moyer et al. 1983). Over the course of a year, ripe gray angelfish were observed in February through June with a peak in March (Munro et al. 1973). However, Aiken (1983) observed the greatest percentage of ripe gray angelfish in October and January. Fecundity estimates for female gray angelfish range from 16,150 to 126,000 eggs per individual and 50 to 123 eggs per gram body weight (Aiken 1975).

## French angelfish, *Pomacanthus paru*

### Distribution and Habitat

The french angelfish occurs in both the Western and Eastern Atlantic. In the Western Atlantic, it ranges from Florida (USA) to Brazil, including the Gulf of Mexico and Caribbean Sea. Adult french angelfish swim about coral reefs, often in pairs, at depths ranging from 15 to 80 m and juveniles inhabit reefs and sandy bottoms, often near holes or protective hard bottom crevices (Humann and DeLoach 2014). French angelfish are similar to gray angelfish in their social, feeding and reproductive behaviors (DeLoach 1999) and large, intraspecifically exclusive home ranges with similar patterns of shallow, medium depth, and deep bands of contiguous home ranges up to 2,300 $m^2$ (Hourigan et al. 1989).

### Life History

This fish is moderately resilient, with a minimum population doubling time of 1.4 - 4.4 years (K=0.21). Maximum reported size is 41.1 cm TL (Allen 1985 in Froese and Pauly 2002). Estimated size at maturity and age at first maturity are 26.7 cm TL and 3.2 years, respectively. Approximate life span is 13.6 years; natural mortality rate, 0.50 (Froese and Pauly 2002). French angelfish size ranges from 10-14 inches, with a maximum observed size of 18 inches (Humann and DeLoach 2014).

### Diet

This fish feeds on sponges, algae, bryozoans, zoantharians, gorgonians and tunicates. Juveniles tend cleaning stations, servicing jacks, snappers, morays, grunts, surgeonfishes, wrasses, and other reef fish (Allen 1985 in Froese and Pauly 2002). This species poses a low risk for ciguatera poisoning (Olsen et al. 1984; Böhlke and Chaplin 1993) and recent surveys conducted in Puerto Rico do not list angelfish as fish species that induced ciguatera poisoning (Azziz-Baumgartner et al. 2012).

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Reproduction and Spawning Characteristics

In the northeastern Caribbean, individuals in spawning condition have been observed in March and May (Erdman 1976). Feitosa *et al*. (2015) detected no sign of hermaphroditism in French angelfish collected from fish traps in Brazil and classified the species as a gonochorist fish. French angelfish also form mated pairs but little is known about their actual spawning behavior.

## Longspine squirrelfish (*Holocentrus rufus*)

Distribution and Habitat

The longspine squirrelfish occurs in the Western Atlantic Ocean, ranging from southern Florida (USA) to Brazil, including the Gulf of Mexico and Caribbean Sea. Longspine squirrelfish are generally found to 32 m depth, near the mouths of caves and holes (Robins and Ray 1986 in Froese and Pauly 2002).

Life History

Young are planktonic (Wyatt 1976). Maximum reported size is 35 cm TL (male) (Robins and Ray 1986 in Froese and Pauly 2002). Size at maturity is estimated as 21.2 cm TL; natural mortality rate, 0.96 (Froese and Pauly 2002). Wyatt (1976) reports the mean length of males and females captured in offshore Jamaican waters was 17.5 cm.

Diet

Olsen et al. (1984), in Froese and Pauly (2002), report that it can be ciguatoxic. This species is nocturnal, and usually moves to sandy areas and grass beds at night to feed on crabs, shrimps, gastropods, and brittle stars (Robins and Ray 1986 in Froese and Pauly 2002). Probable predators include sharks, snappers, and groupers (Wyatt 1976).

Reproduction and Spawning

Spawning activity in Jamaican waters is believed to be similar to that of the squirrelfish, with the greatest proportion of ripe fishes observed in October and in February (Wyatt 1976). Wyatt (1983) reported that spawning of longspine squirrelfish occurred during August through June off Jamaica, In the northeastern Caribbean, individuals in spawning condition have been observed from February through March, in June, and from August through October (Erdman 1976).

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## Dolphin (*Coryphaena hippurus*)

Dolphin are a fast-growing, short-lived highly migratory species (HMS) found throughout tropical and subtropical waters (Froese and Pauly 2018). They are found in open waters and near the coast from and feed on almost all forms of fish and zooplankton, including crustaceans and squid. Frose and Pauly (2018) list the maximum reported length as 210 cm TL, maximum weight as 40.0 kg, and maximum age as 4 years. Sexual maturity is generally reached in the first 4-5 months and adults spawn in the open sea and probably approximate to the coast when water temperature rises. Fishermen use fish attracting devices such as floating bundles of bamboo or cork planks to concentrate dolphin before setting their nets.

### Distribution and Habitat

### Life History

### Diet

### Reproduction and Spawning

## Wahoo (*Acanthocybium solandri*)

Atlantic wahoo grow fast, up to 8 feet and 158 pounds, though they are commonly between 3.3 and 5.4 feet long. They have a short life span, up to 5 or 6 years. They are able to reproduce at about 1 year old. For males, this is when they reach 2.8 feet in length, and for females, when they reach 3.3 feet. Atlantic wahoo spawn multiple times throughout the spawning season. They are very productive, releasing a half-million to 45 million eggs per year to compensate for eggs that might not survive to adulthood. They mainly feed on squid and fish, including frigate mackerel, butterfish, porcupine fish, and round herring. They generally compete with tuna, but can feed on larger prey by using their extremely sharp teeth to render prey into bite-size pieces.

### Distribution and Habitat

### Life History

### Diet

### Reproduction and Spawning

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## Caribbean spiny lobster, *Panulirus argus*

### Distribution and Habitat

The Caribbean spiny lobster, *P. argus* (hereafter referred to as spiny lobster), occurs in the Western Central and South Atlantic Ocean, including the Caribbean Sea and the Gulf of Mexico. North Carolina marks its northernmost limit; Brazil, its southernmost limit (Bliss 1982). The spiny lobster occurs from the extreme shallows of the littoral fringe to depths of at least 100 m (Kanciruk 1980; Munro 1974a). CFMC (1981) reports that its distribution off Puerto Rico extends to the edge of the shelf, which is described as the 100-fathom contour (183 m).
Shallow areas with mangroves and seagrass (Thalassia testudinum) beds serve as nursery areas for pre-adult populations wherever such habitats are available (Munro 1974a). Generally, spiny lobsters move offshore when they reach reproductive size (Phillips et al. 1980). Adults are found on most shelf areas which offer adequate shelter in the form of reefs, wrecks or other forms of cover (Munro 1974a). This species shelters communally by day in groups of two to over one hundred (Cobb and Wang 1985) in holes and crevices in reefs or other refuges. The largest dominant male usually occupies the most favored and safest position deep within the refuge. At night, they emerge to feed (Munro 1974a).
Mass migrations have been reported most often from Florida and the Bahamas, where movement is usually southwards (Munro 1974a) and occurs in mid-autumn or mid-winter, usually after a period of stormy weather (Cobb and Wang 1985). This migratory behavior is especially striking in the Bahamas, where large numbers of lobsters are observed to migrate day and night in queues of 2-60 animals. As many as 100,000 individuals have been observed moving in queue formation in a southerly direction on the shelf area west of Bimini (Cobb and Wang 1985).
The significance of migratory behavior is not yet understood. While local spiny lobster populations travel the same direction each year, populations in other areas may travel in different directions. Return migrations have not been described (Cobb and Wang 1985). Some hypothesize that migrations may serve to redistribute young mature adults in areas appropriate for adult habitation and larval release (Phillips et al. 1980); others, that the lobsters may be trying to escape the stress of severe winters in shallow waters (Cobb and Wang 1985).

### Life History

Kanciruk (1980) estimates maximum age as 20 years.

### Diet

These animals are primarily carnivores, and serve as the major benthic carnivores in some ecosystems (Kanciruk 1980). They generally feed on smaller crustaceans, mollusks and annelids (Cobb and Wang 1985). One study reported that specimens taken from a lagoon area appeared to

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feed only on mollusks, but that individuals taken in reef habitat consumed algae, foraminifera, sponge spicules, polychaetes and sand, in addition to bivalve and gastropod mollusk and crustacean remains (Munro 1974a). The reported consumption of seaweed, algae, and inorganic material has been attributed both to incidental ingestion (Cobb and Wang 1985) and to a shortage of other food sources (Kanciruk 1980), as opposed to preference. A 1971 study reported that juveniles at the USVI sheltered in daytime aggregations of the sea urchin (Diadema antillarum) and thus gained access to extensive feeding areas which were otherwise devoid of shelter (Munro 1974a).

Pelagic fishes, including the tunas Katsuwonus pelamis and Thunnus atlanticus, feed on spiny lobster in their planktonic phase. Natural predators of sub-adult and adult spiny lobster include large benthic feeding fishes, sharks, octopuses (Cobb and Wang 1985), rays, skates, crabs, dolphins (Munro 1974a) and turtles (CMI 1996). A small whelk (Murex pomum) is reported to eat lobsters in traps, and presumably in nature, by boring through the carapace. Barnacles (Balanus ebureus) settle on the carapace of large specimens and could serve as indicators of habitat and of the intermolt period (Munro 1974a).

Reproduction and Spawning

Sexes are separate and anatomically distinct. Males have larger and heavier carapaces, but lighter and shorter tails than females. But relationships between total length and total weight are very nearly identical for males and females in Caribbean waters (Munro 1974a). Molting appears to be tied to reproduction for females (Munro 1974a; Phillips et al. 1980), but males appear to be able to reproduce successfully year round (Phillips et al. 1980).

Maturity occurs at a single molt (the “maturity molt”) and is generally related to length, rather than age. According to CFMC (1981), most females reach sexual maturity between 3.1-3.5 in (7.9-8.9 cm) carapace length (CL) and are at peak egg production between 4.3-5 in CL. Conservation Management Institute reports that intense fishing may have caused a decline in the minimum size of spawning females in Florida waters (CMI 1996). Fecundity varies greatly among size classes, but is generally high. In the early years of a spiny lobster, the larger a female, the more eggs produced. But fecundity begins to decrease at a certain age; possibly around the time when molting decreases in frequency (Munro 1974a). Munro (1974) reports that egg production per unit body weight ranges from about 670 to 1,210 eggs/g of total body weight, with an average of 830 eggs/g. CFMC (1981) reports that the number of eggs ranges from 0.5-1.7 million per spawning.

Spiny lobsters spawn at least once a year (Cobb and Wang 1985). Females in Bermuda have been reported to spawn at least twice (Morgan 1980; Munro 1974a) between May and August. But the numbers of broods produced in Caribbean waters, where the spawning period appears to be more extended are not known. For most territories within the Caribbean Sea, egg-bearing (berried) females have been observed in all months of the year, but with greatest frequency in the

months from February to August (Munro 1974a). CFMC (1981) reports that reproduction occurs yearround, but declines in the fall.
Fertilization is external (Bliss 1982). Females carry fertilized eggs until they are fully developed (Cobb and Wang 1985), a period of about four weeks, and tend to move towards deeper water when the eggs are ready to hatch (Munro 1974a). Embryos hatch as planktonic larvae (Bliss 1982), which spend up to eleven months (Phillips et al. 1980) or more (Munro 1974a; Phillips and Sastry 1980) at sea before metamorphosing into the puerulus stage (Cobb and Wang 1985) and settling on the ocean bottom. This extended planktonic stage could permit extremely wide dispersal of the larvae. It appears most likely that larvae spawned in the Caribbean could, for example, settle at Bermuda (Munro 1974a).

## Queen conch, *Lobatus gigas*

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.

### Distribution and Habitat

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 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 occurs 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 (García-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 certainhabitat 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).

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).

Life History

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).

Diet

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 conch fish (*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).

Reproduction and Spawning

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.

DRAFT

## Sea Urchins

Urchins, such as the long-spined urchin (*Diadema antillarum*) can play an important role on the reefs as herbivores. They are found in all habitats from 0 to 45 m of water, though they tend to hide in sheltered locations during the day, waiting to feed openly on algae after dark. Densities of D. antillarum can be high on reefs, with as many as $13/m^2$ having been reported (Colin 1978). Aside from grazing on reef algae, urchins can denude areas of seagrass beds as well. This grazing on the reefs is an important factor in coral reef health and stability. In some instances where D. antillarum was not present, algae were literally taking over the reef from the corals. At least 15 species of fishes are known to prey on D. antillarum. Some juvenile fishes and shrimp and known to utilize the long spines of this urchin species as shelter. D. antillarum are known to aggregate and spawn throughout the year in the Caribbean. The remaining species of urchin, such as Echinometra lucunter and Lytechinus variegatus, occur in shallower water than Diadema antillarum, generally from 0 to 20 m in depth, and do not play as critical a role as the latter species. The West Indian sea egg (Tripneustes ventricosus) also inhabits seagrass beds, but its numbers have been greatly reduced in some areas of the Caribbean due to harvest for its roe.

## Sea Cucumbers

There are about 25 species of sea cucumbers that occur in shallow Caribbean water. The donkey dung sea cucumber (*Holothuria mexicans*) is perhaps the most common. It inhabits seagrass beds and sandy areas around reefs from 3 to 20 m of water. Sea cucumbers feed by passing sediment through the gut and digesting any organic material contained in it, or by catching detritus or small planktonic organisms on mucous-covered tentacles centered around the mouth. The body wall of sea cucumbers often contain a toxin, called holothurin, which makes them distasteful to predators. The slender sea cucumber (H. impatiens) and the tiger tail cucumber (H. thomasi) occur on reefs are rubble areas from 7 to 45 m of water.

DRAFT

## Hydrocorals, Class Hydrozoa

The Class Hydrozoa is divided into five orders, of which only three are of any significance on Atlantic reefs: Athecatae (hydroids), Milleporina (fire corals), and Stylasterina.
The Athecatae, which include most species of the Hydrozoa, are solitary or colonial with the polypoid generation much more extensively developed than the medusoid generation. The solitary hydroids are not important on Caribbean reefs, but the colonial species can be conspicuous members of the reef community (Colin 1978).

Milleporina species represented in the Coral FMP are the fire corals (Millepora spp.), which belong to the family Milleporidae. Their name derives from the powerful stinging cells they possess, which enable them to paralyze and capture prey. These colonial corals are found from deep fore reef areas to back reefs (Colin 1978), and are considered to play a significant role in coral reef construction, particularly in shallow windward substrates, where they have a buffering effect (Goenaga and Boulon 1992).

Three described species of western Atlantic Millepora exist: M. alcicornis, M. complanata, and M. squarrosa. They differ only in the morphology of the skeleton and are often considered ecological variants of a single species. The branched form, M. alcicornis, occurs somewhat deeper than the others, while M. squarrosa is found in heavy surf or in areas exposed to air in the troughs of waves. Under extreme wave conditions or when covering the remains of another organisms, Millepora can be encrusting. Colonies sometimes cover entire sea fans and may also grow on the outer portion of the stalks of dead gorgonians. Barnacles and serpulid worm tubes may occur on the sides of the blade-like forms of Millepora (Colin 1978).

Stylasterina species represented in the Coral FMP belong to the family Stylasteridae. These corals are also colonial but do not contain zooxanthallae. They have been used frequently as ornamental pieces (Goenaga and Boulon 1992). Only one species, the rose lace coral (Stylaster roseus) is represented in the Caribbean coral reef fishery management unit. S. roseus occur at depths of 6 m to at least 30 m. These small, fragile, fan-like colonies reach 10 cm in height. They commonly occur in caves or crevices, often growing on inverted surfaces and occasionally (as at Mona Island) on open vertical rock faces (Colin 1978).

## Anthozoans, Class Anthozoa

The second class of Coelenterata in the management unit, anthozoans include black corals (Order Antipatharia), gorgonians, sea fans (Sub-class Octocoralia), sea anemones and other similar organisms (Orders Actinaria, Zoanthidea and Corallimorpha), as well as the true reef-building corals (Order Scleractinia) (CFMC 1994). Anthozoans has its life cycle restricted to the polyp phase exclusively, with no medusa stage occurring. They typically attach to a substrate and have

the oral end expanded into a flattened oral disk. A calcareous skeleton may be constructed. Further, a planula larvae may be produced, which is capable of being transported some distance by ocean currents.

## Octocorals, Orders Alcyonacea and Gorgonacea

Due to the large numbers of species in these two orders, please refer to Table 4 for a list of all managed species. The following discussion on octocoral biology is offered to represent the order. These two orders consist of sea fans, sea whips and other gorgonian species. Alcyonacea, also known as soft corals, includes species with skeletons consisting of spicules but no axial skeleton (Goenaga and Boulon 1992). Gorgonacea is the more dominant group of Octocorallia, occurring in abundance on Caribbean reefs (Colin 1978). All gorgonian colonies possess an axial skeletal structure of either a horny or calcareous central cylinder or a zone of tightly bound spicules. Most species have an erect skeletal structure attached to a solid substrate by a holdfast, by a smaller number of species may occur as an encrusting mat (Colin 1978). Gorgonians may live for more than 20 years with annual growth rates ranging from 0.8 - 4.5 cm/yr for 13 species studied in southeastern Puerto Rico over a five-year period (CFMC 1994). At study sites on southeastern Puerto Rico, mortality was found to be higher in small colonies, as compared to larger specimens, the major causes of death being damage to the colony base or detachment (CFMC 1994). Two species of sea whips, Ellisella barbadensis and E. elongata, reach sizes of nearly 2 m and can occur in dense stands on rocky, often vertical substrates at about 20 to at least 250 m. Three other smaller species may also occur within diving depths on deep reefs. Most species have wide geographic ranges, generally from southern Florida to the Caribbean.

The common sea fan, Gorgonia ventalina, has the widest distribution, both on the reef and geographically, of any gorgonian species. It can be found on nearly ever reef and is a characteristic part of reef environments in the Atlantic. It can occur near shore in areas of extreme wave action and on deeper outer reefs at 15 m or more in depth. It can reach a height of nearly 2 m and shows a somewhat "clumped" (non-random) distribution of individuals on a reef (Colin 1978). This species is known from Bermuda to Curacao, including the Florida Keys and western Caribbean.

The Venus sea fan, G. flabellum, is often restricted to shallow water with very strong wave action. It occurs in areas generally somewhat shallower and rougher than G. ventalina where the two occur in the same geographic area. It is seldom found below 10 m depth and can reach sizes near those of G. ventalina. Its known geographic distribution is somewhat odd. It is abundant and easily distinguished from G. ventalina in the Bahamas, but becomes scarce and less distinctive in Florida and the Lesser Antilles. It is common on the windward reef flats and back reef zones where fire corals are abundant. This species is known to fall prey to the flamingo tongue snail (Sefton and Webster 1986).

G. mariae, the wide-mesh sea fan, is the smallest of the sea fans, the fan-like form reaching only about 30 cm in height. There are two other growth forms of this species. One has short free

branchlets form one or both faces, while the plumose form, which may reach 40 cm in height, has the inner and lower branches anastomosed, but the terminal branches free. This is generally a deeper water species than the G. ventalina and G. flabellum and has been encountered as deep as 47 m and as shallow as 5 m. Known from Cuba, Jamaica, Puerto Rico, the Virgin Islands, and the northern Lesser Antilles (Colin 1978).

There are several species of Pseudopterogorgia (sea plumes) on Caribbean reefs. Most are tall, plume-like colonies. On the leeward side of some islands in the Caribbean, a zone of dense growth of these species can occur at 7-10 m, with colonies reaching heights over 1.5 m. They are pinnately branched, with no interconnections between branches, and some are slimy to the touch with abundant mucus. Pseudopterogorgia spp. may be so common as to be the dominant feature of some reefs. Flamingo tongue snails are also common predators of sea plumes (Sefton and Webster 1986). The bipinnate plume produces planulae in Jamaica in late January an dearly February. Unlike stony coral planulae, those of the bipinnate plume do not contain zooxanthellae. In the laboratory, they settle 11 days after release and must acquire their initial zooxanthellae from the environment, as these plant cells are abundant in the adult colonies (Colin 1978).

The genus Eunicea (sea rods) is an important group of reef-dwelling alcyonarians. Most occur from a few meters depth to a maximum of about 30 m (Colin 1978). Eunicea spp. occur at shallow and moderate depths. These gorgonians have single-celled algae (zooxanthellae) in the tissues of the polyps, as do most other gorgonians, corals, and anemones of the reef community. These symbiotic algae aid in the nutrition of the host colony (Sefton and Webster 1986). Muricea spp. are common at moderate depths, particularly in spur and groove systems of the reef. They may also be attached to coral rubble in sandy areas (Sefton and Webster 1986). Sea rods, Plexaura spp., occur to depths of 50 m. P. homomalla has recently been the subject of much study since it was discovered to contain high amounts of a type of chemical (prostaglandins) valuable in the pharmaceutical industry. Advances in chemical synthesis of prostaglandins have not made such considerations less important. This species is tan in color and can reach nearly 12 m in height. Trumpet fishes sometimes hide by aligning themselves with the branches of Plexaurella colonies (Sefton and Webster 1986). Most Plexaurella spp. in the Caribbean commonly occur from about 10 to 50 m depth.

Gorgonian life history is noted by low and variable recruitment of small specimens. Given this uncertain recruitment, the predictable survival of adults is critical to the persistence of gorgonian populations (CFMC 1994). Further, gorgonian species can play an important role as habitat for other managed species. Fire coral, Millepora spp., may encrust entire colonies, particularly the sea fans of the genus Gorgonia. Bivalve mollusks, sponges, and algae may grow upon dead sections of gorgonian skeletons; whether these organisms simply take advantage of already dead substrate or themselves kill a portion of the gorgonian is not known. The gastropod mollusk, Cyphoma gibbosum, feeds on gorgonian polyps by crawling slowly over the skeleton, grazing at will. Other organisms, such as basket starfishes and brittlestars, climb tall gorgonians to reach a

position more advantageous for filter-feeding in reef areas (Colin 1978). These factors warrant the prohibition on their harvest.

## Hard or stony corals, Order Scleractinia

Almost 50 species belonging to 12 different families are represented in the Caribbean coral reef fishery management unit. Due to the numerous scleractinian species included in the coral reef fishery management unit, and that the ecological importance of corals is widely accepted and understood by the public, the following is only a survey of the major species and species groups. Scleractinians are the principal reef builders. They are calcium secreting, anemone-like animals that can form colonies comprised of many physically and physiologically linked polyps or else can be solitary or consisting of one polyp. Tentacles occur in multiples of six and the digestive cavities are divided by partitions (sclerosepta and sarcosepta) that radiate from the center of the polyp. The polyps of stony corals are somewhat similar to those of sea anemones but produce a calcium carbonate cup (the corallite) and are usually colonial, producing a massive calcareous skeleton (the corallum) from the many corallites. In contrast to anemones they produce calcium carbonate, aragonitic skeletons that can reach considerable sizes (e.g., over 5 m in diameter and height in individuals of Montastrea annularis). The skeleton is internal, in contrast to other skeleton forming cnidarians (Goenaga and Boulon 1992). Often scleractinians are considered in two informal groups, the hermatypic or reef-building corals (those making a significant contribution to reef structure) and ahermatypic or non-reef building corals (often small, solitary species without large skeletons) (Colin 1978).

Many stony corals, particularly those that are hermatypic, contain small unicellular plants called zooxanthellae (dinoflagellata) in their gastrodermis. These zooxanthellae are pigmented, giving corals most of their color, and play a role in the production of calcium carbonate by the coral polyp. The exact nature of their contribution is not known and seems to vary within species of corals. Generally, however, ahermatypic corals lack zooxanthellae while hermatypic species possess large numbers. The zooxanthellae can be expelled by a coral (usually termed bleaching) when under stress (Colin 1978).

It is believed that the requirement of light for the zooxanthellae is the reason why coral reefs are limited to fairly shallow waters. With increasing depth below about 30 m corals are generally less heavily calcified than in shallower water and the ability to form reef structures is much less than in shallow water. Reef corals may occur to depths approaching 90-100 m in extremely clear water, but below 45-50 m in their constructional abilities are severely limited and may be surpassed by those of other groups of organisms such as the sclerosponges (Colin 1978).

Within a colony, all reproduction is asexual. New polyps are budded from other polyps as the colony increases in diameter or length. The rate of growth is variable between species, with branched species generally growing faster than massive species, and is strongly influenced within each species by environmental conditions. Sexually produced larvae, termed planulae, result in the establishment of new colonies. Larvae may either swim (entering the plankton and

covering large distances) or crawl (staying close to the parent) until they attach to the bottom to initiate a new colony (Colin 1978).

A number of organisms prey directly on corals. Certain fishes pick polyps from the surface of the colony (butterflyfishes) while others ingest or scrape portions of skeleton with their attached polyps (puffers, parrotfishes). Some gastropod mollusks feed on coral polyps by inserting their proboscis into the polyp, and a few polychaete worms feed on branched corals by engulfing the tip of a branch in their mouth (Colin 1978). Boring sponges and clams occur in the skeleton and weaken it by their mechanisms of removing calcareous material (Colin 1978).

Acropora cervicornis (staghorn coral), found throughout the Caribbean, is characteristic of seaward facing reefs, but generally occurs on reefs below 6 to 9 m depth. It occurs from low water to 50 m but is most common at 12 to 22 m. This is one of the most rapidly growing corals. Length increases of nearly 30 cm per year have been recorded for single branches under optimal conditions. This species can also occur in shallow, quiet back reef areas where the water is fairly clear. Damselfishes frequently stake out their territories in staghorn, as well as elkhorn coral (Sefton and Webster 1986).

A. palmata (elkhorn coral) is also characteristic of seaward facing reefs. It is the most abundant stony coral in shallow water areas, often growing up to low water levels. The "A. palmata zone" is a characteristic component of most West Indian reefs, and it thrives where wave conditions are rough. Severe storms such as hurricanes can have disastrous effects on reefs comprised of this species. Entire reefs may be reduced to rubble, much of this transported over the reef crest or piled above low water levels. Large colonies may be overturned and often renew their growth in the inverted position. A. palmata is strictly a shallow-water coral. Seldom are colonies found below 15 m, and its greatest abundance is in the top 6 m of the water. It can occur in surprisingly turbid water, but may be limited in some areas by low winter temperatures. The fast-growing branching colonies of A. palmata are sometimes 4 m or more across. One of the dominant corals in the Caribbean, elkhorn coral competes by growing rapidly and by shading or over-topping its neighbors. Entire barrier reefs, with no adjacent reef flat, may be built of this coral. The famous barrier reef at Buck Island, St. Croix, is an excellent example of such a situation, but similar reefs are found in many areas of the Caribbean. Occasionally, the branches of A. palmata will have lumpy growths of polyps, termed "neoplasms," on the normally flattened branches. If any portion of the coral surface dies this provides a site of attachment for a wide variety of organisms, and branches of A. palmata with algae, hydroids, and actinians in sections have been observed. Certain crabs, such as Domecia acanthophora, form cavities in the junctions of branches by preventing the coral from growing in these areas (Colin 1978).

Corals of the genus Agaricia and Leptoseris, commonly known as the "lettuce corals," are among the most fragile corals occurring on reefs. However, they play an important role in reef construction, particularly in the deeper sections. Various species are also important elements of the shallow reef environment (Colin 1978). While Agaricia tenuifolia is generally restricted to depths shallower than 18 m, other species are found on reefs down to 80 m in depth.

Two species of Caryophyllidae are in the coral reef fishery management unit, Eusmilia fastigiata (flower coral) and Tubastrea aurea (cup coral). E. fastigiata colonies, found widely in the Caribbean, grow up to 50 cm in diameter. This species has a wide depth range from 1-65 m, but is most common at 3-30 m depth. It can occur in a variety of habitats from back reefs to fore reefs, and under overhanging sides of larger corals. Encrusting sponges, algae, and tubeworms often grow on the dead branches from which the polyps grow (Sefton and Webster 1986). T. aurea is non-reef building (ahermatypic) but is, on occasion, abundant on reefs in the proper habitat. It is not solitary, with clumps containing a few to hundreds of polyps occurring on undercut wave-swept rocks, on overhanging faces in deeper water and in fairly dimly lit caves. One pier off western Puerto Rico has all the area available on the inside of the pilings, beneath a platform providing shade, completely covered by this coral to a depth of 1.5 m. This species lacks zooxanthellae.

Diploria spp. include D. clivosa (knobby brain coral), D. labyrinthiformis (grooved brain coral), and D. strigosa (symmetrical brain coral). In Bonaire, D. clivosa is one of the dominant corals on the leeward side of a fringing reef of Acropora palmata, but is not as significant a constructor on reefs as are the other two species of Diploria. It does not occur as deep as D. strigosa, with its maximum depth begin about 15 m and its distribution centered around 1 to 3 m. This species grows in shallow to moderately deep areas, often in quiet back reef and lagoon habitats. Where wave action is stronger, it exhibits a more plate-like growth and becomes an important structural element of the reef community in some locations (Sefton and Webster 1986). D. labyrinthiformis forms sizeable heads over 1 m in diameter. This species is a minor reef constructor on the seaward slope of reefs and is the most restricted species of Diploria in its distribution on reefs. It occurs as deep as 43 m, but is most common at 2-15 m depth. This common coral is found from shallow to deep locations, but is most abundant at moderate depths on windward reef terraces (Sefton and Webster 1986). D. strigosa can form immense heads well over 2 m across and is capable of making a significant contribution to reef structure. This species, like most brain corals, is slow growing, with an annual increase of size of a head estimated at up to 1 cm per year. This means specimen of 2 m in diameter would be at least 100 years old and probably several hundred with all factors considered. This species occurs from low water to at least 40 m but is most abundant above 10 m. It is perhaps the most widely distributed species of Diploria on the reef and has even been reported from muddy bays where few other corals grow. This species occurs at all scuba depths from shallow nearshore reefs to moderately deep fore reef slopes (Sefton and Webster 1986).

Montrastrea annularis (boulder star coral) and M. cavernosa (great star coral) are generally the most common species of coral on Atlantic reefs at moderate depths (Colin 1978). M. annularis forms massive boulders or heads reaching several meters across in shallow water (1-20 m) and flattened heads or plate-like colonies in deeper water (below 20 m). It reaches depths of at least 60 m (Colin 1978). There is great variation in this species, and much of it seems related to depth. This species is slow growing compared to branching corals such as A. cervicornis, but rates of

1.0-2.5 cm per year increase in height have been recorded. M. annularis is attached by a wide variety of organisms other than corals. Boring sponges are quite abundant in this species, gastropod mollusks of the genus Coralliophila feed either on the polyps or on plankton ingested by the polyps, and filamentous algae occur on areas where coral tissue was removed by mechanical action. This star coral often forms massive mounds that are important structural elements of buttresses and other fore reef elements at moderate depth. Colonies become more plate-like as depth increases. This is frequently the dominant reef-builder in buttresses and fore reef slopes (Sefton and Webster 1986).

In many localities at moderate depths, M. cavernosa is the predominant species of coral present. Either this species or M. annularis is generally the most common coral between 10-30 m in buttressed or sloping areas of Atlantic reefs lacking sizable thickets of A. cervicornis. Below 30 m, M. cavernosa clearly predominates over M. annularis, but increasing importance of agariciid corals and sclerosponges in reef construction somewhat diminishes its contribution. M. cavernosa is one of the most effective zooplankton feeders among stony corals. It is one of the deepest occurring hermatypic corals, found at depths from only a few meters to at least 90 m (Colin 1978). M. cavernosa is somewhat less common than M. annualris but, nevertheless, is an important reef-builder in many areas (Sefton and Webster 1986).

Dendrogyra cylindricus (pillar coral) is one of the most spectacular stony corals found on West Indian reefs. Colonies may contain dozens of upright cylindrical branches and reach a total height of nearly 3 m. If a single one of the "pillars" is broken off and comes to rest in a position where it continues to live, the branch will give rise to several new pillars which again grow vertically. This species is unusual in that the polyps with their tentacles are expanded in the daytime unlike most other stony corals. Pillar coral varies considerably in abundance throughout its range and is a very minor constructor of reefs. It is found on flat or gently sloping reef bottoms between 1 and 20 m. Colonies form spires 3 m or more tall. Distribution is spotty throughout the Caribbean (Sefton and Webster 1986).

Four Poritidae species are represented in the management unit: Porites astreoides (Mustard hill coral); Porites branneri (Blue crust coral); Porites divaricata (Small finger coral); and Porites porites (Finger coral). P. asteroides can occur in a variety of growth forms. In shallow water it can be encrusting, while at deeper depths the colonies are either rounded or flattened with the surface facing towards the light. Fam worms often occur with P asteroides and the sponge Mycale laevis, which grows on the undersurfaces of certain corals, can also be associated with it. Asexual reproduction is accomplished either through extratentacular budding or intratentacular budding. P. asteroides occurs abundantly in nearly all reef zones to depths of over 50 m. P. branneri colonies are encrusting and found from 0.1-12 m of depth, generally associated with bank reef types. P. divaricata is a delicate species of Porites. The branches are about 6 mm in diameter and form, at most, a small clump with widely spaced branches. P. divaricata are typical of back reef areas in shallow water, but occur rarely as deep as 15 m (Colin 1978). P. porites have thick branches, often 25 mm in diameter, that resemble stubby fingers, hence the name. P.

porites can occur in many reef situations including back and clear water fore reef areas, It common throughout the Caribbean, but is rare below 20 m (Colin 1978).

## Black corals, Order Antipatharia

Entire colonies are harvested for artisanal purposes in some regions of the Caribbean. In 1970, the local precious coral jewelry industry (black and pink coral) was estimated to have a retail value of more than 4 million dollars. Their axial skeleton is polished and attains considerable thickness in some species, rendering them commercially valuable in the jewelry trade to humans. Species that do not branch are bent for making necklaces. In Puerto Rico and the Virgin Islands, commercial harvesting is apparently uncommon but is known to occur (Goenaga and Boulon 1992).

The ecology and life history of these organisms is, for the most part, unknown. Taxonomy, to a large extent, is also unknown. Two genera are represented in the Caribbean coral reef fishery management unit: Antipathes spp. (bush black corals) and Stichopathes spp. (wire corals) (Goenaga and Boulon 1992). Black corals are typically deep sea, slow growing colonial anthozoans usually occurring under ledges, possibly because their larvae is negatively phototactic. The axial skeleton is black, spiny and scleroproteinaceous, and is secreted in concentric layers around a hollow core. The polyps overlay the horny skeleton, are interconnected and possess six non-retractile, unbranched tentacles. They usually contain a diverse array of internal and external unstudied commensal organisms that include palaemonid crustaceans, lichomolgid copepods, and pilargiid polychaetes. Available evidence suggests that recruitment is infrequent.

Thick stemmed, branched, and large (i.e., potentially important economically) bush black corals occur in water depths below 50 m in La Parguera, Puerto Rico. Unbranched, thin stemmed wire corals are present at depths of 20 m. Both genera can also occur sparsely in very shallow, turbid waters off Mayaguez, western Puerto Rico and in La Parguera, southwestern Puerto Rico. Individual Antipathes spp. have been observed above depths of 8 m south of Arrecife La Gata, La Parguera, indicating that adult colonies of these species do not require deep waters. In the Virgin Islands, these species are most common at depths exceeding 30 m but can be found on the north shore of St. Croix and north of St. John (e.g., Haulover Bay) at depths of less than 20 m. Some of these colonies have been observed to have been harvested over a several year period which would indicate either cautious harvesting (some of these areas being within the VI National Park) or personal collecting for low level jewelry production (Goenaga and Boulon 1992).

DRAFT

## False corals, Order Corallimorpharia

The corallimorpharians are a small order of Hexacorallia. They lack a skeleton but they form sheet-like colonies or can occur singularly. While they occur on Carribean reefs, they are of minor importance (Colin 1978).

Discosoma spp. are often found in groups on rocky substrates, and they may reach 10 cm in diameter. Generally occurring in shallow waters 2 to 30 m in depth, it can be found growing on vertical shaded areas, on dead branches of coral, and symbiotically growing on sponges (Colin 1978). The Florida false coral, Ricordia florida, covers large areas of rocky substrates on the back and fore reef from 0 to 20 m of water, and can consist of hundreds of polyps. Individual specimens of R. florida are no large than 5 cm in diameter, and has short, rounded tentacles.

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# Appendix G. National Standard 1 Guidelines Overview

National Standard (NS) 1 requires that conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the OY from each fishery for the U.S. fishing industry.

In addition, NS1 provides guidance on:

A. Specifying MSY and OY;

B. Specifying status determination criteria so that overfishing and overfished determinations can be made for stocks and stock complexes that are part of a fishery;

C. Preventing overfishing and achieving OY, incorporating scientific and management uncertainty in control rules, and conducting adaptive management using annual catch limits (ACL) and measures to ensure accountability (AM); and

D. Rebuilding stocks and stock complexes.

NS1 Guidelines

In 2016, the NS1 guidelines were revised to enhance their utility for managers and the public and provide flexibility in meeting current Magnuson-Stevens Act mandates. The revisions do not establish new requirements or require Councils to revise their current FMPs.

Issues addressed in the revisions include:

- Providing stability to fisheries;
- Adding flexibility to rebuilding plans;
- Updating optimum yield and maximum sustainable yield concepts;
- Improving guidance on managing data-limited stocks;
- Consolidating guidance on identifying stocks to be included in federal FMPs;
- Provisions to further advance ecosystem-based fisheries management.

The 2016 NS1 Guidelines include new or modified provisions, as described below.

1) Determining which stocks require conservation and management – Under the Magnuson-Stevens Act, federal management is required when a fishery is in need of conservation and management. The new NS guidelines clarify and streamline guidance on determining whether a stock requires conservation and management.

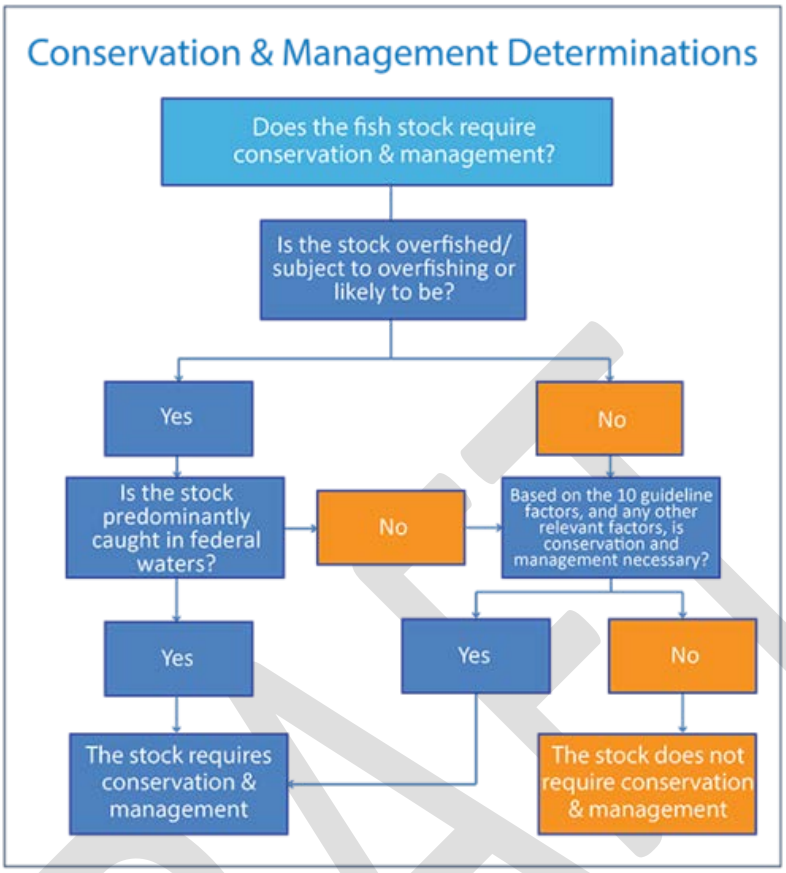


**Figure 6.2.1.** Guidance for determining whether a stock requires conservation and management. (Source: https://www.fisheries.noaa.gov/national/laws-and-policies/2016-revisions-national-standard-1-guidelines)

2) Multi-year approaches to overfishing stock status determinations – Includes guidance on a method for determining the overfishing status of a stock based on a multi-year approach. The Magnuson-Stevens Act defines overfishing as a "rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce MSY on a continuing basis." (16 U.S.C. 1802(34)). Thresholds for deciding whether a stock is subject to overfishing can be determined either by comparing rates of fishing mortality (F) to the MFMT or catch to the OFL (§600.310(e)(2)(i)(B)-(D)).

3) Phasing-in changes to catch levels – Allow changes to catch limits to be gradually phased in over a period of time not to exceed three years, as long as overfishing is prevented. Before, changes in catch limits were made over the course of one year.

4) Carrying-over unused quota into the next year – If a fishery does not catch all of its ACL during one fishing season, the NS1 guidelines allow a Council to carry-over a portion of the catch underage into the next year. Carrying-over unused catch is designed to relieve pressure on

fishermen to catch their entire catch limit, which can result in fishing in unsafe situations or harvesting fish during poor market conditions.

Pursuant to Magnuson-Stevens Act section 304(e)(1), NMFS must report annually to Congress and the eight Councils on the status of all Federally-managed fish stocks (16 U.S.C. 1854(e)(1)). Overfishing status determinations are typically made based on the most recent year for which there is information. When utilizing the F-based approach, the estimate of F for the most recent year for which there are data is often more uncertain than the estimates of F in prior years (NRC 1998). In addition, the extent to which the effort or catch exceeded the threshold for overfishing has not traditionally been considered when determining whether the stock was subject to overfishing. Small amounts of excess effort or catch in a single year may not jeopardize a stocks' ability to produce MSY over the long term, thus an overfishing stock status determination based on that single year's reference point may not be the most appropriate characterization of stock status. To address this issue, the proposed revisions introduced a multi-year approach (that may not exceed 3 years) to allow a Council to examine whether the extent to which a stock has surpassed its overfishing threshold actually jeopardizes the stock's ability to produce MSY on a continuing basis (See §600.310(e)(2)(ii)(A)(3)). A multi-year approach to determine overfishing stock status is best used when managers believe the most recent year of data may not reflect the overall status of the stock[71].

5) An Acceptable Biological Catch (ABC) Control Rule (CR) accounts for scientific uncertainty in the OFL and for the Council's risk policy when establishing an ABC. The revised guidelines allow, but do not require, Councils to develop an ABC CR that would phase-in changes to the ABC over a period of time not to exceed 3 years, so long as overfishing is prevented. See Sections 6.3 and 6.4 for more information about the ABC CR for Caribbean stocks.

6) Adequate progress determinations for rebuilding plans.

7) Adding flexibility in rebuilding plans.

### 6.2.1 Maximum Sustainable Yield (MSY)

The Magnuson Stevens Act requires that each FMP include an estimate of MSY for the stocks and stock complexes that require conservation and management. MSY may also be specified for the fishery as a whole.

[71] Source https://www.federalregister.gov/documents/2016/10/18/2016-24500/magnuson-stevens-act-provisions-national-standard-guidelines.

The Magnuson-Stevens Act establishes the MSY as the basis for fishery management and requires that the fishing mortality rate does not jeopardize the capacity of a stock or stock complex to produce MSY, that the abundance of an overfished stock or stock complex be rebuilt to a level that is capable of producing MSY, and that OY (see below) not exceed MSY. The fishing mortality rate at MSY ($F_{MSY}$) is that rate of fishing mortality that, if applied over the long term, would result in MSY. The stock size at MSY ($B_{MSY}$) is the long-term average size of the stock or stock complex, measured in terms of spawning biomass or other appropriate measure of the stock's reproductive potential that would be achieved by fishing at $F_{MSY}$ (600.310(e)(1)(i)(A-C)).

The MSY is the largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological and environmental conditions, fishery technological characteristics (e.g., gear selectivity), and the distribution of catch among fleets.

The MSY for stocks should be estimated for each stock based on the best scientific information available. When stock complexes are used, MSY should be estimated for one or more indicator stocks or for the complex as a whole. Estimating MSY for an aggregate group of stocks (including stock complexes and the fishery as a whole) can be done using models that account for multi-species interactions, composite properties for a group of similar species, biomass (energy) flow and production patterns, or other relevant factors.

Because MSY is a long-term average, it need not be estimated annually, but it must be based on the best scientific information available, and should be re-estimated as required by changes in long-term environmental or ecological conditions, fishery technological characteristics, or new scientific information. When data are insufficient to estimate MSY directly, Councils should adopt other measures of reproductive potential that can serve as reasonable proxies for MSY, $F_{MSY}$, and $B_{MSY}$. The MSY for a stock or stock complex is influenced by its interactions with other stocks in its ecosystem and these interactions may shift as multiple stocks in an ecosystem are fished. Ecological and environmental information should be taken into account, to the extent practicable, when assessing stocks and specifying MSY. Ecological and environmental information that is not directly accounted for in the specification of MSY can be among the ecological factors considered when setting OY below MSY.

As MSY values are estimates or are based on proxies, they would have some level of uncertainty associated with them. The degree of uncertainty in the estimates should be identified, when practicable, through the stock assessment process and peer review (see § 600.335), and should be taken into account when specifying the ABC CR.

**Scientific Uncertainty** refers to uncertainty in the information about a stock and its maximum sustainable yield reference points. Sources of scientific uncertainty could include uncertainty in stock assessment results, uncertainty in the estimates of MFMT, MSST, the biomass of the stock, and OFL, time lags in updating assessments, the degree of retrospective revision of assessment results, uncertainty in projections, uncertainties due to the choice of assessment model, longer-term uncertainties due to potential ecosystem and environmental effects, or other factors.

**Management Uncertainty** refers to uncertainty in the ability of managers to constrain catch so that the ACL is not exceeded, and the uncertainty in quantifying the true catch amounts (i.e., estimation errors). The sources of management uncertainty could include late catch reporting, misreporting or underreporting of catches, lack of sufficient in-season management, including in-season closure authority, or other factors.

The degree of uncertainty in the estimates should be identified, when possible, through the stock assessment process and peer review, and should be taken into account when specifying the ABC CR (see Sections 6.3 and 6.4 for the ABC CR). When this uncertainty cannot be directly calculated, such as when proxies are used, then a proxy for the uncertainty itself should be established based on the best scientific information, including comparison to other stocks.

### 6.2.2 Status Determination Criteria (SDC)

Section 303(a) of the Magnuson-Stevens-Act requires that an FMP specify objective and measurable criteria, or reference points, for determining when a stock is subject to overfishing or is overfished. In the case of a fishery which the Council or the Secretary of Commerce has determined is approaching an overfished condition or is overfished, the FMP must contain conservation and management measures to prevent overfishing or end overfishing and rebuild the fishery. Another required provision is to establish a mechanism for specifying ACLs in the plan (including a multi-year plan), and implementing regulations or annual specifications (including measures to ensure accountability) at a level such that overfishing does not occur in the fishery.

Status determination criteria are the measurable and objective factors, MFMT, OFL, and MSST (see below), or their proxies, that are used to determine if overfishing has occurred, or if the stock or stock complex is overfished. The Magnuson-Stevens Act Section 3(34) defines both "overfishing" and "overfished" to mean a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce the MSY on a continuing basis. This section clarifies that "overfished" relates to biomass of a stock or stock complex, and "overfishing" pertains to a rate or level of removal of fish from a stock or stock complex. Generally, NMFS uses outcomes from a formal stock assessment, a scientific analysis of the abundance and composition of a fish stock which evaluates the stock against its reference points. Stock assessments use the best

information available, which may include data from fishery landings, scientific surveys, and biological and ecological studies. A stock assessment typically undergoes peer review by independent scientists before it is accepted as the best scientific information available. The resultant reference points are used to determine whether the stock is subject to overfishing or is overfished. Outcomes from the stock assessment are reviewed by the Council's Scientific and Statistical Committee (SSC). If the SSC accepts those outcomes, it then uses them to establish the level of ABC for the stock/stock complex.

*Overfished Status*
*A stock or stock complex is considered overfished when its biomass has declined below the MSST. That is, the biomass is below that at which the capacity of the stock or stock complex to produce MSY on a continuing basis has been jeopardized.*

*Overfishing Status*
The Magnuson-Stevens Act defines overfishing as a ''rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce the MSY on a continuing basis.'' (16 U.S.C. 1802(34)). Overfishing occurs whenever a stock or stock complex is subjected to a level of fishing mortality or total catch that jeopardizes the capacity of a stock or stock complex to produce MSY on a continuous basis.

Thresholds for deciding whether a stock is subject to overfishing can be determined either by comparing rates of F to the MFMT or catch to the OFL.

*Maximum fishing mortality threshold* is the level of F, on an annual basis, above which overfishing is occurring. The MFMT or reasonable proxy may be expressed either as a single number (a fishing mortality rate or F value), or as a function of spawning biomass or other measure of reproductive potential.

*Overfishing limit* is the annual amount of catch that corresponds to the estimate of MFMT applied to a stock or stock complex's abundance and is expressed in terms of numbers or weight of fish.

### 6.2.3. Sustainable Yield Level (SYL)

The SYL is the maximum level of landings that can be sustained over the long term given the abundance of the stock at the time the limit was put in place. It is intended to be used when the information or resources needed to produce a quantitative stock assessment are not available to determine the MSY or corresponding reference point such as the OFL. As such, the SYL may be determined on the basis of historic landings patterns, Productivity Susceptibility Analyses, or other available information including expert opinion.

The SYL is an equilibrium (long-term) concept. This is in contrast to OFL, which is a non-equilibrium (short-term) quantity defined as the annual amount of catch that corresponds to the estimate of the MFMT applied to a stock's abundance. The value of OFL thus increases or decreases in accordance with the abundance of the stock, and MSY is the long-term average of such catches. The SYL is intended to ensure a stock is maintained at a sustainable level until the stock's status relative to MSY-related reference points can be determined. The SYL is not intended as a metric for reporting stock status in terms of overfishing or overfished because it is not defined in those concepts. The landings level that is compared against the SYL is determined according to the monitoring protocol established by the Council in the governing FMP.

$MSY \geq SYL \geq ABC \geq ACL = OY$

The SYL for stocks managed in the Puerto Rico FMP are included in the Council's ABC CR developed to establish ABCs for managed species. The ABC CR is discussed in Sections 6.2.4 and 6.4 below.

### 6.2.4 *Acceptable Biological Catch (ABC)*

The ABC is a product of the ABC CR, as developed and applied by the Council's SSC. The ABC CR is presented in Section 6.3. The analytical process used to develop ABCs for each stock or stock complex (and, as appropriate, indicator stock for a stock complex) is fully described in Section 6.4. Note that "catch" is defined as the total quantity of fish, measured in weight or numbers of fish, taken in commercial, recreational, subsistence, tribal, and other fisheries. Catch includes fish that are retained for any purpose as well as fish that suffer mortality when discarded (i.e., returned to the water rather than being retained).

### 6.2.5 *Annual Catch Limit (ACL)*

An ACL is the total amount of a stock or stock complex that can be taken by fishermen per calendar year. Annual catch limits can be measured in pounds or numbers of individuals. An ACL can apply to a single stock (for example queen conch) or to a stock complex. The ACL is the level of annual catch of a stock or stock complex that serves as the basis for invoking AM.

Any FMP prepared by a Council shall establish a mechanism for specifying ACLs in the FMP (including a multi-year plan), and implementing regulations or annual specifications at a level such that overfishing does not occur in the fishery, including measures to ensure accountability. In general, when specifying limits and AMs intended to avoid overfishing and achieve sustainable fisheries, Councils must take an approach that considers uncertainty in both the

scientific information and the management control of the fishery. The process for setting ACLs for stocks and stock complexes (including indicator stocks) is presented in Section 6.3 and fully described in Section 6.4.

Exceptions to (600.310(h)(1)), and flexibility in (600.310(h)(2)) the application of, the requirement to establish an ACL for each stock or stock complex are provided. Regarding exceptions, the requirement to establish an ACL does not apply in the case of species with a life cycle (i.e., the average age of spawners) is one year or less, unless the Secretary has determined the fishery is subject to overfishing (600.310(h)(1)(i)). However, the full suite of SDC and management reference points (except ACL and AM) must still be established for the stock or stock complex. Stocks governed by an international agreement are similarly exempted but still require establishment of MSY, SDC, and OY (600.310(h)(1)(ii). Regarding flexibility, establishment of ACLs and AMs may not be required in the case of ESA-listed species, aquaculture operations, stocks with unusual life history characteristics, and stocks for which data are not available either to set reference points based on MSY or an MSY proxy, or to manage to those MSY- (or proxy) based reference points. Under these exceptional circumstances, the Council may propose alternative methods for satisfying Magnuson-Stevens Act requirements although they must document their rationale for the alternative approach.

*Relationship to the ABC*

An ACL cannot exceed the ABC and may be set annually or on a multi-year plan basis. An ACL may be divided into sector-ACLs. Annual catch limits in coordination with AMs (see Section 6.2.8 below) must prevent overfishing. If a Council recommends an ACL which equals ABC, and the ABC is equal to OFL, the Secretary may presume that the proposal would not prevent overfishing, in the absence of sufficient analysis and justification for the approach. A "multiyear plan" is a plan that establishes harvest specifications or harvest guidelines for each year of a time period greater than one year. A multi-year plan must include a mechanism for specifying ACLs for each year and include appropriate AMs to prevent overfishing and maintain an appropriate rate of rebuilding if the stock or stock complex is in a rebuilding plan. A multiyear plan must provide that, if an ACL is exceeded for a year, then AMs are triggered for the next year.

### 6.2.6 Optimum Yield (OY)

The Magnuson-Stevens Act defines "optimum", with respect to the yield from a fishery, as the amount of fish that would 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; that is prescribed on the basis of the MSY from the fishery. The OY is also reduced by any relevant economic, social, or ecological factors. In addition, in the case of an overfished fishery, OY must provide for rebuilding to a level consistent with producing the MSY in such fishery. The OY may be established at the stock or stock complex level, or at the

fishery level. The OY is a long-term average amount of desired yield from a stock, stock complex, or fishery. An FMP must contain conservation and management measures, including ACLs and AMs, to achieve OY on a continuing basis, and provisions for information collection that are designed to determine the degree to which OY is achieved.

Exceeding OY does not necessarily constitute overfishing. However, even if no overfishing resulted from exceeding OY, continual harvest at a level above OY would violate NS1, because OY was not achieved on a continuing basis. A Council must identify those economic, social, and ecological factors relevant to management of a particular stock, stock complex, or fishery, and then evaluate them to determine the OY. The choice of a particular OY must be carefully documented to show that the OY selected would produce the greatest benefit to the Nation and prevent overfishing.

In determining the greatest benefit to the Nation, the values that should be weighed and receive serious attention when considering the economic, social, or ecological factors used in reducing from MSY to obtain OY are:

- The benefits of food production derived from providing seafood to consumers, maintaining an economically viable fishery together with its attendant contributions to the national, regional, and local economies, and utilizing the capacity of the Nation's fishery resources to meet nutritional needs;
- The benefits of recreational opportunities reflect the quality of both the recreational fishing experience and non-consumptive fishery uses such as ecotourism, fish watching, and recreational diving. Benefits also include the contribution of recreational fishing to the national, regional, and local economies and food supplies;
- The benefits of protection afforded to marine ecosystems are those resulting from maintaining viable populations (including those of unexploited species), maintaining adequate forage for all components of the ecosystem, maintaining evolutionary and ecological processes (e.g., disturbance regimes, hydrological processes, nutrient cycles), maintaining the evolutionary potential of species and ecosystems, and accommodating human use.

When establishing the OY, if the estimates of MFMT and current biomass are known with a high level of certainty, and management controls can accurately limit catch, then OY could be set very close to MSY assuming no other reductions are necessary for social, economic, or ecological factors. To the degree that such MSY estimates and management controls are lacking or unavailable, OY should be set farther from MSY. If management measures cannot adequately control fishing mortality so that the specified OY can be achieved without overfishing, the Council should reevaluate the management measures and specification of OY so that the dual

requirements of NS1 (preventing overfishing while achieving OY on a continuing basis) are met. The OY for stocks in the Puerto Rico FMP is presented in Section 6.3 and fully described in Section 6.4.

### 6.2.7 Annual Catch Target (ACT)

The ACT is the amount of annual catch of a stock that is the management target of the fishery, and accounts for further management uncertainty in controlling the actual catch at or below the ACL. An ACT set less than the ACL provides a buffer so the risk of exceeding the ACL is reduced and, therefore, the likelihood of triggering an AM is reduced. An ACT lowers the allowed catch below the ACL, but provides stability for fisheries that are apt to fluctuate around a target catch rate.

### 6.2.8 Accountability Measures (AMs)

Accountability measures are management controls to prevent ACLs from being exceeded, and to correct overages of the ACL if they occur. Accountability measures should address and minimize both the frequency and magnitude of overages, and correct the problems that caused the overage in as short a time as possible. NMFS identifies two categories of AMs, in-season AMs designed to prevent an ACL overage, and post-season AMs to correct overages, that is, designed to ensure that the ACL would not again be exceeded. The Magnuson-Stevens Act NS1 also indicates that the FMP should identify what sources of data would be used to implement AMs (e.g., in-season data, annual catch compared to the ACL, or multi-year averaging approach).

#### 6.2.8.1 In-Season AMs

In-season AMs take place during the fishing season. If an ACL exceedance is identified within the fishing season, an AM (or multiple AMs) must be triggered and implemented as soon as possible to correct the operational issue that caused the ACL overage, as well as any known biological consequences to the stock or stock complex resulting from the overage. Available AMs include, but are not limited to, implementing an ACT and using it as the AM, temporary closure of the fishery, closure of specific areas, changes in gear, changes in trip size or bag limits, reductions in effort, or other appropriate management controls for the fishery. For stocks and stock complexes in rebuilding plans, the AMs should include overage adjustments that reduce the ACL in the next fishing year by the full amount of the overage, unless the best scientific information available shows that a reduced overage adjustment, or no adjustment, is adequate to mitigate the effects of the overages.

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If final data or data components of catch are delayed, the Council should make appropriate use of preliminary data, such as landed catch, in implementing in-season AMs. Fishery management plans should contain in-season closure authority giving NMFS the ability to close fisheries if it determines, based on data that it deems sufficiently reliable, that an ACL has been exceeded or is projected to be reached, and that closure of the fishery is necessary to prevent overfishing (§ 600.310 NS1 – OY (b)).

#### 6.2.8.2 Post-season AMs

National Standard 1 indicates that, on an annual basis, the Council must determine as soon as possible after the fishing year if an ACL was exceeded. If an ACL was exceeded, an AM (or multiple AMs) must be implemented as soon as possible to correct the operational issue that caused the ACL overage, as well as any biological consequences to the stock or stock complex resulting from the overage when it is known. As with application of an in-season AM, the AM(s) could include, among other things, the use or modification of ACTs, temporary closure of the fishery, closure of specific areas, changes in gear, changes in trip size or bag limits, reductions in effort, or other appropriate management controls for the fishery. The type of AM chosen by the Council would likely vary depending on the sector of the fishery, status of the stock, the degree of the overage, recruitment patterns of the stock, or other pertinent information. If an ACL is set equal to zero and the AM for the fishery is a closure that prohibits fishing for a stock, additional AMs are not required if only small amounts of catch (including bycatch) occur, and the catch is unlikely to result in overfishing. For stocks and stock complexes in rebuilding plans, the AM should include overage adjustments that reduce the ACL in the next fishing year by the full amount of the overage, unless the best scientific information available shows that a reduced overage adjustment, or no adjustment, is needed to mitigate the effects of the overage.

#### 6.2.8.3 Using Average Landings to Identify ACL Exceedance

Some fisheries have highly variable annual catches and lack reliable in-season or annual data on which to base an identification of an ACL overage. The NS1 indicates that if there are insufficient or inadequate data upon which to compare a single year of catch to the ACL, either in-season or on an annual basis, identifying an ACL exceedance could be based on comparison of average catch during a multi-year period (not to exceed three years) to the ACL. The Council should explain why using a multi-year average is appropriate. Comparison of average catch to the ACL must be conducted annually and AMs should be implemented if the average catch exceeds the ACL.

#### 6.2.8.4 Performance Standard

The NS1 indicates that if catch exceeds the ACL for a given stock or stock complex more than once in four consecutive years, the system of ACLs and AMs should be reevaluated, and

modified if necessary, to improve its performance and effectiveness. If AMs are based on multi-year average data, the performance standard is based on a comparison of the average catch to the average ACL. The initial ACL and management measures may incorporate information from previous years so that AMs based on average ACLs can be applied from the first year. Alternatively, a Council could use a stepped approach where in year-1, catch is compared to the ACL for year-1; in year-2 the average catch for the past 2 years is compared to the average ACL; then in year 3 and beyond, the most recent 3 years of catch are compared to the corresponding ACLs for those years. A Council could choose a higher performance standard (e.g., a stock's catch should not exceed its ACL more often than once every five or six years) for a stock that is particularly vulnerable to the effects of overfishing, if the vulnerability of the stock has not already been accounted for in the ABC CR.

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# Appendix H. Process used in the 2010 and 2011 Caribbean Annual Catch Limit (ACL) Amendments to establish management reference points and status determination criteria for stocks managed by the Caribbean Fishery Management Council (Council)

The Council and its Scientific and Statistical Committee (SSC) employed a variety of approaches when establishing reference points for federally managed species within the 2010 and 2011 Caribbean ACL Amendments. The process was sequential, with those species classified in NMFS' 2010 report to Congress on the status of stocks as overfished or undergoing overfishing (snappers, groupers, parrotfish, queen conch) addressed first (*i.e.*, in the 2010 Caribbean ACL Amendment). The initial step in the reference-point-setting process involved establishing the longest time series of landings data that was consistently reliable across all islands. For all stocks/stock complexes under management, whether commercially or recreationally managed (in Puerto Rico only), the Council and their SSC chose 2005 as the terminal index year because it was the last year before the provisions of the Caribbean Sustainable Fisheries Act Amendment (Caribbean SFA: CFMC 2005) were implemented, an event that substantially altered federal fisheries management in the U.S. Caribbean region and therefore represented a break-point in landings consistency. In contrast to the common end-year for the sequence, the start year differed depending on the island (Puerto Rico, St. Thomas/St. John, St. Croix) and sector (commercial, recreational [for Puerto Rico only]). In the USVI, reporting forms for commercial landings were modified in the late 1990s, with new form compliance being accomplished beginning in 1999 for St. Croix and 2000 for St. Thomas/St. John. Those were therefore chosen as the start years for the St. Croix and St. Thomas/St. John time sequences, respectively. To maintain consistency among the islands, the same 1999-2005 sequence was chosen for commercial landings in Puerto Rico. Because recreational landings data, based on NOAA's Marine Recreational Fisheries Statistics Survey (MRFSS), was initiated in Puerto Rico in 2000, the recreational year sequence was established as 2000-2005. In all cases, landings data used in the determinations of reference points represent combined landings from state and federal waters. For Puerto Rico, the landings data have been adjusted (*i.e.*, expanded) to account for under-reporting, mis-reporting, and non-reporting.

To establish reference points for the St. Croix stocks and stock complexes, the maximum sustainable yield (MSY) proxy was equated to average landings from 1999-2005. The overfishing limit (OFL) was then set equal to the MSY proxy, with the caveat that, if the Southeast Fisheries Science Center (SEFSC) in consultation with the Council and its SSC

determine the overage occurred because data collection/monitoring improved rather than because landings actually increased, overfishing would be deemed to be not occurring. In most cases, the ACL was then derived from the OFL by applying a buffer that reduced from the OFL to account for uncertainty, ecological factors, and other concerns. This reduction buffer was 0.85 for snapper and grouper. Note, however, that the Council's SSC applied two exceptions to this procedure when setting reference points for parrotfish. First the SSC applied expert knowledge to set an ad hoc ABC of 300,000 pound for parrotfish harvest from the St. Croix exclusive economic zone (EEZ). Second, the Council applied the uncertainty reduction buffer of 0.85 to the ABC to derive the ACL (*i.e.*, ABC x 0.85 = ACL) as a means to balance the directed harvest of these species with their ecological importance as algal grazers within the coral reef ecosystem. For the St. Croix EEZ, an additional reduction of 5.8222% was added to the parrotfish complex to address uncertain effects of that harvest on essential settlement substrate for Acroporid corals. For Nassau grouper, goliath grouper, midnight, blue, and rainbow parrotfish the ACL was set as zero, indicating that the harvest of these species should be prohibited to prevent overfishing. The prohibition on fishing for and possession of parrotfish species responds to the important role these larger parrotfish have on the ecological health of the coral reefs and the testimony at Council public meetings on the decrease in numbers of these species on U.S. Caribbean coral reefs. For Nassau and goliath grouper, fishing and possession of these species was already prohibited in all Puerto Rico commonwealth and USVI territorial waters and in the EEZ. In all cases, the optimum yield (OY) was then equated to the ACL.

The Council's SSC followed a similar procedure for setting reference points for queen conch, with the important exception that queen conch harvest from U.S. Caribbean EEZ waters is prohibited west of 64º34'W longitude. Thus, queen conch harvest from federal waters in the U.S. Caribbean is allowed only from the Lang Bank area east of St. Croix. The SSC assigned an ad hoc ABC of 50,000 pounds for queen conch harvest from St. Croix EEZ waters. The ACL and the OY were then set equal to the ABC.

Those species not classified in NMFS' 2010 report to Congress on the status of stocks as overfished or undergoing overfishing (all other reef fish, spiny lobster, and aquarium trade species managed within either the Reef Fish or Coral FMP) were subsequently addressed in the 2011 Caribbean ACL Amendment. The process for setting reference points for managed species in St. Croix that were not classified as overfished or undergoing overfishing differed in several ways from the procedure applied in the 2010 Caribbean ACL Amendment. First, 1999 was chosen as the start year for commercial landings calculations. For St. Croix, species-group level commercial harvest data (e.g., angelfish, grunts) first became available for a full calendar year in 1998. For the 2010 Caribbean ACL Amendment, the annual catch limit group recommended 1999 as the most representative start date for analysis of "recent" landings, and the Council and the government of the USVI requested that average landings estimates be based upon recent

landings. The selected end year for commercial landings calculations was 2008, representing the most recent year for which complete landings were available at the time of document preparation.

Using that year sequence, separate procedures (described below) were applied to each of the reef fish stocks, tilefish, spiny lobster, and consolidated aquarium trade species (*i.e.*, all aquarium trade species listed in each of the Reef Fish and Coral FMPs) to set the MSY proxy. For the reef fish grouping and for spiny lobster, the median of the landings from the chosen year sequence was used as the MSY proxy. For the consolidated aquarium trade species, which were managed at the Caribbean-wide level, the mean of landings from the chosen year sequence was used as the MSY proxy. For tilefish, which was also managed at the Caribbean-wide level, and for which commercial landings data were sparse, the SSC chose to use the highest single year of recreational landings from the chosen year sequence, multiplied by 3, to set the MSY proxy.

For all stocks in the USVI, the OFL was derived from the MSY proxy. Overfishing was defined to occur when annual landings exceed the OFL, with the caveat that, if the SEFSC in consultation with the Council and its SSC determine the overage occurred because data collection/monitoring improved rather than because landings actually increased, overfishing would be deemed to be not occurring. The ABC was then equated to the OFL for all managed stocks. Finally, for all but the angelfish, surgeonfish, and aquarium trade species, an uncertainty reduction of 0.90 was applied to derive the ACL from the ABC. In the case of angelfish and surgeonfish, that uncertainty buffer was set at 0.75 as a means to balance the directed harvest of these species with their ecological importance as algal grazers within the coral reef ecosystem. The uncertainty buffer was also set at 0.75 for aquarium trade species because not much was known about the fisheries in the EEZ and most of the harvest took place in state waters. In all cases, OY was then equated to the ACL.

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# Appendix I. Fisheries Data Requirements

## I.1. Introduction

Management of fisheries and living marine resources depends on careful interpretation and analysis of reliable and comprehensive information (e.g., life history, landings data). The more information managers have available, the greater the likelihood that resource management goals will be achieved and the less uncertainty will be inherent in that effort. National Standard (NS) 1 of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) provides information on what the Councils must include in their fishery management plans (FMP) or associated public documents with respect to data, such as a description of general data collection methods as well as any specific data collection methods used for all stocks in the fishery and ecosystem component species (§ 600.310 (i)(1)-(3). These include:

(1) Source of fishing mortality (both landed and discarded), including commercial and recreational catch and bycatch in other fisheries;

(2) Description of the data collection and estimation methods used to quantify total catch mortality in each fishery, including information on the management tools used (*i.e.*, logbooks, vessel monitoring systems, observer programs, landings reports, fish tickets, processor reports, dealer reports, recreational angler surveys, or other methods); the frequency with which data are collected and updated; and the scope of sampling coverage for each fishery; and

(3) Description of the methods used to compile catch data from various catch data collection methods and how those data are used to determine the relationship between total catch at a given point in time and the annual catch limit (ACL) for stocks and stock complexes that are part of a fishery.

In addition, NS2 of the Magnuson-Stevens Act states that an FMP should identify scientific information needed from other sources to improve understanding and management of the resource, marine ecosystem, and the fishery (including fishing communities) (§ 600.315).

Management of federal fisheries in the U.S. Caribbean relies almost exclusively on landings data derived from the commercial and (presently in Puerto Rico only) recreational sectors. Currently in the U.S. Caribbean, additional parameters used in fisheries management (e.g., species age, length, growth rate, and reproductive patterns) are lacking or not consistently available. Landings data are of considerable value for delineating long-term harvest patterns and for detecting substantial changes in those patterns. However, landings data are not suited to address all federal fisheries management issues, both because of limited temporal and spatial resolution of the landings data and because landings data alone cannot answer important management

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questions pertaining to year-class strength, recruitment patterns, and other essential measures of population health.

Federal fishery management obligations have increased in the past several years resulting from the Congressional mandate to end overfishing of managed species, as defined in the 2007 revision of the Magnuson-Stevens Act. In particular, the Magnuson-Stevens Act requires as a statutory provision that ACLs be established, with few exceptions, for all federally managed species. These ACLs define the maximum allowable annual harvest for each stock (or stock complex) included in a federal FMP. Accountability measures (AM) are corollary to the ACLs and function to either prevent an ACL from being exceeded (generally via in-season response) or to ensure that management actions are taken to prevent an overage from occurring again (generally via a post-season response). More information on how AMs and ACLs are applied to the St. Croix exclusive economic zone (EEZ) can be found in Sections 6.7 and 6.8 of this FMP/DEIS.

It is essential that scientists and managers have available to them, in a timely manner and with the necessary level of temporal and spatial resolution, data suitable to meet these federal management obligations. Ideally, those data would be available on a monthly or more frequent basis, thereby allowing for in-season management, but so far that has not been the case. Instead, essential landings data are typically not available until at least a year following the end of the applicable fishing season. This delay in data availability results in a management approach dependent on post-season responses, and those responses may not be in place until 18 to 24 months following the event.

Appendix E.2 (Data Needs for Management) below, lists and discusses the minimum data requirements for effective management of St. Croix EEZ fisheries and its shortfalls; and Appendix E.3 (Data Sources) discusses where current data comes from and how it is being collected to address management data needs.

## I.2 Data Needs for Management

With respect to effective management of marine fisheries in the U.S. Caribbean EEZ, particularly in the St. Croix EEZ, there exists a set of minimum data requirements necessary to maintain sustainable harvest (Table I2.1). Note that additional data would be required to address economic and social issues associated with the fishery. Those economic and social issues may play an essential role in fishery and ecosystem health.

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**Table I2.1.** Status of data components recommended for enhancing federal fisheries management in the U.S. Caribbean. (Y= program available, N= program not available).

| Program | Puerto Rico | St. Thomas/St. John | St. Croix |
|---|---|---|---|
| Commercial Landings Data | Y | Y | Y |
| Trip Intercept Program | Y | Y | Y |
| Marine Recreational Information Program | Y* | N | N |
| Fishery Independent Data | Y | Y | Y |
| Ecosystem Response Indicators | N | N | N |

* Since late 2017, NMFS Statistics and Technology Office is no longer conducting any Access Point Angler Intercept Surveys (APAIS) sampling in Puerto Rico. MRIP, ST1 will be working with the regional partners to identify administrative body/group/agency to better define data needs and possible data collection projects to be considered for funding and testing by MRIP.

- Commercial landings data: Commercial landings data are necessary to monitor trends in harvest, particularly with respect to changes in those trends, and to identify species that may be appropriate for inclusion in the list of federally managed species. Included in these landings reports is information on fishing effort and location. Commercial landings data are being acquired, but with limitations including a lack of specific information on harvest location, effort expended, and in many cases, species-level descriptions of the catch. Furthermore, it is important to note that some portion of the commercial catch does not enter the market, but instead is kept by the fishermen for personal use. The extent of this subsistence catch, the degree to which it is included in landings reports, and its influence on the achievement of federal management goals is not well understood in the U.S. Caribbean. More information about sources of commercial landings data can be found in Section I3.1.

- Trip intercept program (TIP) data: TIP data provides information on the basic biology of the catch, including size and sex distribution, species composition, and information on fishing locations and effort. These data are derived from surveys of the catch during dockside interviews with the fishermen. More information about the TIP can be found in Section I3.1).

- Recreational Data: The Marine Recreational Information Program (MRIP), formerly known as the Marine Recreational Fisheries Statistics Survey or MRFSS, conducts vessel intercepts, direct and indirect (e.g., telephone) interviews, and other activities to gauge the composition, extent, and variability of harvest by the recreational sector. Additional information about sources for recreational data can be found in Section I3.1.

- Fishery-independent data: Fishery information collected by sampling methods independent of the commercial and recreational sectors provides data complementary to that collected by

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fishery-dependent means. Fisheries-independent data will help determine the health of the fishery to the extent to which those fishery resources can be sustainably harvested. For example, in the U.S. Caribbean stock assessments rely on fisheries-dependent data sources to use data-limited approaches for determining stock status and sustainability levels. Given that data from fishery-independent surveys can provide an unbiased estimate of abundance with which to calibrate stock assessments, its use is preferable. Using good and reliable fishery-independent data can reduce dependence on fisheries-dependent data (Report of the U.S. Caribbean Fishery-Independent Survey Workshop 2016). Specific information about fishery-independent data sources in Puerto Rico can be found in Section E3.2.

Fishery-independent data are collected under the auspices of several organizations and programs in the U.S. Caribbean and include a variety of methods such as diver-based surveys, visual census (underwater transects and point surveys), hook-and-line surveys, trap surveys, hydroacoustics, underwater video, and more, many with a limited spatial scale. However, often times these surveys do not take into account existing fishery knowledge or management needs. The results of these surveys require considerable effort to integrate into existing fishery data analysis. In addition, the survey designs are not necessarily appropriate for application to fishery management questions, nor are they repeated with any level of adequate consistency. A recent NOAA-sponsored workshop conducted in the U.S. Caribbean did a comprehensive review of the existing fishery-independent survey programs (Report of the U.S. Caribbean Fishery-Independent Survey Workshop 2016). Methods, statistical designs, and objectives differ among programs, and the workshop found that the majority of those objectives may not necessarily be directly related to stock assessments (*i.e.*, information collected (abundance, density, size structure) was for particular species in localized areas). A general recommendation from the workshop was to develop comprehensive new surveys and/or improve the temporal and spatial scale of existing efforts to improve data collection activities so that stock assessments in the U.S. Caribbean can be better supported. Substantial funding is expended on these surveys, so it is essential that they be conducted in a manner that provides maximum applicability of the resultant data. This can be accomplished by close coordination among the various management agencies and organizations particularly with the involvement of local experts. Some of the recommendations from the 2016 U.S. Caribbean Fishery-Independent Survey Workshop for the development of new surveys and/or adaptation of existing surveys in the Caribbean include:

1) Identify species of interest in the U.S. Caribbean to allow optimization of survey design.

2) Consult experts in survey design, statistics, and stock assessment prior to modifications/expansion/development of surveys.

3) Use similar methods across platforms to ensure adequate spatial coverage.

4) When using different gear, overlap spatially and temporally to allow calibration of methods.

5) Use cooperative research programs when fiseable (*i.e.*, include fishing community).

6) Develop/enhance capacity to process and analyze age, reproductive information, etc.

7) Conduct a regional workshop to identify gaps in stock demographic data.

8) Focus on filling spatial gaps to achievea "representative fraction of the populations"

9) Enhance data mining and recovery – scour and captura as much regional data as possible.

10) Expand habitat mapping, including high resolution bathymetry.

11) Collect information to facilitate Ecosystem-based Fishery Management (EBFM) and next-generation stock assessment.

(Source: Report of the U.S. Caribbean Fishery-Independent Survey Workshop 2016)

- Ecosystem response indicators: The U.S. Caribbean reef fish fishery is by definition inherently intertwined with its habitat. Fishing is consistently mentioned as one of the top three impacts to coral reef health (NOS n.d.). Yet, fishery and coral reef managers are not relating changes in management regime to ecosystem responses. Parrotfish are an excellent example. Allowable take in the U.S. Caribbean EEZ has been substantially reduced but there is no monitoring program in place that would allow managers to quantify the response, if any, to the harvest reduction. The expected response to the reduction in parrotfish harvest would be an increase or decrease in the availability of critical *Acropora* settlement substrate. Many ecosystem indicators are monitored, but few, if any, allow managers to relate fisheries management decisions to habitat responses despite the high ranking of fishery impacts to ecosystem health.

## I.3 Data Sources

### I.3.1 Fishery-Dependent Data (Commercial and Recreational)

Fisheries managers utilize fishery-dependent catch statistics in the U.S. Caribbean to inform regulation of harvest levels (including ACLs) and implementation of management measures. The NOAA Fisheries Glossary (http://www.st.nmfs.noaa.gov/st4/documents/FishGlossary.pdf) defines fishery-dependent data as data collected directly on a fish or fishery from the commercial

or sport fishermen and seafood dealers. Common methods of collecting fishery-dependent data include logbooks, trip tickets, creel sampling, fishery observers, and phone surveys. In the U.S. Caribbean, such data does not currently capture the full extent to which species under federal management are being extracted from the rest of the population. At the present time, commercial trip ticket data are collected from the U.S. Virgin Islands (USVI) Department of Planning and Natural Resouces (DPNR).

As mentioned above, a commercial TIP also exists in the USVI and it involves information collected by port samplers mainly on fishing effort. TIP is further discussed below. Recent Southeast Data Assessment Review Data (SEDAR)-sponsored stock assessments have primarily utilized commercial landings data obtained from catch reports or the trip tickets, with little reliance on data obtained from TIP sampling (SEDAR 2009). SEDAR is a regional cooperative fishery management council process initiated in 2002 to improve the quality and reliability of fishery stock assessments in the South Atlantic, Gulf of Mexico, and the U.S. Caribbean (SEDAR is discussed in Section 3.3.3.4).

#### I.3.1.1 Commercial Landings Data

Commercial Trip Ticket Data

With such a high reliance on commercial catch reports, it is important to ensure to the greatest possible degree those self-reported data accurately reflect actual catch. Improvements to the USVI commercial catch reporting system have been ongoing throughout the history of the program, with an emphasis on ensuring fishermen adhere to the required reporting timelines. In preparation for implementation of the St. Croix Island-based Fishery Management Plan, the USVI DPNR revised their commercial catch reporting form to include all species to be included for federal management in the new FMP. That latest revision of the reporting form was placed into service on July 1, 2016. State and federal fishery managers are continuing their efforts to improve the commercial data collection system, with a present emphasis on validation of the self-reported data.

Commercial Trip Intercept Program Data

The TIP data collection in the U.S. Caribbean has historically focused on the commercial sector trips in both Puerto Rico and USVI. These data are obtained by port samplers who interview fishermen and gather information on fish length and numbers of each species or species group landed, gear used, and information on the fishing trip (e.g., trip duration, fishing locations). Port samplers also collect a variety of information on fishing effort, including, but not limited to, trap soak time and number of traps. Included in the information collected are at least two matrices (length frequency and species composition) that could be viewed as some of the most valuable information from this data set.

### I.3.1.2 Recreational Landings Data

The MRFSS/MRIP recreational data collection program does not operate in St. Croix. The program was instituted in 2000, but after one year of operation was discontinued due to logistical problems including but not limited to retention of field samplers and complications with access to sampling sites. However, the USVI DPNR and NOAA are working to establish a robust recreational sampling program for the USVI.

### I.3.1.3 Landings Data Transmission and Reporting

A historic problem with fishery dependent data reporting in the U.S. Caribbean has been the lengthy delay between the day species are harvested and the transmission of that harvest information to fishery managers. Currently, there may be as much as a two-year lag between the time landings are recorded and the time data are released for fishery management applications (CFMC 2011). This lag time reduces fishery managers' ability to adjust fishery management measures in a timely fashion. Ideally, landings data would be available to managers on a monthly basis within the fishing season, allowing for in-season adjustment of harvest rates to ensure that harvest limits are met but not exceeded. Currently, federal and territorial fishery agencies are working together to find ways to reduce the time lag and allow for a faster delivery of landings data.

The unavailability of landings data on time is problematic for ACL monitoring. For example, to determine if a sector ACL has been exceeded, NMFS compares the average of the most recent three years of available landings to the sector ACL for each stock or stock complex. Because each year's landings data do not become available until the following year, and there is a substantial time lag between data availability and implementation of a closure rule, effecting an AM-based fishing season reduction in response to a sector ACL overage generally does not occur until two years following the most recent year of available landings.

MRAG Americas Inc. (2009) proposed a reporting scheme in which fishermen on Puerto Rico and the USVI would report on a weekly basis as a solution to the time lag issue. This scheme could speed up the process by reducing the delay with data reporting by using an electronic logbook system. The concern, however, is the time burden on fishermen, which could affect cooperation and compliance. To offset these concerns, a number of options could be offered, including self-addressed stamped envelopes, drop boxes in centralized locations, drop-offs in person at the agency office, and even call-ins (in special circumstances). Under this reporting scheme, receipts would be given to fisherman for all reports received. However there are limitations with this scheme, for example in Puerto Rico, agents cannot pick up landing reports and fishermen cannot drop them off at a centralized location because of the receipt requirement. Under the electronic logbook system, computers could be placed in government-sponsored

fishing associations or in fishermen's associations with the associated training workshops. Fishermen, however, have made counter-proposals in which the MRAG timeline can be phased in on a slower timeframe. They would like to maintain the monthly reporting schedule, and phase in shorter reporting timeframes as the catch is approaching the quota limit (MRAG 2009).

Electronic reporting could aid in the timely submission of data and subsequent analysis to meet Magnuson-Stevents Act requirements in the U.S. Caribbean. Fisheries that may be suitable for electronic reporting include deep-water snapper grouper complex, for-hire boats and some of the key species of small scale fisheries, such as lobster, snappers, groupers, queen conch, among others.

#### I.3.1.4 Non-Reporting and Misreporting

Another integral step in enhancing fishery dependent data is identifying and accurately measuring non-reporting and misreporting. An important component of fishery management is accounting for uncertainty. Uncertainty results from both non- and misreporting. There are two types of non-reporting. The first type is the catch that simply goes unreported, either by the fishermen or the fish house. The second, a smaller portion of the catch is never accounted for because it is sold on the dock en-route to the fish house where the rest of the catch is reported.

Misreporting is the level of under or over reporting by a fisher. Misreporting needs to be corrected in order to more accurately and precisely know the level of species harvest. Better understanding of the temporal and seasonal changes in non-reporting and misreporting would allow for a better overall estimate of the expansion factor to be applied to the reported landings data (MRAG 2009).

A report published by MRAG Americas Inc[72] in 2009 proposed modifications to the present survey design to address these shortcomings. The proposed survey design would use the most recent census data to count the number of unlicensed fishermen by port and fishing center. Port samplers would then be able to refine the list based on their knowledge and experience with the local fishermen. Third, samplers would then conduct follow-up visits to each site confirming their estimates via interviews with the fishermen. Managers would use the information on the number of non-reporters by site to quantify the spatial and temporal variability in the ratio of reporters to non-reporters. From that information, managers can evaluate a design that obtains data from more sites at more times over the entire island, but a shorter sampling duration at each

[72] MRAG Americas Inc. is a company comprised of scientists and specialists with expertise in fisheries and aquatic resource science, management, and monitoring; fisheries observer programs; ecosystem and protected area management; government liaison and relations; stakeholder engagement and outreach; and international conservation and management agreements.

site. Port samplers should repeat this intense survey approximately every five years, and then over the longer term, managers would use the data to determine seasonality for sampling and intensities.

### I.3.2 Fishery Independent Data

The NOAA Fisheries Glossary defines fishery-independent data as characteristic of information (e.g., stock abundance index) or an activity (e.g., research vessel survey) obtained or undertaken independently of the activity of the fishing sector. Fishery-independent data intends to avoid the biases (e.g., non-reporting and misreporting) inherent to fishery-related data or fishery-dependent data. There are fishery-independent data collection initiatives such as the Southeast Area Monitoring and Assessment Program (SEAMAP) and SEDAR currently underway in the U.S. Caribbean. SEAMAP is state/federal program designed to collect, manage and disseminate fishery-independent data in the southeastern United States.

In addition to the SEDAR and SEAMAP initiatives, these are also sporadic fishery independent surveys carried out in the U.S. Caribbean by other NOAA programs (Table I.3.1), academia, and other federal agencies. Increase coordination and prioritization between fishery managers, and these numerous fishery independent surveys will enhance fishery management in the U.S. Caribbean. An initiative to coordinate the numerous fishery independent projects would be labor intensive but would yield important results, and possibly fill the existing data gaps in the region. Thus, early collaboration within the NOAA programs working in the region is very important in setting a priority and avoiding duplication of effort.

As mentioned in Section I.2 (Data Needs for Management) there are many fishery-independent survey programs in the U.S. Caribbean and adjacent waters that serve as data sources for different objectives. Table I3.1 lists NOAA Inititiatives that collect fishery-independent data. Table I3.2 lists a representation of ongoing or recent fishery-independent sampling activities conducted by federal agencies, NGOs, states and territories, and academic partners as discussed in the NOAA sponsored U.S. Caribbean Fishery-Independent Survey Workshop (2016).

**Table I3.1.** List of NOAA initiatives that collect fishery-independent data in the U.S. Caribbean.

| NOAA Initiatives that Collect Fisheries-Independent Data |
|---|
| Caribbean Coral Reef Ecosystem Monitoring Project |
| Baseline Assessment of Guánica Bay, Puerto Rico in Support of Watershed Restoration |
| Seafloor Characterization of the U.S. Caribbean |
| Comprehensive U.S. Caribbean Coral Reef Ecosystem Monitoring Project (C-CCREMP) |

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| NOAA Initiatives that Collect Fisheries-Independent Data |
|---|
| Conservation Effects Assessment Project (CEAP): Jobos Bay, Puerto Rico Special Emphasis Watershed Partnership |
| Acoustic Tracking of Fish Movements in Coral Reef Ecosystems |
| An Ecological Characterization of the Marine Resources of Vieques, Puerto Rico |
| Coral Reef Ecosystem Studies (CRES) – U.S .Caribbean Component |
| Development of Reef Fish Monitoring Protocols to Support the National Park Service Inventory and Monitoring Program |

**Table I3.2**. Ongoing or recent fishery-independent sampling activities.

| Fishery-Independent Sampling/Research Projects | | |
|---|---|---|
| *Survey* | *Description* | *Entity in charge* |
| Biogeography Diver Based Suerveys (historical) and National Coral Reef Monitoring Program (NCRMP) | Surveys covering benthos, fish, people, and climate.<br>Not designed for stock assessment purposes. | Fish and benthos: NOS Biogeography Program, NMFS Southeast Fisheries Science Center |
| Reef Visual Cencus (RVC) Surveys | Provides info not provided by fishery-dependent fara such info on al species, sizes, on appropriate spatial scales within the context of movements and haitats. | J. Ault; Steve Smith; Jim Bonsack |
| Caribbean Reef Fish Video Survey | Provide fishery-independent estimates of reef fish stocks in the U.S. Caribbean and collect biological samples for age and reproductive information. | Southeast Fisheries Science CEnter |
| SEAMAP-C in Puerto Rico | SEveral projects to mainly collect, manage and disseminate fishery-independent data on the species in territorial and EEZ waters; enable Puerto Rico to identify, complement and measure effectiveness of management measures. Projects include: Reef fish, queen conch, lobster, parrotfish, yellowtail snapper, lane snapper, and deep-water snapper surveys, and anhydroacoustic survey. | Collaboration among Puerto Rico DNER, Puerto Rico Sea Grant, Council, U.S. Fish and Wildlife Service, USVI DPNR, NMFS |
| Fish Spawning Aggregation Surveys in Puerto Rico | Monitor spawning aggregations using acoustic techniques focused on west coast areas Abrir La Sierra, Bajo de Sico, and Tourmaline Bank. Characterixe remnant Nassau grouper spawning aggregation and use visual survey results to validate acoustic monitoring work. | M. Scharer-Umpierre |

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| Fishery-Independent Sampling/Research Projects | | |
|---|---|---|
| Mesophotic Surveys | Characterize reef fish population in these ecosystems (30m-70m) | R. Appeldoorn; university partnerships |
| Survey of commercially exploited fish and shellfish populations from mesophotic reefs within the Puerto Rico EEZ | Characterize main species assemblagesof commercially important fish and shellfish in each of benthic habitats and dpeht surveyed (30-50m) within Abrir La Sierra, Bajo de Sico, Tourmaline Bank.; provide inferences of seasonal variations by species in Abrir La Sierra, particularly queen conch; produce rough population estimates for target species; provide preliminary analysis of status of commercially important fish and shellfish within mesophotic habitats based on the length frequency data. | J. García-Sais |

*Information about early NOAA surveys in the U.S. Caribbean dating back to1959 can be found in here http://sero.nmfs.noaa.gov/sustainable_fisheries/caribbean/fish_indep_wkshp/documents/pdfs/presentations/ingram_early_fi_caribbean_surveys.pdf.

### I3.2.1 Socioeconomic Data

In 2018, the NMFS proposed to conduct a census of small-scale fishermen operating in the U.S. Caribbean. The extension for the data collection applies only to the Commonwealth of Puerto Rico because the data collection was completed in the USVI. The proposed socioeconomic study will collect information on demographics, capital investment in fishing gear and vessels, fishing and marketing practices, economic performance, and miscellaneous attitudinal questions. The data gathered will be used for the development of amendments to FMPs, which require descriptions of the human and economic environment and socioeconomic analyses of regulatory proposals. The information collected will also be used to strengthen fishery management decision-making and satisfy various legal mandates under the Magnuson-Stevens Act (U.S.C. 1801 et seq.), Executive Order 12866, Regulatory Flexibility Act, Endangered Species Act, and National Environmental Policy Act, and other pertinent statues. The information will be collected through in-person, telephone and mail surveys.

### I3.2.2 Southeast Data, Assessment, and Review (SEDAR)

The SEDAR is a cooperative fishery management council process initiated in 2002 to improve the quality and reliability of fishery stock assessments in the South Atlantic, Gulf of Mexico, and U.S. Caribbean. SEDAR is managed by the Caribbean, Gulf of Mexico, and South Atlantic Regional Fishery Management Councils in coordination with NMFS and the Atlantic and Gulf States Marine Fisheries Commissions. SEDAR seeks improvements in the scientific quality of stock assessments and greater relevance of quantities information available to address existing

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and emerging fishery management issues. SEDAR emphasizes constituent and stakeholder participation in assessment development, transparency in the assessment process, and a rigorous and independent scientific review of completed stock assessments. SEDAR is organized around three workshops. The first is a data workshop where datasets are documented, analyzed, and reviewed and data for conducting assessment analyses are compiled. The second is an assessment workshop where quantitative population analyses are developed and refined and population parameters are estimated. The third and final is a review workshop where a panel of independent experts reviews the data and assessment and recommends the most appropriate values of critical population and management quantities.

All SEDAR workshops are open to the public. Public testimony is accepted in accordance with each Council's Standard Operating Procedures. Workshop times and locations are noticed in advance through the Federal Register. For more information about the SEDAR visit http://www.sefsc.noaa.gov/sedar/. SEDAR Assessments for species in the U.S. Caribbean include:

- SEDAR 03 - Southeastern United States Yellowtail Snapper
- SEDAR 04 - Atlantic and Caribbean Deepwater Snapper-Grouper, Caribbean Species
- SEDAR 08A - Caribbean Spiny Lobster & Yellowtail Snapper
- SEDAR 14 - Caribbean Yellowfin Grouper, Mutton Snapper, Queen Conch
- SEDAR 26 - Caribbean Queen Snapper, Silk Snapper and Redtail Parrotfish
- SEDAR 30 - Caribbean Blue Tang and Queen Triggerfish
- SEDAR 35 - Caribbean Red Hind
- SEDAR 46 - Caribbean Data Limited Stocks
- SEDAR 57 - Caribbean Spiny Lobster (*scheduled for completion in 2019*)

### I3.2.3 Catch-Per-Unit-Effort Determination

In the U.S. Caribbean, effort data need to be improved so a more accurate catch per unit effort (CPUE) can be derived. The CPUE is used as a measure of economic efficiency and index of fish abundance, and in the U.S. Caribbean is fraught with issues. In addition, fishermen report the time actually fishing, which is a parameter to calculate CPUE, and the time away from the dock interchangeably (MRAG 2009). Multiple SEDAR assessments have attempted to develop standardized CPUE abundance trends from the U.S. Caribbean landings data, with minimal success (SEDAR 2009). For example, for queen conch, there is not a clear definition of the units of effort recorded for CPUE. This lack of definition results in indices that do not properly reflect queen conch abundance (MRAG 2009).

Improved calculations of CPUE can be achieved through enhanced reporting by fishermen. Better reporting would consist of denoting fishing start and end times. Another helpful

improvement would be identifying specific location in which fishing was conducted to help identify transit time. To standardize this data, managers have developed and provided to licensed fishermen a gridded map to properly distinguish locations. Finally, quantifying the total number of helpers on board a fishing vessel would also benefit managers (MRAG 2009).

### I3.2.4 Biological Data Collection

The analysts and reviewers involved with SEDAR assessments have associated several problems with the inability to establish species abundance trends. First, the data lacks an adequate number of samples (temporally or spatially) for constructing an appropriate length time series (e.g., 1-2 life spans) which would allow evaluation of changes in population size over time. There is also inadequate secondary information on the fishing event to explain changes in rate of harvest over time, often resulting in indices with weak ability to predict trends.

Port samplers provide additional fishery-dependent data when collecting species harvest data from the docks. Length-frequency of the catch and species composition is the most important piece of information to collect (MRAG 2009). Port samplers could also collect additional biological samples of ageing parts (*i.e*., otoliths, fins, dorsal spines) for specific species. When collected alongside length measurements and species composition, such samples would provide essential information on age-length relationships. The third priority in sampling is maturity and reproductive data (e.g., age and size at maturity, fecundity, reproductive strategy). The last priority is gathering trophic data (acquired through analyzing stomach contents). All of this data combined would help lower scientific uncertainty if collected according to valid scientific and statistical protocols (MRAG 2009).

The Council's Scientific and Statistic Committee (SSC) has also provided data research recommendations for purposes of enhancing SEDAR Assessment. Some examples of information needed include life history information, updating size/age studies and addressing sampling issues for under-sampled species, evaluating commercial landing expansion factors for Puerto Rico, and include spiny lobster and queen conch into MRIP (Source: SSC Meeting March 2016).

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# Appendix J. Process and Rationale for the Acceptable Biological Catch (ABC) Control Rule in Action 4, Preferred Alternative 2

## J.1 Process and Rationale for Applying Tier 4 of the ABC Control Rule

Tier 4 of the ABC CR defines an MSY proxy along with MFMT and MSST, with respect to assumptions about fishing mortality rate and biomass, but these measures cannot be quantified due to data limitations. Reflecting the data-limited nature of stocks assigned to Tier 4, the SSC chose to specify an SYL for these stocks. The SYL represents a level of catch or yield that the Council's SSC has confidence a stock can sustain through time based on historical trends in catch and the SSC's evaluation of the best scientific information available, including life history information and analysis of the susceptibility of the stock to fishing pressure. Thus, the SYL is similar to the MSY, in that both are measures of catch that can be sustainably taken over the long-term; however, SYL represents a sustainable level of catch or yield whereas the MSY is the *maximum* catch or yield that can be taken from a stock or stock complex on a continuing basis. Hence, the SYL is expected to be less than or equal to the actual MSY. Although the exact relationship between SYL and the MSY is unknown, the SYL reflects the best estimate of MSY at this time and would be considered an MSY proxy. For this reason, the SYL forms the basis for the SSC's ABC recommendation where ABC = buffer * SYL, where the buffer must be $\leq$ 0.9 based on the SSC's determination of scientific uncertainty. The SYL and ABC reference points specified by Tier 4 would inform the Council's specification of ACLs. The ABC and ACL would be set below the SYL, based on consideration of scientific and management uncertainty. Setting the ABC and ACL below the SYL would hold the management system accountable to ensure the fishery's ability to sustain catches and associated economic and ecological benefits, on a long-term basis, and to prevent or rectify incidents of overfishing.

The Council believes the Tier 4 approach is consistent with the Act's intent to ensure fisheries are managed to prevent overfishing while achieving, on a continuing basis, the OY from each fishery (16 U.S.C. 1851(a)(1)). Fishery monitoring data demonstrate that St. Croix's fishery has produced a sustainable yield over a long period of time. The SYL and ABC specified by Tier 4 of the Council's ABC CR are designed to ensure their continued ability to do so. Because catch levels that exceed the SYL may not be sustainable, the Council and its SSC would evaluate the cause of any repeated SYL exceedances (e.g., increased effort, high recruitment, change in the size of the catch) to understand whether overfishing may be occurring and to identify any resulting impacts on stock biomass (e.g., overfished status), and to take appropriate action.

Landings are not expected to exceed the SYL, though, since the ABC and ACL are generally set at 50 percent of the SYL and AMs are in place to prevent the ACLs from being continuously exceeded. Thus, relying on the SYL as the MSY proxy and OFL proxy, and using it as a basis for the ABC and ACL, should promote the long-term sustainability of the stock.

To meet the data and analytical demands required to operate within Tiers 1, 2, and 3 of the ABC CR, NMFS is working with the USVI DPNR and others to achieve three important goals. Those three goals include: (1) developing a modeling toolbox suitable for application in data-limited situations; (2) ensuring the continued delivery of accurate and comprehensive commercial fishery data, and; (3) developing a recreational fishery data collection program. Data and analytical improvements resulting from achievement of these three goals would serve to inform which of Tiers 1-3 can be applied. However, those data and analytical refinements are not yet complete. As a result, available data with which to assess stock status and assign values for MSY and associated SDC are currently inadequate for any of the Tier 1, 2, or 3 reference point assignment processes. Thus, all of the federally managed stocks/stock complexes in the St. Croix FMP fall into Tier 4 of the Council's ABC CR, which applies to data-limited stocks where no accepted assessment is available and thus where specifying quantitative values for MSY and associated SDC is not possible.

Data limitations for stocks managed by the Council in the St. Croix EEZ go beyond even those constraints typical of data-limited stocks throughout the nation (See Appendix E for Data Needs). The USVI DPNR collects commercial landings data through their commercial catch report (CCR) program. However, the CCR forms do not provide an opportunity to contribute biological data (e.g., fish length) information. Instead, obtaining biological information from commercial fishermen depends on dockside sampling (*i.e.*, the Trip Intercept Program), which historically has been inadequately effected due to budget and resultant personnel limitations (McCarthy and Gedamke, 2008).

The Southeast Data Assessment and Review (SEDAR) program supervises stock assessments throughout the NOAA NMFS Southeast Region. Under SEDAR auspices, Caribbean-specific assessments have been conducted for deepwater species (SEDAR 4), yellowtail snapper and spiny lobster (SEDAR 8), yellowfin grouper, mutton snapper, and queen conch (SEDAR 14), queen snapper, silk snapper, and redtail parrotfish (SEDAR 26), blue tang and queen triggerfish (SEDAR 30), and red hind (SEDAR 35). This list includes some of the most ubiquitous, commonly targeted, and economically valuable stocks in the region. Yet, none of these assessment efforts has produced quantitative management advice such as MSY, SDC, or OFL. Each report cited data deficiency as a fundamental problem, along with lack of basic life history data and poor understanding of the quantity and identity of fish discarded at sea. In combination, these systemic data deficiencies render St. Croix specifically and the U.S. Caribbean region

generally as not just data-limited but substantially data-deficient. Until these data deficiencies are addressed, a Tier 4 approach to management is unavoidable and quantitative MSY, SDC, and OFL would remain unknown.

## J2. Description of the 3-Step Process to Establish Status Determination Criteria (SDC) and Allowable Harvest Levels in Action 4, Preferred Alternative 2

**Preferred Alternative 2** would define a *three-step process* to establish SDC and allowable harvest levels (*i.e.*, ACLs) for managed stocks caught in the St. Croix EEZ. In *Step 1*, the Council's ABC CR, composed of four tiers designed to respond to different levels of data availability (Table 2.4.1), results in quantitative reference point estimates culminating in an ABC for each managed stock. *Step 2* establishes a proxy to use when $F_{MSY}$ cannot be determined. *Step 3* then applies a reduction factor, which reflects the Council's estimate of management uncertainty and is specific to each stock or stock complex, to the resultant ABC to establish the ACL for that stock or stock complex.

*Preferred Alternative 2, Step 1*:
Tiers 1-3 of the ABC CR each require inputs from a quantitative assessment of stock status. Tier 1 is applicable in a data-rich environment that supports a full stage-structured stock assessment dependent on the availability of reliable time series of catch, stage composition, and index of abundance. Inputs to the ABC CR, from the stage-structured assessment, include MSST, MFMT, and the probability density function (PDF) of the OFL. Both OFL and ABC are derived by applying assessment outcomes within the Control Rule process, tempered by consideration of scientific uncertainty and a Council-defined risk of overfishing. Tier 1 outcomes are characterized by a minimal level of parameter uncertainty relative to the following tiers. Tier 2 is applicable in a data-moderate environment where two of the three time series described above are deemed informative. The approach and outcomes are the same as for the Tier 1 approach, but a higher level of parameter uncertainty is associated with those outcomes. Tier 3 is applicable in a data-limited environment that remains supportive of a quantitative assessment, but may also be applicable in the case of an out-of-date assessment. The data-limited assessment is expected to provide MFMT but it is likely MSST would be unknown. The OFL remains a quantitative output, but the ABC is more strongly constrained by application of conservative estimates of scientific uncertainty and risk of overfishing as determined by the Council. Tier 3 of the ABC CR results in a higher level of parameter uncertainty relative to Tiers 1 and 2. Note that for each of Tiers 1-3, MSY also may be quantified from the assessment, assuming the spawner-recruit relationship is well estimated, but is not a necessary requirement of the ABC CR process to produce OFL and ABC estimates.

Tier 4 is applicable in situations where an accepted quantitative assessment is not available, which is the present case for all stocks proposed for management in the St. Croix FMP. Defining reference points within this tier instead relies on landings data, ancillary information on the species in question such as life history traits and characteristics of the fishery, and expert opinion. Two sub-tiers are defined within Tier 4. Tier 4a is applicable when the Council's SSC determines the stock has a relatively low or moderate vulnerability to fishing pressure. A stock's vulnerability to fishing pressure reflects a combination of its biological productivity and its susceptibility to the fishery (Patrick et al. 2009). Tier 4b is applied when the Council's SSC determines the stock has relatively high vulnerability to fishing pressure or when SSC consensus (= 2/3 or more members concur) cannot be reached on the use of Tier 4a. "Vulnerability to fishing pressure" is defined based on a combination of 10 productivity attributes (Table 2.4.2) and 12 susceptibility attributes (Table 2.4.3). Productivity provides an estimate of the capacity of the stock to recover if depleted, whereas, susceptibility relates to the potential of the stock to be impacted by the fishery. Note that not all attributes are used for each stock, dependent on availability of stock-specific data for each attribute. Based on published research and expert knowledge, and using the attributes in Tables J.1 and J.2 as guidelines, the SSC at their July 2017 meeting assigned a productivity score and a susceptibility score to each stock selected for management in the St. Croix FMP.

The SSC's intent when using Tier 4a is to allow expansion of the fishery for those stocks with a relatively low vulnerability to fishing pressure, suggesting the stock may be able to sustain a higher rate of exploitation relative to average landings during the reference period. Similarly, for those stocks with a moderate vulnerability to fishing pressure, the intent of the SSC when applying Tier 4a is to hold ABC at or near average landings during the reference period. The SSC's intent when using Tier 4b is to address those situations when the stock has relatively high vulnerability to fishing pressure in order to ensure those stocks are more conservatively managed and thus minimize the likelihood of depleting the stock. For those Tier 4b stocks for which harvest is deemed by the SSC to be sustainable, the ABC would be held at or below average reference period landings. For those stocks for which even that level of harvest places the stock at risk of depletion, the ABC would be set still lower, including as appropriate a prohibition on all harvest.

**Table J.1.** Attributes and scoring ranges for components of productivity.

| Productivity Attributes | High (3) | Moderate (2) | Low (1) |
|---|---|---|---|
| r | >0.5 | 0.5-0.16 (mid-pint 0.10) | <0.16 |
| Maximum Age | < 10 years | 10 - 30 years (mid-point 20) | > 30 years |
| Maximum Size | < 60 cm | 60-150 cm (mid-point 105) | > 150 cm |

| Productivity Attributes | High (3) | Moderate (2) | Low (1) |
|---|---|---|---|
| von Bertalanffy Growth Coefficient (k) | > 0.25 | 0.15-0.25 (mid-point 0.20) | < 0.15 |
| Estimated Natural Mortality | > 0.40 | 0.20-0.40 (mid-point 0.30) | < 0.20 |
| Measured Fecundity | > 10e4 | 10e2-10e3 | < 10e2 |
| Breeding Strategy | 0 | between 1 and 3 | ≥4 |
| Recruitment Pattern | highly frequent recruitment success (> 75% of year classes are successful) | moderately frequent recruitment success (between 10% and 75% of year classes are successful) | infrequent recruitment success (< 10% of year classes are successful) |
| Age at Maturity | < 2 years | 2-4 years (mid-point 3.0) | > 4 years |
| Mean Trophic Level | <2.5 | 2.5-3.5 (mid-point 3) | >3.5 |

**Table J.2.** Attributes and scoring ranges for components of susceptibility.

| Susceptibility Attributes | Low (1) | Moderate (2) | High (3) |
|---|---|---|---|
| Management Strategy | Targeted stocks have catch limits and proactive accountability measures; Non-target stocks are closely monitored. | Targeted stocks have catch limits and reactive accountability measures | Targeted stocks do not have catch limits or accountability measures; Non-target stocks are not closely monitored. |
| Areal Overlap | < 25% of stock occurs in the area fished | Between 25% and 50% of the stock occurs in the area fished | > 50% of stock occurs in the area fished |
| Geographic Concentration | stock is distributed in > 50% of its total range | stock is distributed in 25% to 50% of its total range | stock is distributed in < 25% of its total range |
| Vertical Overlap | < 25% of stock occurs in the depths fished | Between 25% and 50% of the stock occurs in the depths fished | > 50% of stock occurs in the depths fished |
| Fishing rate relative to M | <0.5 | 0.5 - 1.0 | >1 |
| Biomass of Spawners (SSB) or other proxies | B is > 40% of B0 (or maximum observed from time series of biomass estimates) | B is between 25% and 40% of B0 (or maximum observed from time series of biomass estimates) | B is < 25% of B0 (or maximum observed from time series of biomass estimates) |
| Seasonal Migrations | Seasonal migrations decrease overlap with the fishery | Seasonal migrations do not substantially affect the overlap with the fishery | Seasonal migrations increase overlap with the fishery |

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| Susceptibility Attributes | Low (1) | Moderate (2) | High (3) |
|---|---|---|---|
| Schooling/Aggregation and Other Behavioral Responses | Behavioral responses decrease the catchability of the gear | Behavioral responses do not substantially affect the catchability of the gear | Behavioral responses increase the catchability of the gear [*i.e.*, hyperstability of CPUE with schooling behavior] |
| Morphology Affecting Capture | Species shows low selectivity to the fishing gear. | Species shows moderate selectivity to the fishing gear. | Species shows high selectivity to the fishing gear. |
| Survival After Capture and Release | Probability of survival > 67% | 33% < probability of survival < 67% | Probability of survival < 33% |
| Desirability/Value of the Fishery | stock is not highly valued or desired by the fishery | stock is moderately valued or desired by the fishery | stock is highly valued or desired by the fishery |
| Fishery Impact to EFH or Habitat in General for Non-targets | Adverse effects absent, minimal or temporary | Adverse effects more than minimal or temporary but are mitigated | Adverse effects more than minimal or temporary and are not mitigated |

To derive the ABC recommendation for Tier 4 stocks, the SSC first estimated the SYL. For Tier 4a stocks, the SYL is the product of the *75$^{th}$ percentile* of landings during the landings reference period and a scaling factor (*i.e.*, scalar) specific to each stock. For Tier 4b stocks, the SYL is the product of the *mean* landings during the landings reference period and a stock-specific scalar. For both Tier 4a and Tier 4b stocks, the scalar is the product of a variability adjustment factor (VAF) and the susceptibility of the stock to the fishery (Table J.2). The methods used to establish the landings reference period and to quantify the scalar, for each stock, are described in turn below.

<u>Reference Period Landings</u>: Establishing the SYL requires defining a reference period of landings that, for each stock, reflects stability in the fishery. Because that period of relative stability differs among stocks, the year sequence chosen by the Council (in consultation with the SSC and the SEFSC) was specified separately for each stock. However, several features of the landings data were common to all stocks, resulting in common year-sequence decisions as follows:

1) Prior to 2000, commercial landings data collected by the USVI DPNR were allocated by gear type rather than by species. Those data could not be confidently reallocated to species due to a lack of historic information on catch composition and therefore could not be applied to determination of stock or stock complex reference points. As a result, the first year of landings data availability for St. Croix is 2000;

2) St. Croix commercial catch reporting forms remained relatively stable from 2000 through the first half of 2011. However, beginning July 1, 2011, revised forms were implemented. Those changes responded to the Council's proposed changes to federal

fishery management discussed herein, particularly changes in the stocks proposed for management. USVI DPNR staff ensured all stocks proposed for management in the St. Croix FMP were included on the reporting forms. For those stocks newly added to the reporting form, including some stocks previously included in the federal fishery management regimen as well as stocks newly added to management, the landings reference period includes no years prior to 2012. For those stocks added to the reporting forms beginning in July 2011, landings from 2011 are not included in the data sequence because only six months of 2011 landings data were available for those stocks;

3) Those 2000-2010 landings, originally reported only at the group level (e.g., snapper, parrotfish, grouper), were allocated to the individual stocks based on the proportional contribution of the known landings of each stock to the group total during 2012-2016, when more stocks were included on the USVI commercial reporting form and stock-specific landings data were therefore more available;

4) For species that were not on the data reporting forms during the historical period, but were listed by species on the reporting form during the recent period (e.g., angelfishes), the SSC recommended using the species-specific landings data from 2012 – 2016; and

5) The SSC determined that zeroes in the commercial landings data were not informative of the fishery, because those zeroes provide no insight regarding the dynamics of the stock or the capacity of the stock to support the fishery. The SSC therefore recommended zeroes be removed from the applicable commercial landings data for all stocks prior to calculating the 75$^{th}$ percentile or mean landings for use in SYL determinations.

Based on these caveats, the year sequences presented in Table J.3 were chosen for use in the ABC CR Tiers 4a and 4b when calculating SYLs and ABCs for each stock/stock complex proposed in Action 3, Preferred Alternative 3 for inclusion in the St. Croix FMP.

**Table J.3**. Year sequences selected for stocks/stock complexes to be included in the St. Croix FMP.

| Year Sequence | Stocks/Stock Complexes |
|---|---|
| 2000 – 2010 | Spiny Lobster; Queen Conch; Snappers; Groupers; Parrotfish; Grunts; Triggerfish; Surgeonfish; Sea cucumbers; Sea urchins; Corals |
| 2012 – 2016 | Angelfish and Squirrelfish |
| 2000 – 2016 | Dolphin and Wahoo |

75th Percentile: The 75th percentile of landings is simply that level of landings below which 75 percent of the landings during the reference period fall. For example, if there are 100 years in the annual landings reference period and they are ordered from smallest to largest, the 75th percentile of those landings would be that level of landings below which 75 of the ordered landings fall. In the event that the 75th percentile falls between two values, the value would be inferred using simple interpolation. As an example, consider five years of hypothetical landings data:

| Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|
| 5000 | 12000 | 8000 | 22000 | 14000 |

Ordering the data from smallest to largest = 5000, 8000, 12000, 14000, 22000

The smallest number would be the zero percentile, because no numbers are smaller. Next would be the 25th percentile = 8000, then the 50th percentile (*i.e.*, median) = 12000, the 75th percentile = 14000 and the 100th percentile = 22000. The average (*i.e.*, mean) landings during this hypothetical 5-year period would be 12200, very similar to the median of 12000.

With normally distributed data, it is expected that the mean (average of all included years) and the median (= 50th percentile) would be similar although rarely the same. Thus, with normally distributed data, the 75th percentile would be larger than the mean. However, in those cases where the data are not normally distributed, this relationship would not necessarily hold. In the case of non-normal data, the 75th percentile may be less than the mean, and in some cases may be zero. For fisheries landings data, and particularly for landings of the less common or less targeted species such as angelfish, a 75th percentile less than the mean may occur because there are many years where no landings were reported.

Variability Adjustment Factor: The VAF is derived from the relationship between the maximum allowed susceptibility score (maximum = 3), which was assigned to each individual stock by the SSC, and the coefficient of variation (CV) determined from the landings data during the chosen year sequence.

As previously discussed, the susceptibility score reflects the stock's potential to be impacted by the fishery. Attributes of the susceptibility score are described in Table J.2. The SSC assigned low (1), medium (2) and high (3) susceptibility scores to each stock, but they realized that in order to use the susceptibility score as a factor for calculating the VAF, it would be necessary to use the inverted susceptibility score (*i.e.*, a score of three changes to a score of one). In this way, susceptibility scores ranged from three for stocks determined to be least susceptible to the fishery, to one for those stocks with a high susceptibility to the fishery. Generally, stocks with a

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high vulnerability (productivity * susceptibility) to fishing pressure were assigned to Tier 4b and had an inverted susceptibility score as low as one.

The CV = standard deviation (SD)/mean and serves to standardize variation relative to the magnitude of the mean. Without this standardization, *i.e.*, if simply using the SD, the product of any multiplication involving the SD would become increasingly large as the numbers being measured increase, even though the variability relative to the mean is not changing. Standardization controls for that, ensuring the measure of variation does not change whether the numbers being collected are small or large. For example, if small fish and large fish are being measured, the small fish may average 10 inches in length and the SD around that average might be 2, whereas, the average size of the large fish may be 200 inches and the SD around that average might be 40. Multiplying by 40 rather than 2 would result in a much larger product, even though the relationship between the mean and the SD, when standardized, is the same. Thus, the CV for the small fish is 2/10 = 0.2 and the CV for the large fish is 40/200 = 0.2.

The VAF is then calculated using the equation VAF = (max score – CV)/max score. As noted above, the maximum susceptibility score for both Tier 4a and Tier 4b stocks is 3. Following through on the simple example above, the VAF for both of those fish species would be (3-0.2)/3 = 0.9333.

A characteristic of the VAF calculation is that, for normally distributed data, an increasing CV translates into a higher ABC relative to the mean reference period landings when the other factors employed in the calculations are held constant. Based on simulated outcomes (Figure J.1), if the CV is 0.1 and a susceptibility score of 2.5 is applied along with a buffer of 0.5 (discussed below), the resultant ABC would be 29 percent higher than the mean landings for the reference period. In contrast, with the same scalar and susceptibility score but a CV of 1.0, the resultant ABC would be 40 percent higher than the mean landings for the reference period.

However, this relationship no longer holds when the CV > 1.0 (Figure J.2). As in Figure J.1, the percent increase of the ABC relative to the mean landings for the reference period remains at 40 percent when all else remains the same (Figure J.2), but rather than continuing to increase when the CV = 2.0, the resultant ABC instead is 2 percent less than the mean landings for the reference period.

CV: 0.1

| Suceptibility \ Buffer | 0.50 | 0.55 | 0.60 | 0.65 | 0.70 | 0.75 | 0.80 | 0.85 | 0.90 |
|---|---|---|---|---|---|---|---|---|---|
| 3.0 | 55 | 70 | 86 | 101 | 117 | 132 | 148 | 163 | 179 |
| 2.9 | 50 | 65 | 80 | 95 | 109 | 124 | 139 | 154 | 169 |
| 2.8 | 44 | 59 | 73 | 88 | 102 | 117 | 131 | 146 | 160 |
| 2.7 | 39 | 53 | 67 | 81 | 95 | 109 | 123 | 137 | 151 |
| 2.6 | 34 | 48 | 61 | 74 | 88 | 101 | 115 | 128 | 141 |
| 2.5 | 29 | 42 | 55 | 68 | 81 | 93 | 106 | 119 | 132 |
| 2.4 | 24 | 36 | 49 | 61 | 73 | 86 | 98 | 111 | 123 |
| 2.3 | 19 | 31 | 42 | 54 | 66 | 78 | 90 | 102 | 114 |
| 2.2 | 14 | 25 | 36 | 48 | 59 | 70 | 82 | 93 | 104 |
| 2.1 | 8 | 19 | 30 | 41 | 52 | 63 | 73 | 84 | 95 |
| 2.0 | 3 | 14 | 24 | 34 | 44 | 55 | 65 | 75 | 86 |

CV: 0.1

| Suceptibility \ Buffer | 0.50 | 0.55 | 0.60 | 0.65 | 0.70 | 0.75 | 0.80 | 0.85 | 0.90 |
|---|---|---|---|---|---|---|---|---|---|
| 3.0 | 55 | 70 | 86 | 101 | 117 | 132 | 148 | 163 | 179 |
| 2.9 | 50 | 65 | 80 | 95 | 109 | 124 | 139 | 154 | 169 |
| 2.8 | 44 | 59 | 73 | 88 | 102 | 117 | 131 | 146 | 160 |
| 2.7 | 39 | 53 | 67 | 81 | 95 | 109 | 123 | 137 | 151 |
| 2.6 | 34 | 48 | 61 | 74 | 88 | 101 | 115 | 128 | 141 |
| 2.5 | 29 | 42 | 55 | 68 | 81 | 93 | 106 | 119 | 132 |
| 2.4 | 24 | 36 | 49 | 61 | 73 | 86 | 98 | 111 | 123 |
| 2.3 | 19 | 31 | 42 | 54 | 66 | 78 | 90 | 102 | 114 |
| 2.2 | 14 | 25 | 36 | 48 | 59 | 70 | 82 | 93 | 104 |
| 2.1 | 8 | 19 | 30 | 41 | 52 | 63 | 73 | 84 | 95 |
| 2.0 | 3 | 14 | 24 | 34 | 44 | 55 | 65 | 75 | 86 |

**Figure J.1**. Percent change in the ABC relative to the mean landings used in the equation, when the CV = 0.1 (left) and when the CV = 1.0 (right). The y-axis values represent the susceptibility score used in the scalar equation to calculate SYL and the x-axis values represent the buffer used in the equation to calculate ABC from SYL.

CV: 0.1

| Suceptibility \ Buffer | 0.50 | 0.55 | 0.60 | 0.65 | 0.70 | 0.75 | 0.80 | 0.85 | 0.90 |
|---|---|---|---|---|---|---|---|---|---|
| 3.0 | 55 | 70 | 86 | 101 | 117 | 132 | 148 | 163 | 179 |
| 2.9 | 50 | 65 | 80 | 95 | 109 | 124 | 139 | 154 | 169 |
| 2.8 | 44 | 59 | 73 | 88 | 102 | 117 | 131 | 146 | 160 |
| 2.7 | 39 | 53 | 67 | 81 | 95 | 109 | 123 | 137 | 151 |
| 2.6 | 34 | 48 | 61 | 74 | 88 | 101 | 115 | 128 | 141 |
| 2.5 | 29 | 42 | 55 | 68 | 81 | 93 | 106 | 119 | 132 |
| 2.4 | 24 | 36 | 49 | 61 | 73 | 86 | 98 | 111 | 123 |
| 2.3 | 19 | 31 | 42 | 54 | 66 | 78 | 90 | 102 | 114 |
| 2.2 | 14 | 25 | 36 | 48 | 59 | 70 | 82 | 93 | 104 |
| 2.1 | 8 | 19 | 30 | 41 | 52 | 63 | 73 | 84 | 95 |
| 2.0 | 3 | 14 | 24 | 34 | 44 | 55 | 65 | 75 | 86 |

CV: 2

| Suceptibility \ Buffer | 0.50 | 0.55 | 0.60 | 0.65 | 0.70 | 0.75 | 0.80 | 0.85 | 0.90 |
|---|---|---|---|---|---|---|---|---|---|
| 3.0 | 17 | 29 | 41 | 53 | 64 | 76 | 88 | 100 | 111 |
| 2.9 | 14 | 25 | 36 | 48 | 59 | 70 | 82 | 93 | 104 |
| 2.8 | 10 | 21 | 32 | 43 | 53 | 64 | 75 | 86 | 97 |
| 2.7 | 6 | 16 | 27 | 37 | 48 | 59 | 69 | 80 | 90 |
| 2.6 | 2 | 12 | 22 | 32 | 43 | 53 | 63 | 73 | 83 |
| 2.5 | −2 | 8 | 17 | 27 | 37 | 47 | 57 | 66 | 76 |
| 2.4 | −6 | 3 | 13 | 22 | 32 | 41 | 50 | 60 | 69 |
| 2.3 | −10 | −1 | 8 | 17 | 26 | 35 | 44 | 53 | 62 |
| 2.2 | −14 | −5 | 3 | 12 | 21 | 29 | 38 | 46 | 55 |
| 2.1 | −18 | −10 | −1 | 7 | 15 | 23 | 32 | 40 | 48 |
| 2.0 | −22 | −14 | −6 | 2 | 10 | 17 | 25 | 33 | 41 |

**Figure J.2.** Percent change in the ABC relative to the mean landings used in the equation, when the CV = 1.0 (left) and when the CV = 2.0 (right). The y-axis values represent the susceptibility score used in the scalar equation to calculate SYL and the x-axis values represent the buffer used in the equation to calculate ABC from SYL.

To correct for this decrease in the ABC relative to mean reference period landings when the CV exceeds 1.0, the SSC chose to put a cap on the CV at 1.0. If the actual CV derived from the relationship between the mean and the SD for the reference year sequence was > 1.0, the CV was set at 1.0 for purposes of the VAF calculation. This ensures, as relative variability continues to increase above the 1.0 breakpoint, that the variability alone does not continue to push the resultant ABC steadily downward. The SSC carefully considered the concept of capping the CV

at 1.0, including a review of the landings data for each stock with a CV > 1.0. The SSC determined that instances where the CV exceeded 1.0 reflected stocks with no or very low landings during most years, interspersed with one or a few years with relatively high landings. However, the SSC found no instances where the low landings would have been due to some high level of fishing that would have driven the population down to such a state where recruitment could have been compromised. The SSC determined capping the CV at 1.0 served their intent for Tier 4a stocks to allow expansion of the fishery for those stocks with a relatively low vulnerability to fishing pressure, and to hold ABC at or near average landings during the reference period for those stocks with a moderate vulnerability to fishing pressure. Similarly for Tier 4b stocks, capping the CV at 1.0 served to ensure stocks with a relatively high vulnerability to fishing pressure were more conservatively managed to minimize the likelihood of depleting the stock.

Scalar: The scalar was calculated as the product of the VAF and the (inverted) susceptibility score. Thus, the scalar is derived from the characteristics of the fishery for each stock as captured by the factors composing susceptibility (Table J.2), combined with the inter-annual variability in harvest of the stock as captured by the CV. The VAF coefficient in the scalar equation serves to standardize the magnitude of the scalar relative to the extent of variation in the data. The susceptibility coefficient in the scalar equation serves to constrain the scalar (a multiplication factor in the SYL equation described below) as appropriate to reflect a stocks exposure to fishing activities. As a result, moderate susceptibility to fishing pressure leads to a harvest level that is similar or only marginally increased from average landings during the reference period, whereas a high susceptibility score (= low susceptibility to fishing pressure) results in an increase in allowable harvest relative to average landings during the reference period. This approach enabled the SSC to ground the scalar for a stock/stock complex within the context of the vulnerability analysis while simultaneously accounting for inherent variability in the landings data.

In our simple example, for a stock with low susceptibility to the fishery (inverted susceptibility score = 3), the scalar = VAF x susceptibility score = 0.9333 x 3 = 2.7999. Conversely, for a stock with a high susceptibility to the fishery (inverted susceptibility score = 1), the scalar = VAF x susceptibility score = 0.9333 x 1 = 0.9333.

SYL: The SYL for Tier 4a stocks results from multiplying the 75$^{th}$ percentile by the scalar. For our simple example of a stock with low susceptibility to the fishery:

75$^{th}$ percentile = 14000
Scalar = 2.7999
SYL = 14000 x 2.7999 = 39,199

For a Tier 4b stock, the same process would be followed except the mean of landings during the reference period (rather than the 75th percentile) would be used in the calculation.

ABC: Following establishment of the SYL for each stock, a reduction factor (*i.e.*, buffer) accounting for scientific uncertainty in the data is applied to the SYL to arrive at the ABC. Scientific uncertainty would take into account the deficiencies in and vagaries of reporting, which includes potential biases (over reporting, underreporting, trends), changes in reporting forms, changes in fisher behavior, the contribution of unspecified landings, availability of ancillary data, and life history parameters (e.g., Table J.1). The SSC was concerned that these issues created uncertainty in what the data showed and what information could be understood from the available data. Scientific uncertainty was determined based on expert input from the SSC members and user-group representatives. The latter provided input primarily through the St. Croix District Advisory Panel (DAP), with outcomes provided to the SSC by St. Croix's DAP Chair. Most Tier 4 stocks were assigned a scientific uncertainty factor of 0.50, although the factor was larger (*i.e.*, the reduction less) for spiny lobster (0.60). However, in instances when landings data could not be confidently assigned at the species level, that created uncertainty in the landings data, which the SSC addressed through the scientific uncertainty buffer. The SSC assigned additional reductions to the baseline buffers in cases where unspecified landings reported at the family or genus level were distributed among the stocks constituting a complex at the species level, as follows:

- Use 2012-2016 year sequence and species-specific landings for squirrelfish and angelfish and do not apply any additional buffer reductions;
- Use total annual landings during 2000-2010 for surgeonfish and triggerfish, but do not apply additional buffer reductions. This is because either the indicator, or the group selected for management going forward, made up more than 99% of the 2012-2016 catch; and ,
- For all remaining stocks/stock complexes previously managed, use the 2012-2016 proportions to back calculate landings during 2000-2010 and apply an additional buffer reduction of 0.12.

Applying the ABC Control rule using the reference periods and reduction buffers specified above would result in the SYLs and ABCs listed in Table J.4. Stocks/complexes for which the SSC set ad hoc ABCs equal to 0 are not included in the table and include: Grouper 1 (Nassau grouper), Grouper 2 (goliath grouper), Parrotfish 1 (midnight, blue and rainbow parrotfish), Sea Cucumbers, Sea Urchins, and Corals.

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**Table J4**. Calculated SYL and ABC for each stock/stock complex to be managed under the St. Croix FMP.

| Stock/Complex | Reference Period | Mean | SYL | ABC |
|---|---|---|---|---|
| Spiny Lobster | 2000-2010 | 129,681 | 346,541 | 207,925 |
| Snapper 1 | 2000-2010 | 52,695 | 170,235 | 64,689 |
| Snapper 2 | 2000-2010 | 6,783 | 21,914 | 8,327 |
| Snapper 3 | 2000-2010 | 13,241 | 39,213 | 14,901 |
| Snapper 4 | 2000-2010 | 10,949 | 23,582 | 8,961 |
| Snapper 5 | 2000-2010 | 19,618 | 63,376 | 24,083 |
| Snapper 6 | 2000-2010 | 16,124 | 43,408 | 16,495 |
| Grouper 3 | 2000-2010 | 13,621 | 37,478 | 14,241 |
| Grouper 4 | 2000-2010 | 19,881 | 32,822 | 12,472 |
| Grouper 5 | 2000-2010 | 1,399 | 1,943 | 738 |
| Grouper 6 | 2000-2010 | 64 | 212 | 81 |
| Parrotfish 2 | 2000-2010 | 141,249 | 224,040 | 85,135 |
| Grunts | 2000-2010 | 36,451 | 75,261 | 28,599 |
| Squirrelfish | 2012-2016 | 2,364 | 7,399 | 3,699 |
| Surgeonfish | 2000-2010 | 43,552 | 91,909 | 45,954 |
| Angelfish | 2012-2016 | 8,138 | 15,087 | 7,543 |
| Triggerfish | 2000-2010 | 29,335 | 45,158 | 22,579 |
| Dolphin | 2000-2016 | 56,420 | 182,386 | 91,193 |
| Wahoo | 2000-2016 | 18,311 | 57,390 | 28,695 |

Continuing with our example, multiplying the SYL (39,199) by the most commonly assigned scientific uncertainty reduction buffer (0.5) gives:

$$ABC = 39{,}199 \times 0.5 = 19{,}600$$

Generally for St. Croix landings data, the units associated with the ABC value would be pounds whole weight.

*Preferred Alternative 2, Step 2*:

Step 2 addresses data limitations that prevent establishment of an MSY based on outcomes from a valid quantitative assessment. Instead, Step 2 provides three sub-alternatives for setting an $F_{MSY}$ proxy based on various fishing mortality rates. Sub-alternative 2a establishes a fishing mortality rate equivalent to $F_{MAX}$, whereas Sub-alternative 2b equates $F_{MSY}$ to the fishing mortality rate at a 40% SPR and Sub-alternative 2c sets that rate at a 30% SPR.

*Preferred Alternative 2, Step 3*:

Step 3 provides six sub-alternatives for establishing the ACL as discussed in Section 2.4. The ACL would be reduced from ABC based on the Council's choice of buffer reduction to account for management uncertainty. The OY would be set equal to the ACL.

The Council chose **Preferred Sub-alternative 2d** (ACL equal ABC) for queen conch, **Preferred Sub-alternative 2e** (ACL equal to the ABC x 0.95) for all managed finfish stocks except angelfish, parrotfish and surgeonfish, and **Preferred Sub-alternative 2g** (ACL equal to the ABC x 0.85) for angelfish, parrotfish and surgeonfish. Table J5 shows the values that would result from each of the sub-alternatives proposed under **Preferred Alternative 2**.

**Table J.5.** Annual catch limits for each stock and stock complex in the St. Croix FMP, based on Preferred Alternative 2, Sub-alternatives 2d-2h. All ACLs under Sub-alternative 2i would be equal to zero, and were not included in the table. Additionally stocks/complexes with an ABC set equal to zero by the SSC were not included in the table. Values in bold represent the ACL resulting from the preferred sub-alternative selected by the Council.

| Stock/Complex | Sub-alt 2d ACL=ABC | Sub-alt 2e ACL=ABC*0.95 | Sub-alt 2f ACL=ABC*0.90 | Sub-alt 2g. ACL=ABC*0.85 | Sub-alt 2h ACL=ABC*0.75 |
|---|---|---|---|---|---|
| Queen Conch | **50,000** | 47,500 | 45,000 | 42,500 | 37,500 |
| Spiny Lobster | 207,925 | **197,529** | 187,133 | 176,736 | 155,944 |
| Snapper 1 | 64,689 | **61,455** | 58,220 | 54,986 | 48,517 |
| Snapper 2 | 8,327 | **7,911** | 7,494 | 7,078 | 6,245 |
| Snapper 3 | 14,901 | **14,156** | 13,411 | 12,666 | 11,176 |
| Snapper 4 | 8,961 | **8,513** | 8,065 | 7,617 | 6,721 |
| Snapper 5 | 24,083 | **22,879** | 21,675 | 20,471 | 18,062 |
| Snapper 6 | 16,495 | **15,670** | 14,846 | 14,021 | 12,371 |
| Grouper 3 | 14,241 | **13,529** | 12,817 | 12,105 | 10,681 |
| Grouper 4 | 12,472 | **11,848** | 11,225 | 10,601 | 9,354 |
| Grouper 5 | 738 | **701** | 664 | 627 | 554 |
| Grouper 6 | 81 | **77** | 73 | 69 | 61 |
| Parrotfish 2 | 85,135 | 80,878 | 76,622 | **72,365** | 63,851 |
| Grunts | 28,599 | **27,169** | 25,739 | 24,309 | 21,449 |
| Squirrelfish | 3,699 | **3,514** | 3,329 | 3,144 | 2,774 |
| Surgeonfish | 45,954 | 43,656 | 41,359 | **39,061** | 34,466 |
| Angelfish | 7,543 | 7,166 | 6,789 | **6,412** | 5,657 |
| Triggerfish | 22,579 | **21,450** | 20,321 | 19,192 | 16,934 |
| Dolphin | 91,193 | **86,633** | 82,074 | 77,514 | 68,395 |
| Wahoo | 28,695 | **27,260** | 25,826 | 24,391 | 21,521 |

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Taking the worked example through this final step, and using **Sub-alternative 2g** (management reduction coefficient = 0.85) as the hypothetical choice of the Council:

ACL = ABC x 0.85 = 19,600 x 0.85 = 16,660 pounds whole weight.

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# Appendix K. Essential Fish Habitat Description for Species in the St. Croix FMP

**Background**

This section describes the EFH for those species that are new to fisheries management in the St. Croix FMP (*i.e.*, dolphin, and wahoo). The species that would be retained for management resulting from Action 2 of this DEIS, have EFH already described and identified through the 1998 EFH Generic Amendment, the 2004 Environmental Impact Statement (EIS) (CFMC 2004), and the Sustainable Fisheries Act (SFA) Amendment (CFMC 2005) as well as its EFH designation being reviewed under the 2011 five-year EFH Review (CFMC 2011) and the on-going Council five-year EFH review. The 2011 EFH five-year review includes revision of literature that include most of the species proposed for management in this DEIS.

This section is arranged in the following order: summary of species distribution, habitat (including information on eggs, larvae, feeding and spawning), predator-prey interactions, and reported incidence of ciguatera. The issue of ciguatera is significant in the region and should be considered when there are site-specific areas of ciguatoxic fish. Ciguatera is presumably primarily caused by the bioaccumulation of the toxin by *Gambierdiscus toxicus*, dinoflagellates, eaten by herbivores feeding on macroalgae growing on coral and passed up through the food chain.

## Pelagic species

The species described in this section, described as coastal pelagic, are generally found over a broad longitudinal and latitudinal range in the Atlantic in addition to the St. Croix - Virgin Island platform. Some species such as the dolphin and possibly wahoo are oceanic species and are found in the high seas of the Atlantic and Pacific in addition to coastal areas. These species occasionally may be found at sea, on reefs or near shore (CFMC 1983). A specific habitat description is further complicated by the fact that the specific location of larval development is unknown and little scientific information is available on specific migration patterns through the area. The pelagic species are the most affected by the oceanographic phenomena, these species follow for example currents or temperature gradients and have a general established seasonal movement throughout not only the US Caribbean but throughout the larger area of distribution. The following sections are modified from the proceedings of the dolphin/wahoo workshop (SAFMC 1998a) and the 1983, Draft Environmental Impact Statement (DEIS) for the Caribbean Coastal Migratory Pelagic Fishery Management Plan developed by the Caribbean Fishery Management Council (CFMC 1983). Unless otherwise cited, the workshop report is the source for the material in these sections.

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**Dolphin, *Coryphaena hippurus***

Distribution

The common dolphin (*Coryphaena hippurus)* is an oceanic pelagic fish found worldwide in tropical and subtropical waters. The range for dolphin in the western Atlantic is from George's Bank, Nova Scotia to Rio de Janeiro, Brazil. They are also found throughout the Caribbean Sea and the Gulf of Mexico, and they are generally restricted to waters warmer than 20˚C (Oxenford, 1997). According to Shcherbachev (1973), dolphin penetrates temperate latitudes to range above 40°N in the summer. Rose and Hassler (1968) give Prince Edward Island, Nova Scotia and the southern tip of Africa as the range limits of the dolphin in the Atlantic. Sightings in the extreme limits of the range reportedly are rare, and the general range of this species probably is best described by the 20°C (68°F) isotherm (Gibbs and Collette, 1959).

Dolphin is oceanic but also approaches the coast. Gibbs and Collette (1959) report that this species comes close to shore; where blue waters sometimes are found near the shore. The increase in river outflow, rain events, near shore water contamination and sedimentation could have changed the behavior of the dolphin fish thus not allowing it to come nearshore. Garcia-Moliner (2013) showed that during significant events of rain in the Amazon and the entrainment of these "green waters" in water masses moving from Brazil through the Caribbean, the landings of dolphin fish decreased significantly. Other changes in the habitat of dolphin fish include the massive presence of Sargasso in the Caribbean (Franks et al. 2010). Dammann (1969) reported that dolphin were caught in the Virgin Islands at the edge of the 100 fathom shelf and sometimes inshore. Dammann (pers. com. CFMC 1983) also reported that dolphin have been caught in green water on top of the shelf very close (*i.e*. 100 yards) to shore.

There is pronounced seasonal variation in abundance. Dolphin are caught off North and South Carolina from May through July. Dolphin caught off Florida's East Coast are caught mainly between April and June. February and March are the peak months off St. Thomas/St. John's coast. Dolphin are caught in the Gulf of Mexico from April to September with peak catches in May through August (SAFMC 1998a).

Juvenile and adult dolphin fish occur in the same areas. Essential fish habitat for dolphin fish (*C. hippurus*) occurs throughout the state and federal waters of the U.S. Caribbean.

The migratory circuits of the dolphin fish include a northern cycle – extending from the east coast of the U.S. to north of St. Thomas/St. John and the USVI and a southern circuit extending from south –southeast St. Thomas/St. John to the south. The peak season in St. Thomas/St. John is reported to occur in February-March (SAFMC SAFE Report Dol-Wa FMP 1999) but having two seasons that are different for the North and South coasts. Changes in the peak months when dolphin are present in the U.S. Caribbean have been reported by fishermen (e.g., Captain M.

Hanke, personal communication). It is suggested that these changes are associated with the presence of Sargassum. Sargasso flux is currently a much discussed issue throughout the wider Caribbean as it is yet to be determined the timing and frequency with which it arrives in local waters.

Habitat

Habitat of the dolphin include floating objects such as trees and other material brought by currents and river outflows, flotsam and jetsam, Sargasso and other floating seaweeds (lines of *Thalassia* and *Syringodium* for example concentrated by Langmuir circulation). The floating objects and vegetation create an environment where dolphin fish can feed and shelter during various life stages. The dolphin is well known for its propensity to station itself near nonmotile objects on the ocean surface (Kojima, 1965). This is because there is a greater availability of food near floating objects. Dolphin are also harvested around trap bouys as well as other specialized fish aggregating devices (FAD). FADs have been used in the USVI for over 30 years.

In the Florida Current and Gulf Stream dolphin associate with Sargassum windrows and, according to Beardsley (1967) and Gibbs and Collette (1959), take much of their food from that community. This tendency of dolphin to accumulate around floating objects also appears to take place in the Caribbean. Commercial and recreational fishermen in the Virgin Islands and St. Thomas/St. John indicate increased catches of dolphin when fishing near floating debris. It is common practice for fishermen to troll around floating buoys, discharged garbage, and Sargassum rafts.

Spawning

In the Caribbean area most adult female dolphin had sub ripe ovaries throughout the year with a probable peak in February (Erdman, 1976). More than one set of eggs in the ovary of a single dolphin may ripen at different stages indicating that dolphin may have more than one spawning per season (Beardsley, 1967).

Predator-Prey Interactions

Stomach content analyses of dolphin indicate that fish are the most abundant, but not the sole food item, indicating that dolphin are non-selective feeders. In St. Thomas/St. John, Erdman (1976) showed that the diet of dolphinfish includes reef-associated species in the families Balistidae and Monacanthidae (triggerfish and filefishes), Acanthuridae (surgeonfish), *Pseudupeneus maculatus* (goatfish) Carangidae (jacks) as well as surface -associated species of flying fish, ballyhoo, with additional differences in species specific prey items during each season. The orange spotted filefish, *Cantherines pullus* being the most common fish found in the dolphin fish stomachs indicates that dolphin fish move throughout the water column since its

prey item tend to stay near the bottom and near reef structures. Other prey species include *Priacanthus* spp found near deep water reefs.

The importance of the Sargassum community in providing food for common dolphin, particularly for juvenile and younger mature individuals, has been noted by several authors. Rose and Hassler (1974) found significantly more empty stomachs in small female dolphin in a summer when tidelines off the North Carolina coast were relatively rare, which suggests that this community makes an important contribution to the food supply of this group. Kojima (1965), Rose and Hassler (1974), and Beardsley (1967) considered the Sargassum community to have great ecological importance to the dolphin because of the food supply it provides. Furthermore, the Sargassum community provides protection for younger individuals from predation by other species. Segregation of younger from older individuals through behavioral differences reduces cannibalism. An adaptive significance to the attraction of smaller individuals to the Sargassum community is suggested (Rose and Hassler, 1974). The common dolphin is thought to be a day feeder (Erdman, 1958) and perhaps does not feed effectively in darkness (Gibbs and Collette, 1959), although they would feed at night on small fishes and squid attracted to light from ships. Two known predators of the common dolphin in western Atlantic waters are the blue marlin (*Makaira nigricans*) (Gibbs and Collette 1959), and the swordfish (*Xiphias gladius*) (D. DeSylva, pers. comm. CFMC 1983).

The determination of EFH for dolphin could be influenced by the presence of floating objects and FADs. Association of dolphin with floating objects could be determined by the presence of prey, an association that could change over time as fish grow. Palko et al (1982) suggested that the distribution and migration of dolphin fish can be highly influenced by the drifting floating objects. Taquet et al. (unknown) suggest the presence of FADs can also influence the migration of dolphin and wahoo specifically arguing that juvenile fish aggregate and remain near these FADs because food is available. Further, because it has been shown in other pelagic species (Cayré, 1991; Marsac et al., 1995), dolphin and wahoo could learn to navigate among FADs.

Taquet et al. argue, based on stomach contents studied by Oxenford & Hunte (1999), that food is an important factor in determining the aggregation of dolphinfish. Stomach contents of wahoo and dolphin show them to be piscivorous, most significantly feeding on fish known to be associated with drifting objects.

Hemphill (2005) argues that the Sargassum, as it extends into international waters, is an ecosystem that should be considered a critical marine habitat. As a pelagic top predator, dolphin have been shown to be food-dependent on floating algae such as Sargassum (Manooch et al. 1984) in at least part of their range. The changes in the presence of Sargassum throughout the Caribbean might influence the presence, abundance and seasonality of dolphin.

**Wahoo, *Acanthocybium solandri***

Distribution

The wahoo is an oceanic pelagic fish found worldwide in tropical and subtropical waters of the Atlantic, Indian and Pacific oceans and the Caribbean and Mediterranean Seas. The north to south extension of their distribution ranges from Brazil to the Northeast USA. In the western Atlantic wahoo are found from New York through Columbia including Bermuda, the Bahamas, the Gulf of Mexico, and the Caribbean. There is pronounced seasonal variation in abundance. They are caught off North and South Carolina primarily during the spring and summer (April-June and July-September), off Florida's east coast year-round, off St. Thomas/St. John and the USVI year-round with peak catches between September and March, in the Gulf of Mexico year-round, in the eastern Caribbean between December and June, and in Bermuda between April and September (SAFMC, 1998a). It is also common off northern Brazil in the Guiana Current, the Gulf of Mexico, in the Gulf Stream from Florida to Cape Hatteras and in the Caribbean (Böhlke and Chaplin, 1968). In the Pacific it is found off Central America, southern California, around Hawaii, and from Japan down to Australia (Iversen, 1957). It is reported from the Indian Ocean, and one specimen has been reported from the Mediterranean. However, nowhere is the fish very abundant and large accumulations of the fish are not known to exist in any of the regions (FAO, 1978). Routine seasonal migrations of wahoo are unknown in either St. Thomas/St. John or the Virgin Islands. Wahoo apparently move frequently however. The species is landed in the Virgin Islands year-round although it is less abundant in June through August (Dammann, 1969).

However, nowhere is the fish very abundant and large accumulations of the fish are not known to exist in any of the regions (FAO, 1978). Routine seasonal migrations of wahoo are unknown in either Puerto Rico or the Virgin Islands. Wahoo apparently move frequently however and might be considered highly migratory species as exemplified by a recapture of one fish recaptured 6.5 months and 1,707 miles away after being tagged and released (WRP, 2007).

Theisen et al (2008) determined that wahoo constitute a "single globally distributed population" a finding attributed to extensive dispersal at all life stages. The determination of EFH for wahoo, as for other pelagic species in the U.S. Caribbean would have to consider the international areas beyond.

Habitat

The pelagic zone is 'typical habitat' for the adults of the wahoo (in Jacobsen and Browder 1987; 2006). It appears to be migratory in the Florida Straits and Gulf Stream but is caught with regularity in the USVI. Wahoo have been reported to travel in small schools, but this trait is probably restricted to young fish. In the Pacific, wahoo are usually caught by trolling approximately 200 yards to 3 miles from fringing reefs or by long line not far from land.

Experimental fishing in the Pacific suggests that wahoo prefer shallow depths and are more abundant close to land. However, in the USVI, wahoo are reported from beyond the shelf edge. Analysis of fish caught in the Gulf Stream suggests that they are pelagic fish of the open ocean and prey on organisms associated with Sargassum. Larval and post larval wahoo are usually collected in water at depths greater than 100 meters. The species is a very powerful fast swimmer and, like the dolphin fish, is also frequently found in the open ocean (Hogarth, 1976 and Iversen, 1957). Large fish appear to be solitary but have been reported to form aggregations of different sized fish. It is not known if these aggregations serve a specific function. Wahoo tend to be found near flotsam and jetsam, sargassum, and in distinct breaks in the water (e.g., weed lines, sediment fronts).

Although wahoo is a targeted species in both the commercial and recreational fisheries, little is known about its habitat (e.g., https://www.fisheries.noaa.gov/species/atlantic-wahoo), about its spawning sites, or better information on the specific oceanographic conditions for growth to maturity, feeding and spawning.

EFH for wahoo is the Gulf Stream, Charleston Gyre, Florida Current, and pelagic Sargassum (http://safmc.net/download/SAFMCEFHUsersGuideFinalRevAug17_2.pdf ). Lacking specific information on harvest sites, EFH for wahoo in the USVI would be all the waters around the islands.

Eggs and Larvae

Wahoo produce buoyant eggs and are known to spawn in the vicinity of open-ocean currents, characteristics which can enhance dispersal (e.g., Brown-Peterson et al. 2000). Scombridae larvae in general are of the oceanic type, being found offshore, south of Puerto Rico, at more that 49 km (Ramirez-Mella and Garcia-Sais 2003). Larval and post larval wahoo are usually collected in water at depths greater than 100 meters. The species is a very powerful fast swimmer and, like dolphin, is also frequently found in the open ocean (Hogarth, 1976 and Iversen, 1957).

Predator-Prey Interactions

Hogarth (1976) found that fishes accounted for 97.4% of all food items collected from wahoo stomachs with mackerels, butterfish, porcupinefish, and round herrings being the most identified fish.

## Sea Urchins and Sea Cucumbers

Sea urchins and sea cucumbers belong to the Phylum Echinodermata. All echinoderms are exclusively marine and mostly bottom dwellers; except for the swimming sea cucmbers of the

deep ocean. Echinoderms are one of the most abundant groups in the deep ocean occurring as solitary individuals or aggregated in large numbers (Barnes 1974).

**Sea Urchins – Class Echinoidea**

There are over 800 species of echinoids. These organisms are found in rocky bottoms, sandy bottoms, mud-like bottoms, they are associated with both the benthos and the water column (eggs and larvae), with feeding taking place over sand-like sediment. Sea urchins appear to be more sedentary but are capable of rapid movement, giving the appearance of a stampede. Sea urchins are common in shallow and deep-waters around St. Croix. The deep-water surveys recently conducted in the U.S. Caribbean EEZ show what appear to be trails of these organisms; the almost ubiquitous presence of these trails could be indicative of high densities at depth. However, not much information is available to confirm this. Urchins are adapted to live on rocks and other types of hardbottom (Barnes 1974) and are capable of living under rocky layers and excavating depressions on rocky surfaces. Urchins are capable of burrowing in sand and crevices when confronting high wave action and their distribution in rough water areas includes surviving in rocky shores exposed to dry periods of time as well as the deep ocean floor. The Class Echinoidea includes not only the sea urchins but also the sand dollars, common prey items of the rays. Sea urchins feed on algae, sessile organisms and carrion while being themselves food source for fish (e.g., triggerfishes) or being used as shelter (e.g., juvenile grunts). Deep-water urchins are detritus feeders.

Sea urchins eject sperm and eggs into the water column with fertilization occurring in the sea water. Depending on the species, brooding behavior might be observed in the retention of the fertilized eggs among the spines. The echinoderms have planktonic larvae that might take months to develop. Once the adult skeleton is being formed, larvae sink to the bottom. Metamorphosis can be as short as 1 hour.

**Sea Cucumbers – Class Holothuroidea**

These organisms are found in rocky bottoms, sandy bottoms, mud-like bottoms, they are associated with both the benthos and the water column (eggs and larvae, and juveniles and adults), with feeding taking place over sand-like sediment. Full guts can be observed while swimming sea cucumbers move from one place to another with some control over this movement as determine by the videos available following their movements (https://oceanexplorer.noaa.gov/okeanos/explorations/ex1811/logs/photolog/welcome.html#cbpi=/okeanos/explorations/ex1811/dailyupdates/nov6/media/dive6-1.html).

There are about 500 species of holthuroids known as sea cucumbers. These are found on the surface of sand and/or mud habitats or burrowed in these, they are also found on rocky surfaces, hard bottoms and under rocks. Crawling on this surface and feeding on detritus from the

sediments or algae growing over the hard surfaces. Elasipodida are the deep-water holothurids that can be pelagic and benthic. Mostly are deposit or suspension feeders. The cucumbers can be sluggish in their movement or more mobile (Stichopus and elasipods). Sediment passes through the gut and is returned devoid of food particles ingested during the feeding to the habitat.

Some cucumbers have a commensal relationship with a fish (pearl fish) that lives in the respiratory tree with no apparent damage to the cucumber. The fish uses the cucumber as shelter.

Reproduction in the sea cucumbers includes hermaphroditic protrandy (changing from male to females) and brooding behavior. Fertilization is external, except in a deep-water species that appears to have internal fertilization. The young leave the mother well formed or brooding takes place within the ovary. In most species however, fertilized eggs develop in the water column and embryos are planktonic (pelagic). The stages of metamorphosis of the larvae are all pelagic until a small cucumber is form and settlement to the benthos takes place.

## Corals

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# Appendix L. Endangered Species Act (ESA) Consultations

The St. Croix Fishery Management Plan (St. Croix FMP) would subsume some of the activities currently managed under the FMP for the Reef Fish Fishery of Puerto Rico and the U.S. Virgin Islands (USVI) (Reef Fish FMP), and the FMP for the Spiny Lobster Fishery of Puerto Rico and the USVI (Spiny Lobster FMP). Activities under these FMPs have been determined to potentially affect ESA species and ESA Section 7 consultations have been done for them in the past. The following summarizes the consultation history for each of the two FMPs.

Reef Fish FMP

The National Marine Fisheries Service (NMFS), Caribbean Fishery Management Council (Council) and the U.S. Fish and Wildlife Service completed an informal Section 7 consultation on the original Reef Fish FMP that was implemented in 1985. The consultation included the following species: sei whale (*Balaenoptera borealis*; endangered); humpback whale (*Megaptera novaeangliae*; endangered); sperm whale (*Physeter catodon*; endangered); West Indian manatee (*Trichechus manatus*; threatened); and leatherback sea turtle (*Dermochelys coriacea;* endangered); and critical habitat for the leatherback sea turtle in St. Croix, USVI. The Council prepared a biological assessment of the potential effects of the proposed management system on the above-listed species. The consultation concluded that based on the best available information, populations of endangered and threatened species and their critical habitat would not be adversely affected by the Reef Fish FMP.

On April 28, 1989, NMFS conducted a Section 7 consultation on the effects of all commercial fishing activities in the Southeast Region. The resulting opinion concluded that commercial fishing activities in the Southeast Region were not likely to jeopardize the continued existence of any threatened or endangered species.

Amendment 1 to the Reef Fish FMP, implemented in December 1990, proposed no changes to the manner in which species listed under the Endangered Species Act were affected by fishing managed under the Reef Fish FMP. NMFS concluded its proposed actions would have no anticipated impact on threatened or endangered species.

An informal ESA Section 7 consultation was conducted on Amendment 2 to the Reef Fish FMP in August 1992. NMFS concluded that neither the directed fisheries nor the management measures proposed in Amendment 2 would jeopardize endangered or threatened species, or adversely impact their critical habitat.

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An informal ESA Section 7 consultation was conducted on a regulatory amendment to the Reef Fish FMP in October 1996. NMFS concluded that the regulatory amendment and the operation of the U.S. Caribbean reef fish fishery, in accordance with the amendment, were not likely to adversely affect endangered or threatened species under NMFS' jurisdiction.

An informal ESA Section 7 consultation was conducted on the Generic Essential Fish Habitat (EFH) Amendment in 1998. NMFS concluded that the amendment would not adversely affect the recovery of endangered or threatened species, or their critical habitat. NMFS only partially approved the Generic EFH Amendment in March 1999, finding that it did not evaluate all managed species or all fishing gear types with the potential to damage fish habitat.

An informal ESA Section 7 consultation was conducted on the Comprehensive Amendment to FMPs of the U.S. Caribbean in August 2001. NMFS concluded the management measures proposed in the amendment were not likely to adversely affect any listed species under the ESA. The Comprehensive Amendment was ultimately disapproved by NMFS in May 2002.

Effects of the reef fish fishery managed under the Reef Fish FMP were analyzed in a formal consultation for the first time as part of a May 19, 2005, opinion (NMFS 2005a; hereafter referred to as the 2005 Caribbean opinion or NMFS [2005a]), which evaluated the effects of all Caribbean fisheries in the exclusive economic zone (EEZ) on listed species and designated critical habitat. NMFS (2005a) concluded the continued authorization of all Caribbean fisheries in the EEZ (including the reef fish fishery) was not likely to jeopardize the continued existence of green, hawksbill, leatherback, or loggerhead sea turtles. An incidental take statement was issued specifying the amount and extent of anticipated take of these species, along with reasonable and prudent measures and associated terms and conditions deemed necessary and appropriate to minimize the impact of these takes; the reef fish fishery was allotted take. Other listed species (olive ridley sea turtles and listed marine mammals) and designated critical habitat for sea turtles in the action area were determined not likely to be adversely affected by the continued authorization of any Caribbean EEZ fisheries.

On October 4, 2011, NMFS completed its most recent biological opinion evaluating the effects of the continued authorization of the U.S. Caribbean reef fish fishery, managed under the Reef Fish FMP, on ESA-listed species and designated critical habitat. In the opinion, NMFS concluded that its continued authorization is not likely to jeopardize the continued existence of green, hawksbill, or leatherback sea turtles, or elkhorn or staghorn corals, or destroy or adversely modify *Acropora* critical habitat. The opinion also concluded that the continued authorization of the U.S. Caribbean reef fish fishery is not likely to adversely affect ESA-listed whales or Northwest Atlantic loggerhead sea turtles, or the critical habitat for green, hawksbill or

leatherback sea turtles. No longer believed to be present and thus unaffected, olive ridley sea turtles were not discussed in the opinion.

Spiny Lobster FMP

An informal Section 7 consultation was completed on the original Spiny Lobster FMP in July 1980. The consultation concluded that based on the best available information, populations of endangered and threatened species and their critical habitat would not be adversely affected by the continued authorization of the fishery.

On April 28, 1989, NMFS conducted a Section 7 consultation on the effects of all commercial fishing activities in the Southeast Region. The resulting opinion concluded that commercial fishing activities in the Southeast Region were not likely to jeopardize the continued existence of any threatened or endangered species.

Amendment 1 of the Spiny Lobster FMP, implemented in December 1990, proposed no changes to the manner in which species listed under the Endangered Species Act were affected by fishing managed under the Spiny Lobster FMP. NMFS concluded its proposed actions would have no anticipated impact on threatened or endangered species.

A formal consultation was conducted on Amendment 2 to the Spiny Lobster FMP in 2005. Amendment 2 was part of the Comprehensive Amendment to all the FMPs of the U.S. Caribbean to address required provisions of the Magnuson-Stevens Fishery Conservation and Management Act. The effects of the spiny lobster fishery were analyzed as part of a May 19, 2005, opinion (NMFS 2005a), which evaluated the effects of all Caribbean fisheries in the EEZ on listed species and designated critical habitat. NMFS (2005a) concluded the continued authorization of all Caribbean fisheries in the EEZ was not likely to jeopardize the continued existence of green, hawksbill, leatherback, or loggerhead sea turtles. The spiny lobster fishery was determined to be likely to adversely affect only green, hawksbill, and leatherback sea turtles. An incidental take statement was issued specifying the amount and extent of anticipated take of these species, along with reasonable and prudent measures and associated terms and conditions deemed necessary and appropriate to minimize the impact of these takes; both the reef fish and spiny lobster fisheries were separately allotted take. Other listed species (olive ridley sea turtles and listed marine mammals) and designated critical habitat for sea turtles in the action area were determined not likely to be adversely affected by the continued authorization of any Caribbean EEZ fisheries.

On October 8, 2008, F/SER2 requested reinitiation of Section 7 consultation for Amendment 4 to the Spiny Lobster FMP specifically to address adverse effects to elkhorn (*Acropora palmata*) and staghorn (*Acropora cervicornis*) corals, which were listed subsequent to completion of the

2005 Caribbean opinion. Additionally, on November 26, 2008, NMFS designed critical habitat for these species. Both of these listed species and their critical habitats overlap in some areas where fishing managed by the Spiny Lobster FMP is authorized; thus, they may be adversely affected by this fishery.

On January 27, 2011, NMFS published a Notice of Intent that it was developing Amendment 5 to the Caribbean Spiny Lobster FMP. On July 21, 2011, the Caribbean Fisheries Management Council (CFMC) selected the preferred alternatives for Amendment 5. Formal consultation was initiated on November 12, 2011. NMFS proposed to continue authorizing the federal Caribbean spiny lobster fishery as managed under the Spiny Lobster FMP, including proposed Amendment 5. Amendment 5 was prepared by the Council and NMFS Southeast Regional Office (SERO) and was designed to bring the Caribbean spiny lobster fishery into compliance with the 2007 revisions to the MSA. An Opinion concluded on December 12, 2011, that the proposed action was not likely to destroy or adversely modify *Acropora* critical habitat in the U.S. Caribbean. It also concluded that the action was not likely to jeopardize the continued existence of staghorn corals, or green, hawksbill, or leatherback sea turtles.

<u>Reinitiation of Consultation (Reef Fish and Spiny Lobster)</u>
As provided in 50 CFR 402.16, reinitiation of formal consultation is required if discretionary federal action agency involvement or control over the action has been retained, or is authorized by law, and, if among other things, a new species is listed or critical habitat designated that may be affected by the action.

On July 3, 2014 (79 FR 38214) NMFS listed the Central and Southwest Atlantic Distinct Population Segment (DPS) of scalloped hammerhead sharks. The NMFS SERO Sustainable Fisheries Division (SFD) determined the continued authorization of the subject fisheries of this Opinion may adversely affect this DPS and believed it should be included in the reinitiation of ESA Section 7 consultation to evaluate these fisheries' potential impacts.

On September 10, 2014, NMFS listed 20 new coral species under the ESA. Five of those new species (rough cactus coral [*Mycetophyllia ferox*], pillar coral [*Dendrogyra cylindrus*], lobed star coral [*Orbicella annularis*], mountainous star coral [*Orbicella faveolata*], and boulder star coral [*Orbicella franksi*]) occur in the Caribbean and all are listed as threatened. The two previously listed coral species (elkhorn coral [*Acropora palmata*] and staghorn coral [*Acropora cervicornis*]) remain listed as threatened. In a September 26, 2014, memorandum, NMFS Sustainable Fisheries Division determined that the continued authorization of the Caribbean reef fish and spiny lobster fisheries may affect these five newly-listed species and requested reinitiation of ESA Section 7 consultation to evaluate these fisheries' potential impacts on them.

Since requesting reinitiation on the five recently listed coral species, NMFS has published five final rules listing a total of six additional species that may be affected by the continued authorization of the reef fish and spiny lobster fisheries under the Reef Fish FMP and Spiny Lobster FMP in the U.S. Caribbean and, has expanded the ongoing reinitiation to consult on the effect to these species. These listings include the following:

- On July 3, 2014, NMFS published a final rule listing the Central and Southwest Atlantic DPS of scalloped hammerhead shark (*Sphyrna lewini*) as threatened under the ESA (79 FR 38213). This DPS occurs in the Caribbean;
- On April 6, 2016, NMFS and the U.S. Fish and Wildlife Service published a final rule removing the range-wide and breeding population ESA listings of the green sea turtle (*Chelonia mydas*), and in their place, listing eight DPSs of green sea turtle as threatened and three DPSs as endangered (81 FR 20058). Two of the green sea turtle DPSs, the North Atlantic DPS and the South Atlantic DPS, occur in the U.S. Caribbean and are listed as threatened;
- On June 29, 2016, NMFS published a final rule listing the Nassau grouper (*Epinephelus striatus*) as threatened (81 FR 42268);
- On January 22, 2018, NMFS published a final rule listing the giant manta ray (*Manta birostris*) as threatened (83 FR 2916);
- On January 30, 2018, NMFS published a final rule listing the oceanic whitetip shark (*Carcharhinus longimanus*) as threatened (83 FR 4153).

In memoranda dated January 19, 2016, October 24, 2016, and March 31, 2017, NMFS determined that allowing the continued authorization of fishing under the Reef Fish FMP and Spiny Lobster FMP would not violate Section 7(a)(2) or 7(d) of the ESA during the reinitiation period, which, under those memoranda, extended until July 31, 2017. These determinations were based on NMFS' analyses of the effects of the continued operation of the reef fish and spiny lobster fisheries during the reinitiation period on the five most recently listed coral species, two new green sea turtle DPSs, and Nassau grouper. In particular, NMFS determined that continued operation of these fisheries during the reinitiation period would not jeopardize the continued existence of these species or destroy or adversely modify critical habitat, and thus would not violate Section 7(a)(2). NMFS also determined that there had not been any irreversible or irretrievable commitment of resources that would prevent implementation of any reasonable and prudent alternatives that might be provided at the conclusion of the consultation. Thus, NMFS determined that continued operation of the fisheries during the reinitiation period would not violate Section 7(d). In addition, in a memorandum dated August 29, 2017, NMFS considered whether the continued authorization of fishing managed under the Reef Fish FMP, while reinitiating consultation to consider the effects on the Central and Southwest Atlantic DPS of scalloped hammerhead shark, would violate Sections 7(a)(2) or 7(d) of the ESA, and concluded it would not.

The listing of the additional corals, the green sea turtle DPSs, and Nassau grouper triggered reinitiation of consultation on numerous federal fisheries in the Southeast region, resulting in significant Section 7 workload. In a March 31, 2017, memorandum, it was expected the consultations on the reef fish and spiny lobster fisheries in the U.S. Caribbean would be completed by the end of July 2017.

In an October 31, 2018 memorandum updating ESA Section 7(a)(2) and Section 7(d) determinations for allowing the continued authorization of fishing managed by the U.S. Caribbean Reef Fish and Spiny Lobster FMPs during reinitiation of ESA consultation on these fisheries anticipated that the reinitiation period on these fisheries to extend through December 2019.. That memorandum addressed all listed species for which one or more reinitiation triggers for these FMPs have been met and provided analysis of effects of these ongoing fisheries during the reinitiation period on the recently listed giant manta ray and oceanic whitetip shark listings for the first time. NMFS also reviewed analysis from previous findings relative to Nassau grouper, the North Atlantic and South Atlantic DPSs of green sea turtle, the Central and Southwest Atlantic DPS of scalloped hammerhead shark, and the five corals listed in 2014 to ensure that those findings still apply.

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# Appendix BYCATCH

## 3.5 Bycatch in St. Croix Fisheries

### 3.5.1 Introduction

The Council is required by the Magnuson-Stevens Fishery Conservation and Management (Magnuson-Stevens) Act §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 Magnuson-Stevens Act 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" (Magnuson-Stevens Act §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) 10 factors that should be considered in determining whether a management measure minimizes bycatch or bycatch mortality to the extent practicable, including:

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 non-consumptive uses of fishery resources;

I. Changes in the distribution of benefits and costs; and,

J. Social effects.

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Agency guidance provided at 50 CFR §600.350(d)(3)(ii) advises 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 10 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.

## 3.5.2 Bycatch Practicability Analysis

### 3.5.2.1 Background

A bycatch practicability analysis (BPA) was first addressed in the Caribbean Sustainable Fisheries Act Amendment/Final Environmental Impact Statement (Caribbean SFA Amendment [CFMC 2005]). The BPA 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 Act. To summarize, four alternatives including a "no action" alternative were presented, and impacts were described regarding bycatch reporting. The three action alternatives would, to a greater or lesser degree, accomplish the following objectives: 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 Marine Recreational Fisheries Statistics Survey database to provide additional bycatch information on the recreational and subsistence sectors; and, modify the trip ticket system in the U.S. Caribbean to require standardized collection of bycatch data.

Additional measures were included in the Caribbean SFA Amendment to minimize bycatch and bycatch mortality to the extent practicable. The analysis of the practicability of those measures can be found in Section 6.6.2 of that amendment and is included herein by reference. Four alternatives, including a "no action" alternative, were presented. The three action alternatives 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, which must be tended at all times; and, amend current requirements for trap construction such that only one escape panel is required, which included the door.

The BPA in the Caribbean SFA Amendment discussed that beach seines, the gear with the highest rate of discard mortality, are not used in the EEZ. Trammel nets, which were banned from the EEZ in 2005 (CFMC 2005), were reported to produce little bycatch, although supporting data were limited.

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The BPA concluded that, due to the nature of U.S. Caribbean fisheries, it was unlikely that any of the alternatives proposed in the Caribbean SFA Amendment would significantly reduce bycatch. Most Caribbean fishermen utilize all they catch, and gear types that are noted for producing large amounts of bycatch (e.g., trawling) are essentially absent from U.S. Caribbean fisheries. 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 in the BPA. Regardless, the Council also opted to prohibit the use of gill and trammel nets in the U.S. Caribbean EEZ (excluding some bait fishing), primarily to reduce fishing mortality, though it would also have an ancillary benefit in the reduction of bycatch. The effects of the management regime implemented in 2005 have not been fully assessed to determine the impact on bycatch. To date, the Council has not implemented a federal permit system for commercial and charter boat fishermen participating in the harvest of Council managed species, as proposed in the Caribbean SFA Amendment. However, the USVI has modified their commercial trip tickets to include the reporting of bycatch. The form collects data on the amount of bycatch and whether the bycatch is released alive or dead.

A BPA also was included in the 2010 Caribbean ACL Amendment (CFMC 2011a) and supplemented in the 2011 Caribbean ACL Amendment (CFMC 2011b) (2010/2011 BPA). The 2010/2011 BPA is herein included by reference and summarized below. Bycatch considerations for measures evaluated in that BPA, and that remain valid and applicable in this FMP, are noted below.

The 2010/2011 BPA determined that commercial or recreational bycatch could be affected through alternatives that revised/established management reference points, allocated resources (based on stock or stock complexes, sectors, and geographic criteria), established species-specific management measures, and established harvest limits. The Council considered the list of 10 factors discussed above (Section 3.5.1) to determine if the management measures minimized bycatch or bycatch mortality. Those determinations are summarized below.

A). Population effects for the bycatch species: the 2010/2011 BPA discussed that management measures may have an indirect but slight impact on minimizing bycatch. If those measures redefining management reference points result in more conservative estimates of MSY and OY, along with conservative establishment of OFLs and ACLs, and if those measures would result in a high compliance with 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. The findings of the 2010/2011 BPA would also be applicable to the St. Croix FMP, as Action 4 of the St. Croix FMP/DEIS redefined/established management reference points and redefined/established ACLs.

B). Ecological effects due to changes in the bycatch of a species (effects on other species in the ecosystem): the 2010/2011 BPA discussed that if management develops conservative measures as cited in (A) above, 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 to fewer non-target individuals being extracted or dying from the impacts of capture and release. This determination would also apply to actions in the St. Croix FMP and remains valid.

C). Changes in the bycatch of other species of fish and the resulting population and ecosystem effects: same as (B) above. This determination would also apply to actions in the St. Croix FMP and remains valid.

D). Effects on marine mammals and birds: the 2010/2011 BPA discussed that, because fishermen in the U.S. Caribbean region traditionally utilize most resources harvested, the amounts of bycatch resulting from actions included in the 2010 and 2011 Caribbean ACL Amendments were not expected to change, so little or no effect to marine mammals or birds was expected. This determination would also apply to actions in the St. Croix FMP and remains valid.

E). Changes in fishing, processing, disposal, and marketing costs: the 2010/2011 BPA noted that, if management chose the most conservative and restrictive proposals in the respective amendments, one might expect changes to fishing in that more fishing effort might take place after implementation of each amendment to hedge against closure once limits are reached. Such a change may result in a proportionate change in bycatch or bycatch mortality. If that were to occur, an AM would be triggered to reduce the length of the fishing season in subsequent fishing years, thereby minimizing bycatch. This determination would also apply to actions in the St. Croix FMP and remains valid.

F). Changes in fishing practices and behavior of fishermen: the 2010/2011 BPA discussed that changes to fishing practices were not expected to result in greater or lesser amounts of bycatch. The BPA noted that fish traps, hook-and-line, and spearfishing have been the fishermen's most popular and productive fishing practices and these practices were not expected to change without further regulations. Bycatch was not expected to change from its current level. In the St. Croix FMP, changes to fishing practices also would not be expected to result in greater or lesser degrees of bycatch as fishing methods would not change in the regulations implementing this FMP.

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G). Changes in research, administration, and enforcement costs and management effectiveness: the 2010/2011 BPA discussed that research and monitoring is needed to understand the effectiveness of proposed management measures in reducing bycatch. Additional work is needed to determine the effectiveness of measures being developed in those amendments 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 would begin accumulation of information needed to assess bycatch questions. Additional administrative and enforcement efforts would be needed to implement and enforce these regulations.

H). Changes in the economic, social, or cultural value of fishing activities and non-consumptive uses of fishery resources: the 2010/2011 BPA noted that proposed management measures, including those that are likely to increase or decrease discards, could result in social and/or economic impacts (discussed in Chapter 4 of each of the 2010 and 2011 Caribbean ACL Amendments). In the St. Croix FMP, socioeconomic impacts of measures that would be likely to increase or decrease discards are discussed in Sections 4.5.3, 4.5.4, 5.5.3, 5.5.4, 5.10.3, 5.10.4, 6.6.3, 6.6.4, 6.11.3, 6.11.4, 7.5.3, 7.5.4, 8.5.3, and 8.5.4.

I). Changes in the distribution of benefits and costs: the 2010/2011 BPA noted that attempts were made to ensure reductions resulting from proposed management measures were equal in the commercial and recreational sectors. The extent to which those management measures would increase or decrease the magnitudes of discards was not clear. Potential increases in dead discards were 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 would be the same in the commercial and recreational sectors.

J). Social effects: in the 2010 and 2011 Caribbean ACL Amendments, the social effects of all the management measures, including those most likely to reduce bycatch, were described in Chapter 6 of each amendment. In the St. Croix FMP, social effects are described in Sections 4.5.4, 5.5.4, 5.10.4, 6.6.4, 6.11.4, 7.5.4, and 8.5.4.

#### 3.5.2.2 Commercial and Recreational Bycatch

Trip tickets used by commercial fishermen operating in St. Croix waters include an area for reporting bycatch. However, a similar facility for reporting recreational bycatch does not exist in the USVI. As mentioned in the Caribbean SFA Amendment BPA, anecdotal information suggests that the vast majority of fish harvested from St. Croix waters are retained for the market or for personal use – including species with low market value. 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, including St. Croix, compared to other regions. With the exception of species that are commonly believed to be ciguatoxic, economic discards in this region appear to be minimal. What little bycatch occurs is generally confined to regulatory discards. Current regulatory discards from both the recreational and commercial sectors may potentially include:

- Nassau grouper: federal and territorial laws require that Nassau grouper caught must be released immediately with a minimum of harm;
- Goliath grouper: federal and territorial laws require that goliath grouper caught must be released immediately with a minimum of harm;
- Midnight, rainbow, and blue parrotfish: federal laws prohibit the harvest and possession of these species in federal waters off St. Croix and the U.S. Caribbean and any fish caught must be released immediately with a minimum of harm;
- Redband parrotfish: federal law requires that catches of redband parrotfish under 8 inches (20.3 cm) in fork length in St. Croix EEZ waters be released immediately with a minimum of harm;
- Princess, queen, striped, redtail, stoplight, and redfin parrotfish: federal law requires that catches of these parrotfish under 9 inches (22.9 cm) in fork length in St. Croix EEZ waters be released immediately with a minimum of harm;
- Yellowtail snapper: federal law requires that catches of yellowtail snapper under 12 inches (30.5 cm) in total length be released immediately with a minimum of harm;
- Queen conch[73]: federal and territorial laws prohibit the harvest of queen conch under 9 inches (22.9 cm) in length or 3/8 inches (9.5 mm) in lip width at its widest point. Federal and territorial laws prohibit the harvest of queen conch during the June 1 – October 31 seasonal closure;
- Spiny lobster: federal and territorial laws prohibit the harvest of spiny lobster under 3.5 inches (8.9 cm) in carapace length and berried spiny lobsters (this size limit also applies to *Panulirus argus* imports into the U.S. Caribbean, CFMC 2008);
- Red, black, tiger, yellowfin or yellowedge groupers: federal and territorial laws prohibit the harvest of these groupers during the February 1 – April 30 seasonal closure. Depending on the species and depth of the fishing activity, there might be high bycatch mortality;
- Vermilion, black, silk, and blackfin snappers; federal law prohibits the harvest of these snappers during the October 1 – December 31 seasonal closure. Depending on the species and depth of the fishing activity, there might be high bycatch mortality;

[73] Harvest of queen conch in St. Croix EEZ waters is only allowed east of 64 34' W, which includes Lang Bank, St., Croix, USVI.

- Lane and mutton snappers: federal and territorial laws prohibit the harvest of these snappers during the April 1 – June 30 seasonal closure. Depending on the species and depth of the fishing activity, there might be high bycatch mortality;
- Red Hind Spawning Aggregation area closure: fishing for any Council-managed reef fish (including HMS species and spiny lobster) is prohibited during the December 1 – February 28 seasonal area closure, thus any Council-managed reef fish species caught while fishing for other species should be returned to the water;
- Mutton Snapper Spawning Aggregation area closure: fishing for any Council-managed reef fish (including HMS species and spiny lobster) is prohibited during the March 1 –June 30 seasonal area closure, thus any Council-managed reef fish species caught while fishing for other species should be returned to the water;
- Reef fish with recreational bag limits: any Council-managed reef fish that is harvested over the specified bag limit[74], should be returned to the water;
- Spiny lobster recreational bag limit[75]: any spiny lobster that is harvested over its specified bag limit, should be returned to the water;
- Stocks for which AMs apply: any stocks for which AMs are applied should not be retained.

### 3.5.3 Interactions with Protected Species

Protected species and critical habitat located within the St. Croix management area (See Section 2.4.2) would be potentially affected by activities authorized under the St. Croix FMP.

All protected species under the Endangered Species Act (ESA) are potentially subject to effects from boating activities occurring in the management area, including vessel strikes (e.g., turtles), contaminants/pollution from boating activities, and damage through anchoring (e.g., benthic habitats).

Listed turtle and fish species are potentially subject to effects from fishing activities that would occur under the St. Croix FMP, most notably hooked as bycatch. Listed turtles and mammals could be entangled in line, trap, and net fishing gear. Corals are potentially physically impacted by fishing gear/activities, for example through crushing (by gear or vessel anchors), abrasion (by gear/anchor line or trap gear), and snagging (breaking of coral by gear/anchor). Additionally,

[74] Groupers, snappers, and parrotfishes combined — 5 per person per day or, if 3 or more persons are aboard, 15 per vessel per day; but not to exceed 2 parrotfish per person per day or 6 parrotfish per vessel per day. Other reef fish species combined — 5 per person per day or, if 3 or more persons are aboard, 15 per vessel per day, but not to exceed 1 surgeonfish per person per day or 4 surgeonfish per vessel per day.
[75] For spiny lobster — 3 per person per day, not to exceed 10 per vessel per day, whichever is less

Nassau grouper could potentially be caught in traps or speared by fishermen. Several fishing related activities could potentially startle turtles, fish, and marine mammals.

Additionally, the harvest of herbivorous fish or invertebrates (e.g., sea urchins) would be expected to indirectly affect both *Acropora* critical habitat and listed coral species through impacts to the grazing and the related control of algae.

Since this is a new, island-based FMP, specific numbers of protected species bycatch for the fishery as it would be promulgated are not available. However, bycatch estimates from the previous Reef Fish FMP and Spiny Lobster FMP biological opinions are available (NMFS 2011a and NMFS 2011b, respectively). While they do not represent the exact numbers expected to be taken during fishing activities authorized under this new St. Croix FMP (since fishing effort is not expected to be identical under the new FMP), they are presented here to provide context to the approximate magnitude of bycatch that could occur. The actual bycatch expected to occur would be estimated and analyzed as part of the ongoing ESA Section 7 consultation. The most recent biological opinion for the Reef Fish FMP (NMFS 2011a) stated that up to 75 green, 48 hawksbill, and 18 leatherback sea turtles could be taken lethally over three year periods. Take of *Acropora* (staghorn and elkhorn combined) coral was calculated for three one-year periods at 0.0041 square miles (mi) (0.0106 square kilometers [km]). Indirect effects to *Acropora* coral via reduced sexual/asexual reproductive success were noted also. The most recent biological opinion for the Spiny Lobster FMP (NMFS 2011b) stated that up to 12 green, 12 hawksbill, and 9 leatherback sea turtles could be taken lethally over three one-year periods. Take of staghorn coral was calculated for three one-year periods at 93 square feet (8.64 square meters).

Recently listed species (*i.e*., rough cactus coral, pillar coral, lobed star coral, mountainous coral, boulder star coral, scalloped hammerhead shark Central DPS, Nassau grouper, oceanic whitetip shark, and giant manta ray) could also be taken under activities authorized under the St. Croix FMP, however previous calculations of take for these species under the Reef Fish or Spiny Lobster FMPs do not exist (they would be estimated in the ongoing Section 7 consultation).

Previous analyses of effects to ESA-listed species are summarized in Section 7 consultations for the Reef Fish and Spiny Lobster FMPs (see Appendix D) and were determined for each fishing sector (*i.e.*, Puerto Rico commercial, Puerto Rico recreational, St. Thomas/St. John, and St. Croix). It would be expected that those determinations accurately reflect known effects to listed marine mammals, sea turtles, and corals in the St. Croix management area. Similarly, NMFS' effects analyses for Nassau grouper, scalloped hammerhead shark Central and Southwest Atlantic DPS, giant manta ray, and oceanic whitetip shark described in NMFS' October 31, 2018, memorandum should accurately reflect potential effects to these species through the extended reinitiation period of December 2019.

A formal consultation is currently in process to comprehensively package all analyses for all actions under the St. Croix FMP into one document (*i.e.*, biological opinion) and update information/analyses as appropriate. This biological opinion would also outline any expected take, and its effect to populations, and determine whether the FMP jeopardizes the continued existence of any ESA-listed species, or destroys or adversely modifies designated critical habitat.

### 3.5.4 Summary

This section evaluates the need and efficacy of taking additional action to minimize bycatch and bycatch mortality in the fisheries that comprise the St. Croix FMP using the 10 factors provided at 50 CFR 600.350(d)(3)(i). Management measures mentioned in section 3.5.2.1 above, as well as past measures implemented by the Council to reduce fishing mortality that were migrated to this FMP as a result from Action 1, indirectly minimize bycatch in St. Croix fisheries. 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. Changes to those gear types or their operations are not considered in this FMP, thus bycatch is not expected to change from its current level. These measures continue to be applicable to fishery management in the St. Croix EEZ. It is likely that management measures such as redefined ACLs and AMs could increase the number of discards. However, this depends primarily on how well the reference points and particularly the ACLs reflect actual fishing activity, and secondarily on if fishermen shift effort to other species, seasons, or fisheries and if effort decreases in response to more restrictive management measures. The extent to which community structure and age/size composition respond to ending overfishing also would influence bycatch. Bycatch minimizing measures taken in previous Council actions (e.g., 2010 and 2011 Caribbean ACL Amendments) as discussed in Section 3.5.2.1 above, which would still be applicable in the St. Croix FMP, took into consideration potential increases in dead discards when setting bag and size limits, commercial quotas, and when determining the effectiveness of a seasonal closure. In addition, the effect that overlapping seasonal closures could have on reducing bycatch and fishing mortality of many co-occurring species is also expected to continue in the St. Croix FMP. New species groupings based on biological, geographic, economic, taxonomic, technical, social, and/or ecological factors proposed in this FMP could also reduce bycatch of co-occurring species.

Finally, 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, for example as a result of changing predator/prey relationships or habitat characteristics. Such 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 future

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patterns of bycatch. As appropriate and necessary, the St. Croix FMP could be amended to further reduce bycatch as additional information becomes available.

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