Modification of Spiny Lobster Management Reference Points Based on SEDAR 57 Stock Assessments

Options Paper

For a Generic Amendment to the Comprehensive Fishery Management Plans for Puerto Rico, St. Thomas/St. John, and St. Croix

August 2020

Abbreviations and Acronyms Used in this Document

ABC	acceptable biological catch
ACL	annual catch limit
AM	accountability measure
CFMC	(Council); Caribbean Fishery Management Council
EEZ	exclusive economic zone
EIS	environmental impact statement
FMP	fishery management plan
FMSY	fishing mortality rate yielding MSY
MFMT	maximum fishing mortality threshold
MSA	(Magnuson-Stevens Act); Magnuson-Stevens Fishery Conservation and Management Act
MSST	minimum stock size threshold
MSY	maximum sustainable yield
NMFS	National Marine Fisheries Service
OFL	overfishing limit
OY	optimum yield
SDC	status determination criteria
SEDAR	Southeast data assessment review (stock assessment)
SEFSC	Southeast Fisheries Science Center
SSC	Scientific and Statistical Committee
SYL	sustainable yield level
USVI	United States Virgin Islands

Table of Contents

List of Tables

1. INTRODUCTION

At their 169th Regular meeting held on June 2020, the Caribbean Fishery Management Council (Council) requested the preparation of an Options Paper to evaluate potential options to include in a framework amendment to each of the Puerto Rico, St. Thomas/St. John, and St. Croix Fishery Management Plans (FMP). The generic framework amendment would update the management reference points, including status determination criteria (SDC), for spiny lobster in Puerto Rico, St. Thomas/St. John, and St. Croix based on the Southeast Data, Assessment, and Review 57 (SEDAR 57) stock assessments. Using SDC definitions from the island-based FMPs, the framework amendment would update the SDC values for spiny lobster in each island/island group, including the maximum fishing mortality threshold (MFMT), the minimum stock size threshold (MSST), and the overfishing limit (OFL) or OFL proxy, which are used to determine if the stock is undergoing overfishing, or if the stock is overfished (16 U.S.C. 1853(a)(10); 50 CFR 600.310(e)(2)(i)(A)). The framework amendment would also update the management reference points for spiny lobster in each island/island group, namely the maximum sustainable yield (MSY) or MSY proxy, the acceptable biological catch (ABC), the optimum yield (OY), and the annual catch limit (ACL), which are designed to ensure that management prevents overfishing while achieving OY (50 CFR 600.310(b)(2)(iv)).

1.1 Background

The spiny lobster stock was historically managed in the U.S. Caribbean exclusive economic zone (EEZ) under the Spiny Lobster Fishery Management Plan (Spiny Lobster FMP) of Puerto Rico and the U.S. Virgin Islands (USVI) (CFMC 1981), which was implemented in 1984. Spiny lobster ACLs were established for each island/island group under the Comprehensive ACL Amendment for the U.S. Caribbean (CFMC 2011b) (2011 Caribbean ACL Amendment). Local regulations for the management of spiny lobster have been in place in the USVI since 1972, and in Puerto Rico at least since 1981.

At their December 2019 regular meeting, the Council voted to submit to the National Marine Fisheries Service (NMFS) three new FMPs for review, approval, and implementation: the Comprehensive FMP for the Puerto Rico EEZ (Puerto Rico FMP) (CFMC 2019a), the Comprehensive FMP for the St. Thomas and St. John EEZ (St. Thomas and St. John FMP) (CFMC 2019b), and the Comprehensive FMP for the St. Croix EEZ (St. Croix FMP) (CFMC 2019c). If approved by the Secretary of Commerce, the new FMPs (hereafter collectively

referred to as island-based FMPs) would replace the existing U.S. Caribbean-wide FMPs (including the Spiny Lobster FMP) and transition management of Federal fisheries in the U.S. Caribbean EEZ from a U.S. Caribbean-wide approach to an island-based approach.

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) requires each federal FMP to assess and specify the present and probable future condition of, and the MSY and OY from, the fishery and include a summary of the information utilized in making such specification (16 U.S.C. 1853(a)(3)). To guide effective management, the Magnuson-Stevens Act also requires FMPs to specify objective and measurable criteria for determining stock status, specifically whether the stock is overfished or undergoing overfishing (16 U.S.C. 1853(a)(10)).

SDC and Management Reference Points

Maximum Sustainable Yield – 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 – 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.

Minimum Stock Size Threshold – 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.

Overfishing Limit – 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.

Acceptable Biological Catch - the catch level recommended by the SSC and set at or below OFL to account for scientific uncertainty.

To satisfy these requirements, the island-based FMPs adopt and apply a newly devised, four-tiered ABC control rule to specify SDC (i.e., MFMT, MSST, and OFL) and management reference points (i.e., MSY or MSY proxy and ABC), depending on differing levels of data availability (see Appendix A). Each tier of the Council's ABC Control Rule includes a description of these SDC and management reference points.

The ABC is a level of annual catch recommended by the Council's Scientific and Statistical Committee (SSC), which accounts for the scientific uncertainty in the estimate of the OFL, any other scientific uncertainty, and the Council's risk policy (50 CFR 600.310(f)(1)(ii)). In each island-based FMP, spiny lobster was considered a Tier 4a stock (stock is data limited and has no accepted assessment available). The Council set the ACL for spiny lobster at 95% of the recommended ABC for each island/island group (Table 1.1) to account for management uncertainty.

Table 1.1. Spiny lobster ABCs and ACLs as specified for federal waters under the Puerto Rico FMP, St. Thomas/St. John FMP, and St. Croix FMP. Values are in pounds whole weight.

Fishery Management Plan	Spiny Lobster ABC	Spiny Lobster ACL
Puerto Rico	554,981	527,232
St. Thomas and St. John	220,221	209,210
St. Croix	207,925	197,528

1.2 SEDAR 57 Spiny Lobster Stock Assessment

Concurrent with the development of the island-based FMPs, the Southeast Data, Assessment, and Review (SEDAR) process conducted and completed stock assessments on spiny lobster for each of Puerto Rico, St. Thomas/St. John, and St. Croix in 2019 (SEDAR 57 2019; http://sedarweb.org/sedar-57). SEDAR 57 incorporated commercial landings data[1] from 1983-2016 (Puerto Rico), 1974-2016 (St. Thomas/St. John), and 1975-2016 (St. Croix) and available length frequency data from NMFS, Southeast Fisheries Science Center (SEFSC) Trip Interview Program (1980-2016 for Puerto Rico; 1980-2017 for St. Thomas/St. John; 1980-2017 for St. Croix).

Due to the lack of an estimable spawner-recruit relationship, MSY could not be reliably estimated for the spiny lobster stocks for any of the islands/island groups. Therefore, the stock status, OFL and projected landings were presented relative to a provisional MSY proxy of $F_{SPR30\%}$.[2] SEDAR 57 used management threshold definitions of $F_{SPR30\%}$ for the MFMT and 75% of $S_{SPR30\%}$ for the MSST. The assessments estimated that the fishing mortality was below MFMT and the spawning output was above MSST, thus, the spiny lobster stock in each island/island group was not undergoing overfishing or overfished. For each island/island group, the SEDAR 57 assessment model provided status indicators (SEDAR 57 2019; Table 17) and OFL projections for years 2019-2022 (SEDAR 57 2019; Table 18) that were calculated using provisional landings data through 2018. For the OFL projections, provisional landings for 2017 and 2018, were set equal to the estimates of landings for 2017 that were available as of August 2018. Although catches observed in the 2017 landings data were reduced from previous years,

> **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 continuing basis.
>
> **Overfished**. A stock or stock complex is considered "overfished" when its biomass has declined below the MSST.

[1] Fishery statistics of recreational spiny lobster removals are not available for any of the island platforms.
[2] The F_{MSY} proxy of $F_{SPR30\%}$ is 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 $F_{SPR30\%}$ would allow the stock to attain 30% of the maximum spawning potential, which would have been obtained under conditions of no fishing mortality.

the assessment model assumed that spiny lobsters were unaffected by Hurricanes Irma and Maria in 2017, and that the only impact on the population was a reduction in catch, leaving the uncaught population in the water.

At their October 2019 meeting, the Council's SSC reviewed the results from SEDAR 57 and determined that the stock assessments are suitable for management advice. Specifically, the SSC (1) supported the three island-based spiny lobster stock assessments (statistical catch at age models) as providing the best scientific information available relative to the SDC of overfishing status and overfished status; (2) accepted the $F_{SPR30\%}$ as an MSY proxy; (3) supported the outcome of the SEDAR 57 that overfishing is not occurring relative to the recommended MFMT and that the populations are not overfished relative to the recommended MSST; and (4) supported and recommended the use of the assessments to update the values for management reference points and SDC in each of the island-based FMPs, once approved and implemented, using the Council's ABC control rule included in the island-based FMPs.

1.3 ABC Control Rule Tier Update for Spiny Lobster

In the ABC control rule included in each island-based FMP, Tier 4a stocks are considered data limited with no accepted assessment, but with relatively low vulnerability to fishing pressure. Spiny lobster was considered to be a Tier 4a stock in each island-based FMP due in part to recruitment (the species is found throughout the Caribbean and the duration of the larval stage is several months) and sizes of spiny lobsters harvested compared to the minimum size limit in place (average carapace lengths observed were greater than the minimum size limit).

In the island-based FMPs, for Tier 4a stocks, the MSY proxy, MFMT, and MSST were defined, but due to data limitations, these reference points were not quantified. Similarly under Tier 4a, the OFL could not be quantified; thus, a new reference point, the sustainable yield level (SYL), which is a level of landings that can be sustained over the long-term, was used as the OFL proxy. The SYL 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, and therefore it is specific to Tier 4.

Following acceptance of the SEDAR 57 assessments, which determined MSY proxy, MFMT, and MSST reference points consistent with the ABC control rule in the island-based FMPs, the spiny lobster stock in each island/island group would be characterized under a different tier of the ABC control rule, with reference points consistent with that tier. The MSY proxy, MFMT, and MSST reference points determined from SEDAR 57 would be specified for spiny lobster stocks in Puerto Rico, St. Thomas/St. John, and St. Croix and would remain in place until new stock assessments for spiny lobster are conducted. SEDAR 57 projected provisional OFLs corresponding to the level of catch at the MSY proxy, which could be updated to account for

substantial changes in actual landings data from the landings data used in the assessment, if so requested by the Council.

At their December 2019 meeting, the Council reviewed the SEDAR 57 results presented by the SEFSC and the recommendations from the SSC. The SEFSC also presented a summary of the ABC control rule contained in each island-based FMP and how the control rule estimates ABC from OFL for stocks based on an accepted stock assessment (Tiers 1-3). For Tiers 1-3 of the ABC control rule, the ABC is determined from the OFL, as reduced or buffered by scientific uncertainty (represented by sigma) and reflecting the Council's acceptable probability of overfishing (represented by P*), which reflects the risk level the Council is willing to take. Scientific uncertainty is quantified by the SSC, by taking into account various information about the species life history and ecological function, perceived level of depletion, and vulnerability of the stock to collapse. The acceptable P* determined by the Council cannot exceed 50 percent (i.e., 0.50). At a P* of 0.5, the OFL would be set equal to the ABC, which implies that there is no scientific uncertainty. A P* at or near 0.5 should only be considered for data-rich assessments, when scientific uncertainty can be assumed to be negligible, which is not a condition currently in the U.S. Caribbean. A selection of lower P* values would avoid triggering overfished or overfishing determinations. An overfishing determination would require that the Council takes immediate action to end overfishing, and an overfished determination would require the implementation of a rebuilding plan to bring the stock back up to an acceptable level of biomass.

Preliminary ABC estimates presented at the December 2019 Council meeting, used an assumed P* and sigma, and the SEFSC noted that further input would be needed from the Council (P*) and its SSC (sigma). Following the SEFSC presentation, the Council requested that the SEFSC update the OFL projections and ABC estimates using updated landings data[3] over a range of preliminary P* values (0.40-0.45).

At their May 2020 meeting, the SSC reviewed the updated spiny lobster OFL projections and ABC estimates for each island/island group. The SSC agreed that although the spiny lobster stock assessment technically qualified as Tier 2 (data moderate) in the Council's ABC control rule included in the island-based FMPs, due to the uncertainty in the catch data, the assessment should be classified as Tier 3 (data limited). In order to determine ABCs using Tier 3 of the ABC control rule, the SSC selected a sigma (σ) of 1.0 (estimated using a σ_{min} value of 0.5 and a multiplier of 2.0) for spiny lobster for each island/island group. The SSC agreed that the preliminary selected range of P* (0.40 – 0.45) is reasonable for the Council to consider, and based on the updated OFL projections, recommended ABCs representing their scientific

[3] The 2017 and 2018 landings data used in the assessment were provisional at the time the assessments were conducted. The SEFSC staff noted that those landings data would be available as of December 2019, and the projections could be updated with the more recent data if so requested by the Council.

uncertainty over that range. Additionally, the SSC recommended that once the Council selects its P*, the OFL projections and ABC estimates for spiny lobster should be updated for all three islands/island groups using 2019 and 2020 data as soon as they are available.[4]

1.4 Purpose and Need

The purpose of this Amendment is to modify the management reference points and SDC for spiny lobster in each of the Puerto Rico, St. Thomas/St. John, and St. Croix FMPs based on results of the SEDAR 57 stock assessment as requested by the Council.

The need for this Amendment is to update the values for management reference points and SDC for spiny lobster in each of the Puerto Rico, St. Thomas/St. John, and St. Croix FMPs based on best scientific information available for spiny lobster stocks to prevent overfishing and achieve OY consistent with the requirements of the Magnuson-Stevens Act.

1.5 History of Federal Management

Prior to the development of the island-based FMPs, spiny lobster in the U.S. Caribbean was managed under the Spiny Lobster FMP (CMFC 1981; 49 FR 50049), as amended. The history of management actions taken to date under the Spiny Lobster FMP are summarized in Appendix C of each island-based FMP.

On June 26, 2020, a **Notice of Availability** (NOA; 85 FR 38350) was published requesting comments on the three island-based FMPs. If approved, the Puerto Rico FMP (CFMC 2019a), the St. Thomas and St. John FMP (CFMC 2019b), and the St. Croix FMP (CFMC 2019c), in combination, would replace the existing U.S. Caribbean-wide FMPs, including the Spiny Lobster FMP. Each island-based FMP would establish management measures for the EEZ around the respective island. The island-based FMPs would update the list of species included for federal management, management reference points and SDC, including ACLs, and accountability measures, but would retain most of the other management measures established under the U.S. Caribbean-wide FMPs that apply to the respective island management area (e.g., seasonal and area closures, minimum size limits, recreational bag limits).

[4] For Puerto Rico, 2020 landings were estimated using average landings from 2017-2019. For St. Thomas/St. John and St. Croix, 2019 and 2020 landings were estimated using average landings from 2016-2018.

2. MANAGEMENT OPTIONS

Framework procedures for modifying management measures listed in each of the island-based fishery management plans (FMP) included situations in which a new stock assessment indicates changes should be made to related management reference points and status determination criteria (SDC). Based on the SEDAR 57 results for spiny lobster in Puerto Rico, St. Thomas/St. John, and St. Croix, and using Tier 3 of the Caribbean Fishery management Council's (Council) Acceptable Biological Catch (ABC) control rule included in each island-based FMP, this framework amendment would update the values for the following reference points: maximum sustainable yield (MSY) or MSY proxy, maximum fishing mortality threshold (MFMT), and minimum stock size threshold (MSST) (Table 2.1).

Table 2.1. Management reference points from SEDAR 57 spiny lobster stock assessments for each island/island group.

Management Reference Point	Puerto Rico	St. Thomas/St. John	St. Croix
MSY proxy*	432,501	133,601	127,742
MFMT (F_{SPR30})	0.197	0.244	0.203
MSST (0.75*SSB_{MFMT}) (1000 eggs)	8.48 E+07	2.13 E+07	2.30 E+07

* Values are in pounds whole weight.

Additionally, based on SEDAR projections and provisional landings data through 2020, the framework amendment would update the OFLs for spiny lobster from 2021-2026 for each island/island group (Table 2.2).

Table 2.2. Projected OFLs for spiny lobster for 2021-2026 for each island/island group based on SEDAR 57. Values are in pounds whole weight.

Year	Puerto Rico	St. Thomas/St. John	St. Croix
2021	406,257	186,341	197,709
2022	425,164	160,714	158,538
2023	430,109	148,335	143,801
2024	431,140	142,313	137,668
2025	431,566	139,044	134,529
2026	431,905	137,056	132,599

Other management reference points updated in this framework amendment, based on SEDAR 57 determinations and following the update to Tier 3 of the ABC control rule included in each island-based FMP, would include the ABC (Action 1) and the annual catch limit (ACL) (Action 2) for the Puerto Rico, St. Thomas/St. John, and St. Croix spiny lobster stocks.

2.1 Action 1 – Update ABCs for Spiny Lobster in the Puerto Rico, St. Thomas/St. John, and St. Croix FMPs

For stocks and stock complexes required to have an ABC, each Council must establish an ABC control rule that accounts for scientific uncertainty in the OFL and for the Council's risk policy, and that is based on a comprehensive analysis that shows how the control rule prevents overfishing. The Council's risk policy could be based on an acceptable probability (at least 50%) that catch equal to the stock's ABC will not result in overfishing. The Council's choice of a risk policy cannot result in an ABC that exceeds the OFL (50 CFR 600.310(f)(2)(i)). Councils and their scientific and statistical committee (SSC) should develop a process by which the SSC can access the best scientific information available when implementing the ABC control rule (i.e., specifying the ABC (50 CFR 600.310(f)(3)).

Each of the Puerto Rico, St. Thomas/St. John, and St. Croix FMPs contains the Council's ABC control rule (Appendix A). Under Tier 3 of the ABC control rule, the ABC is derived from the OFL, reduced by the SSC's scientific uncertainty buffer and reflecting the acceptable probability of overfishing (P*) determined by the Council. Under Action 1, the Council would select their P* for the spiny lobster stock for each island/island group and accept the SSC's ABC recommendation associated with that P*. The Council could select a different option for each island/island group.

2.1.1 Proposed Options for Action 1

Option 1: No Action. Retain the ABC specified for spiny lobster using Tier 4a of the ABC control rule under the Puerto Rico FMP (Table 2.3), St. Thomas/St. John FMP (Table 2.4), or St. Croix FMP (Table 2.5).

Option 2: Using Tier 3 of the ABC Control Rule in the island-based FMPs, select a P* of 0.40 and accept the resulting ABC recommendation from the SSC based on SEDAR 57 (Tables 2.3 - 2.5).

Option 3: Using Tier 3 of the ABC Control Rule in the island-based FMPs, select a P* of 0.41 and accept the resulting ABC recommendation from the SSC based on SEDAR 57 (Tables 2.3 - 2.5).

Option 4: Using Tier 3 of the ABC Control Rule in the island-based FMPs, select a P* of 0.42 and accept the resulting ABC recommendation from the SSC based on SEDAR 57 (Tables 2.3 - 2.5).

Option 5: Using Tier 3 of the ABC Control Rule in the island-based FMPs, select a P* of 0.43 and accept the resulting ABC recommendation from the SSC based on SEDAR 57 (Tables 2.3 - 2.5).

Option 6: Using Tier 3 of the ABC Control Rule in the island-based FMPs, select a P* of 0.44 and accept the resulting ABC recommendation from the SSC based on SEDAR 57 (Tables 2.3 - 2.5).

Option 7 (preliminary preferred for Puerto Rico, St. Thomas/St. John, and St. Croix): Using Tier 3 of the ABC Control Rule in the island-based FMPs, select a P* of 0.45 and accept the resulting ABC recommendation from the SSC based on SEDAR 57 (Tables 2.3 - 2.5).

Table 2.3. Spiny lobster ABCs recommended by the Council's SSC for Puerto Rico based on the range of P* options under Action 1. All values are in pounds whole weight.

Year	Option 1 (No Action)	Option 2 ABC at P* = 0.40	Option 3 ABC at P* = 0.41	Option 4 ABC at P* = 0.42	Option 5 ABC at P* = 0.43	Option 6 ABC at P* = 0.44	Option 7 (prel. pref.) ABC at P* = 0.45
2021	554,981	315,336	323,578	331,986	340,567	349,330	358,283
2022	554,981	330,011	338,637	347,436	356,417	365,587	374,958
2023	554,981	333,850	342,576	351,477	360,562	369,839	379,319
2024	554,981	334,651	343,398	352,320	361,427	370,727	380,229
2025	554,981	334,981	343,736	352,668	361,784	371,092	380,604
2026+	554,981	335,244	344,007	352,945	362,068	371,384	380,903

Table 2.4. Spiny lobster ABCs recommended by the Council's SSC for St. Thomas/St. John based on the range of P* options under Action 1. All values are in pounds whole weight.

Year	Option 1 (No Action)	Option 2 ABC at P* = 0.40	Option 3 ABC at P* = 0.41	Option 4 ABC at P* = 0.42	Option 5 ABC at P* = 0.43	Option 6 ABC at P* = 0.44	Option 7 (prel. pref.) ABC at P* = 0.45
2021	220,221	144,638	148,418	152,275	156,211	160,230	164,337
2022	220,221	124,746	128,006	131,332	134,727	138,194	141,736
2023	220,221	115,137	118,147	121,217	124,350	127,549	130,819
2024	220,221	110,463	113,351	116,296	119,302	122,371	125,508
2025	220,221	107,926	110,747	113,624	116,561	119,560	122,625
2026+	220,221	106,383	109,163	112,000	114,895	117,851	120,872

Table 2.5. Spiny lobster ABCs recommended by the Council's SSC for St. Croix based on the range of P* options under Action 1. All values are in pounds whole weight.

Year	Option 1 (No Action)	Option 2 ABC at P* = 0.40	Option 3 ABC at P* = 0.41	Option 4 ABC at P* = 0.42	Option 5 ABC at P* = 0.43	Option 6 ABC at P* = 0.44	Option 7 (prel. pref.) ABC at P* = 0.45
2021	207,925	153,462	157,473	161,565	165,741	170,005	174,363
2022	207,925	123,057	126,273	129,554	132,903	136,322	139,817
2023	207,925	111,618	114,536	117,512	120,549	123,651	126,820
2024	207,925	106,858	109,651	112,500	115,408	118,377	121,411
2025	207,925	104,421	107,151	109,935	112,776	115,678	118,643
2026+	207,925	102,923	105,614	108,358	111,159	114,019	116,941

2.1.2 Discussion of Action 1 Options

Option 1 (No Action) would retain the ABC recommended by the SSC for spiny lobster under the Puerto Rico FMP, St. Thomas/St. John FMP, or St. Croix FMP. The ABCs recommended under the island-based FMPs were determined using Tier 4 of the ABC Control Rule, which was defined as data limited with no accepted assessment available. However, the Council's SSC agreed with the Southeast Fisheries Science Center (SEFSC) that the SEDAR 57 stock assessments represent the best scientific information available, and are suitable for management advice. Therefore, for each island/island group, the spiny lobster stock would qualify as a Tier 3 stock under the Council's ABC control rule. As such, the Council's SSC provided new recommendations of ABC based on OFL projections from the SEDAR 57 stock assessments using Tier 3 ABC determinations (Appendix A). **Option 1** would not allow for an update of SDC and management measures based on stock assessment results and using the best scientific information available, which is contrary to National Standard 2 of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act).

Options 2 - 7 would specify ABCs based on recommendations from the Council's SSC using the ABC control rule Tier 3 determinations, which reduce the SEDAR 57 projected OFLs by the SSC's scientific uncertainty buffer and the Council's acceptable probability of overfishing (P*). The P* values suggested in **Options 2 - 7** are less than the maximum acceptable probability (0.50) that catch equal to the stock's ABC will not result in overfishing, as explained in NMFS's guidelines on National Standard 1 of the Magnuson-Stevens Act (50 CFR 600.310(f)(2)(i)). Under **Options 2 - 7**, the Council's risk policy (i.e., probability of overfishing) increases in risk as the P* increases towards 0.5. **Option 2** (P* = 0.40) would have the lowest probability of overfishing of the options, and would result in the lowest ABC within a given year for each island/island group (Tables 2.3 - 2.5). Conversely, **Option 7** (P* = 0.45), which was selected as preliminary preferred by the Council at their June 2020 meeting, would have the greatest probability of overfishing of the options, and would result in the greatest ABC within a given year for each island/island group (Tables 2.3 - 2.5). The probability of overfishing and ABCs for

Option 3 (P* = 0.41)**, Option 4** (P* = 0.42)**, Option 5** (P* = 0.43)**,** and **Option 6** (P* = 0.44) would fall between that of **Option 2** and **Option 7.**

Even though **Option 7** has the smallest buffer between OFL and ABC, the Council preliminary selected this probability of overfishing for all three island-based FMPs based on the current management measures in place for the spiny lobster (e.g., minimum size limit of 3.5 inch carapace length) in both state and federal waters, high degree of compliance with the regulations, the long history of stable landings, and other specific life history parameters, which are pertinent to each island/island group.

For **Options 2 – 7,** after 2026, subsequent ABCs would be set equal to the ABC recommended by the SSC for 2026.

2.2 Action 2 – Update ACLs for Spiny Lobster in the Puerto Rico, St. Thomas/St. John, and St. Croix FMPs

Under the Magnuson-Stevens Act, the Council shall develop ACLs for each of its managed fisheries that may not exceed the fishing level recommendations of its SSC (i.e., ABCs) (Magnuson-Stevens Act section 302(h)(6); 50 CFR 600.310(b)(2)(v)(D)). ACLs can be set annually or on a multi-year basis, and in coordination with accountability measures (AM) must prevent overfishing (50 CFR 600.310(f)(4)(i)). In addition, the ACLs and AMs are among the conservation and management measures designed to achieve optimum yield (OY) from the fishery on a continuing basis (50 CFR 600.310(e)(3)(ii)). The OY is intended to provide the greatest overall benefit to the nation, and is established considering ecological, economic, and social factors (Magnuson-Stevens Act 3(33)).

Under Action 2, the Council would select the process for determining the ACL from the ABC recommended by the SSC for spiny lobster in each island/island group based on the Council's management uncertainty.[5] As described in each island-based FMP, the ACL would be set equal to OY for the stock. The Council could select a different option for each island/island group to be implemented in the EEZ applicable to each island/island group.

2.2.1 Proposed Options for Action 2

Option 1: No Action. Retain the ACL (=OY) specified for spiny lobster under the Puerto Rico FMP (Table 2.6), St. Thomas/St. John FMP (Table 2.7), or St. Croix FMP (Table 2.8).

[5] 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; underreporting of catches; lack of sufficient in-season management, including in-season closure authority; or other factors. 50 CFR 600.310(f)(1)(v)

Option 2: Set the ACL (=OY) equal to the ABC recommended by the SSC based on SEDAR 57, as reduced by a management uncertainty buffer in one of the sub-options below (Table 2.6 – 2.8):

Sub-option 2a. OY = ACL = ABC

Sub-option 2b. OY = ACL = ABC x 0.95

Sub-option 2c. OY = ACL = ABC x 0.90

Option 3: Set the ACL (=OY) equal to the minimum ABC recommended by the SSC based on SEDAR 57 for the 2021 to 2026 time period, as reduced by a management uncertainty buffer in one of the sub-options below (Table 2.6 – 2.8):

Sub-option 3a. OY = ACL = $ABC_{min\ 2021\text{-}2026}$

Sub-option 3b. OY = ACL = $ABC_{min\ 2021\text{-}2026}$ x 0.95

Sub-option 3c. OY = ACL = $ABC_{min\ 2021\text{-}2026}$ x 0.90

Table 2.6. Spiny lobster ACLs for Puerto Rico based on the options under Action 2 based on the ABCs recommended by the Council's SSC over the range of P* options under Action 1. All values are in pounds whole weight.

Year	Option 1 (No Action)	Sub-option 2a ACL=ABC	Sub-option 2b ACL=ABC*0.95	Sub-option 2c ACL=ABC*0.90	Sub-option 3a ACL=ABC	Sub-option 3b ACL=ABC*0.95	Sub-option 3c ACL=ABC*0.90
ABC at P* = 0.40							
2021	527,232	315,336	299,569	283,802	315,336	299,569	283,802
2022	527,232	330,011	313,510	297,010	315,336	299,569	283,802
2023	527,232	333,850	317,158	300,465	315,336	299,569	283,802
2024	527,232	334,651	317,918	301,186	315,336	299,569	283,802
2025	527,232	334,981	318,232	301,483	315,336	299,569	283,802
2026+	527,232	335,244	318,482	301,720	315,336	299,569	283,802
ABC at P* = 0.41							
2021	527,232	323,578	307,399	291,220	323,578	307,399	291,220
2022	527,232	338,637	321,705	304,773	323,578	307,399	291,220
2023	527,232	342,576	325,447	308,318	323,578	307,399	291,220
2024	527,232	343,398	326,228	309,058	323,578	307,399	291,220
2025	527,232	343,736	326,549	309,362	323,578	307,399	291,220
2026+	527,232	344,007	326,807	309,606	323,578	307,399	291,220
ABC at P* = 0.42							
2021	527,232	331,986	315,387	298,787	331,986	315,387	298,787
2022	527,232	347,436	330,064	312,692	331,986	315,387	298,787
2023	527,232	351,477	333,903	316,329	331,986	315,387	298,787
2024	527,232	352,320	334,704	317,088	331,986	315,387	298,787
2025	527,232	352,668	335,035	317,401	331,986	315,387	298,787
2026+	527,232	352,945	335,298	317,651	331,986	315,387	298,787
ABC at P* = 0.43							
2021	527,232	340,567	323,539	306,510	340,567	323,539	306,510
2022	527,232	356,417	338,596	320,775	340,567	323,539	306,510
2023	527,232	360,562	342,534	324,506	340,567	323,539	306,510
2024	527,232	361,427	343,356	325,284	340,567	323,539	306,510
2025	527,232	361,784	343,695	325,606	340,567	323,539	306,510
2026+	527,232	362,068	343,965	325,861	340,567	323,539	306,510
ABC at P* = 0.44							
2021	527,232	349,330	331,864	314,397	349,330	331,864	314,397

Year	Option 1 (No Action)	Sub-option 2a ACL=ABC	Sub-option 2b ACL=ABC*0.95	Sub-option 2c ACL=ABC*0.90	Sub-option 3a ACL=ABC	Sub-option 3b ACL=ABC*0.95	Sub-option 3c ACL=ABC*0.90
2022	527,232	365,587	347,308	329,028	349,330	331,864	314,397
2023	527,232	369,839	351,347	332,855	349,330	331,864	314,397
2024	527,232	370,727	352,191	333,654	349,330	331,864	314,397
2025	527,232	371,092	352,537	333,983	349,330	331,864	314,397
2026+	527,232	371,384	352,815	334,246	349,330	331,864	314,397
ABC at P* = 0.45							
2021	527,232	358,283	340,369	322,455	358,283	340,369	322,455
2022	527,232	374,958	356,210	337,462	358,283	340,369	322,455
2023	527,232	379,319	360,353	341,387	358,283	340,369	322,455
2024	527,232	380,229	361,218	342,206	358,283	340,369	322,455
2025	527,232	380,604	361,574	342,544	358,283	340,369	322,455
2026+	527,232	380,903	361,858	342,813	358,283	340,369	322,455

Table 2.7. Spiny lobster ACLs for St. Thomas/St. John based on the options under Action 2 based on the ABCs recommended by the Council's SSC over the range of P* options under Action 1. All values are in pounds whole weight.

Year	Option 1 (No Action)	Sub-option 2a ACL=ABC	Sub-option 2b ACL=ABC*0.95	Sub-option 2c ACL=ABC*0.90	Sub-option 3a ACL=ABC	Sub-option 3b ACL=ABC*0.95	Sub-option 3c ACL=ABC*0.90
ABC at P* = 0.40							
2021	209,210	144,638	137,406	130,174	106,383	101,064	95,745
2022	209,210	124,746	118,509	112,271	106,383	101,064	95,745
2023	209,210	115,137	109,380	103,623	106,383	101,064	95,745
2024	209,210	110,463	104,940	99,417	106,383	101,064	95,745
2025	209,210	107,926	102,530	97,133	106,383	101,064	95,745
2026+	209,210	106,383	101,064	95,745	106,383	101,064	95,745
ABC at P* = 0.41							
2021	209,210	148,418	140,997	133,576	109,163	103,705	98,247
2022	209,210	128,006	121,606	115,205	109,163	103,705	98,247
2023	209,210	118,147	112,240	106,332	109,163	103,705	98,247
2024	209,210	113,351	107,683	102,016	109,163	103,705	98,247
2025	209,210	110,747	105,210	99,672	109,163	103,705	98,247

Year	Option 1 (No Action)	Sub-option 2a ACL=ABC	Sub-option 2b ACL=ABC*0.95	Sub-option 2c ACL=ABC*0.90	Sub-option 3a ACL=ABC	Sub-option 3b ACL=ABC*0.95	Sub-option 3c ACL=ABC*0.90
2026+	209,210	109,163	103,705	98,247	109,163	103,705	98,247
ABC at P* = 0.42							
2021	209,210	152,275	144,661	137,048	112,000	106,400	100,800
2022	209,210	131,332	124,765	118,199	112,000	106,400	100,800
2023	209,210	121,217	115,156	109,095	112,000	106,400	100,800
2024	209,210	116,296	110,481	104,666	112,000	106,400	100,800
2025	209,210	113,624	107,943	102,262	112,000	106,400	100,800
2026+	209,210	112,000	106,400	100,800	112,000	106,400	100,800
ABC at P* = 0.43							
2021	209,210	156,211	148,400	140,590	114,895	109,150	103,406
2022	209,210	134,727	127,991	121,254	114,895	109,150	103,406
2023	209,210	124,350	118,133	111,915	114,895	109,150	103,406
2024	209,210	119,302	113,337	107,372	114,895	109,150	103,406
2025	209,210	116,561	110,733	104,905	114,895	109,150	103,406
2026+	209,210	114,895	109,150	103,406	114,895	109,150	103,406
ABC at P* = 0.44							
2021	209,210	160,230	152,219	144,207	117,851	111,958	106,066
2022	209,210	138,194	131,284	124,375	117,851	111,958	106,066
2023	209,210	127,549	121,172	114,794	117,851	111,958	106,066
2024	209,210	122,371	116,252	110,134	117,851	111,958	106,066
2025	209,210	119,560	113,582	107,604	117,851	111,958	106,066
2026+	209,210	117,851	111,958	106,066	117,851	111,958	106,066
ABC at P* = 0.45							
2021	209,210	164,337	156,120	147,903	120,872	114,828	108,785
2022	209,210	141,736	134,649	127,562	120,872	114,828	108,785
2023	209,210	130,819	124,278	117,737	120,872	114,828	108,785
2024	209,210	125,508	119,233	112,957	120,872	114,828	108,785
2025	209,210	122,625	116,494	110,363	120,872	114,828	108,785
2026+	209,210	120,872	114,828	108,785	120,872	114,828	108,785

Table 2.8. Spiny lobster ACLs for St. Croix based on the options under Action 2 based on the ABCs recommended by the Council's SSC over the range of P* options under Action 1. All values are in pounds whole weight.

Year	Option 1 (No Action)	Sub-option 2a ACL=ABC	Sub-option 2b ACL=ABC*0.95	Sub-option 2c ACL=ABC*0.90	Sub-option 3a ACL=ABC	Sub-option 3b ACL=ABC*0.95	Sub-option 3c ACL=ABC*0.90
ABC at P* = 0.40							
2021	197,528	153,462	145,789	138,116	102,923	97,777	92,631
2022	197,528	123,057	116,904	110,751	102,923	97,777	92,631
2023	197,528	111,618	106,037	100,456	102,923	97,777	92,631
2024	197,528	106,858	101,515	96,172	102,923	97,777	92,631
2025	197,528	104,421	99,200	93,979	102,923	97,777	92,631
2026+	197,528	102,923	97,777	92,631	102,923	97,777	92,631
ABC at P* = 0.41							
2021	197,528	157,473	149,599	141,726	105,614	100,333	95,053
2022	197,528	126,273	119,959	113,646	105,614	100,333	95,053
2023	197,528	114,536	108,809	103,082	105,614	100,333	95,053
2024	197,528	109,651	104,168	98,686	105,614	100,333	95,053
2025	197,528	107,151	101,793	96,436	105,614	100,333	95,053
2026+	197,528	105,614	100,333	95,053	105,614	100,333	95,053
ABC at P* = 0.42							
2021	197,528	161,565	153,487	145,409	108,358	102,940	97,522
2022	197,528	129,554	123,076	116,599	108,358	102,940	97,522
2023	197,528	117,512	111,636	105,761	108,358	102,940	97,522
2024	197,528	112,500	106,875	101,250	108,358	102,940	97,522
2025	197,528	109,935	104,438	98,942	108,358	102,940	97,522
2026+	197,528	108,358	102,940	97,522	108,358	102,940	97,522
ABC at P* = 0.43							
2021	197,528	165,741	157,454	149,167	111,159	105,601	100,043
2022	197,528	132,903	126,258	119,613	111,159	105,601	100,043
2023	197,528	120,549	114,522	108,494	111,159	105,601	100,043
2024	197,528	115,408	109,638	103,867	111,159	105,601	100,043
2025	197,528	112,776	107,137	101,498	111,159	105,601	100,043
2026+	197,528	111,159	105,601	100,043	111,159	105,601	100,043
ABC at P* = 0.44							
2021	197,528	170,005	161,505	153,005	114,019	108,318	102,617

Year	Option 1 (No Action)	Sub-option 2a ACL=ABC	Sub-option 2b ACL=ABC*0.95	Sub-option 2c ACL=ABC*0.90	Sub-option 3a ACL=ABC	Sub-option 3b ACL=ABC*0.95	Sub-option 3c ACL=ABC*0.90
2022	197,528	136,322	129,506	122,690	114,019	108,318	102,617
2023	197,528	123,651	117,468	111,286	114,019	108,318	102,617
2024	197,528	118,377	112,458	106,539	114,019	108,318	102,617
2025	197,528	115,678	109,894	104,110	114,019	108,318	102,617
2026+	197,528	114,019	108,318	102,617	114,019	108,318	102,617
ABC at P* = 0.45							
2021	197,528	174,363	165,645	156,927	116,941	111,094	105,247
2022	197,528	139,817	132,826	125,835	116,941	111,094	105,247
2023	197,528	126,820	120,479	114,138	116,941	111,094	105,247
2024	197,528	121,411	115,340	109,270	116,941	111,094	105,247
2025	197,528	118,643	112,711	106,779	116,941	111,094	105,247
2026+	197,528	116,941	111,094	105,247	116,941	111,094	105,247

2.2.2 Discussion of Action 2 Options

Option 1 (No Action) would retain the ACL (=OY) specified for spiny lobster under the Puerto Rico FMP, St. Thomas/St. John FMP, or St. Croix FMP. The ACLs specified under the island-based FMPs were determined using the Council's management uncertainty buffer (0.95) as applied to the recommended ABC from Tier 4 of the ABC Control Rule (defined as data limited with no accepted assessment available). However, the Council's SSC agreed with the SEFSC that the SEDAR 57 stock assessments represent the best scientific information available, and are suitable for management advice. **Option 1** would not update the ACL using the best scientific information available, which is contrary to National Standard 2 of the Magnuson-Stevens Act. Additionally, **Option 1** would be inconsistent with the decision to update the SDC (MFMT, MSST, and OFL) and management reference points (MSY and ABC) for spiny lobster stocks in each island/island group in this framework amendment and in Action 1.

Option 2 would set the ACL (=OY) each year during the 2021-2026 time period equal to the ABC recommended by the SSC for that year, as reduced by the Council's management uncertainty buffer (Tables 2.6 – 2.8). The ACLs would change each year from 2021 through 2026. After 2026, subsequent ACLs would be set equal to the ACL for 2026. This option could require an additional action to revise the AMs for spiny lobster.

Sub-option 2a would set the ACL (=OY) equal to the ABC, with no management uncertainty buffer. This sub-option would allow for the greatest level of catch of spiny lobster each year, but would have the greatest risk of reaching or exceeding the OFL. This sub-option assumes no management uncertainty.

Sub-option 2b would set the ACL (=OY) equal to 95% of the ABC, which is the same ABC to ACL management uncertainty buffer (0.95) used in the island-based FMPs for spiny lobster. This sub-option 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-option 2c would set the ACL (=OY) equal to 90% of the ABC, using a larger management uncertainty buffer that the other sub-options. This would provide a greater buffer between the ACL and the ABC, and would result in the lowest level of catch allowed each year. This level of reduction to account for management uncertainty was previously used by the Council when establishing an ACL for stocks identified as not undergoing overfishing in the 2011 Caribbean ACL Amendment.

Option 3 would set a multi-year, constant ACL that would be applicable from 2021 until the Council revisits the ACL. The ACL (=OY) would be equal to the lowest ABC value recommended by the SSC during 2021-2026, as reduced by the Council's management

uncertainty buffer selected in **Sub-options 3a-3c**. This option may not require an additional action to revise the AMs, since the ACLs would not be changing from year to year, and it may be possible to use the phase-in sequence described in the island-based FMPs. **Sub-options 3a-3c** would use the same management uncertainty buffers described above for **Sub-options 2a-2c**.

3. References

CFMC (Caribbean Fishery Management Council). 1981. Fishery management plan, final environmental impact statement, and regulatory impact review for the spiny lobster fishery of Puerto Rico and the U.S. Virgin Islands. Caribbean Fishery Management Council, San Juan, Puerto Rico.

CFMC (Caribbean Fishery Management Council). 2011a. Amendment 2 to the Fishery Management Plan for the Queen Conch Fishery of Puerto Rico and the U.S. Virgin Islands and Amendment 5 to the Reef Fish Fishery Management Plan of Puerto Rico and the U.S. Virgin Islands. Caribbean Fishery Management Council, San Juan, Puerto Rico. September 22, 2011. 523 pp + Appendices.

CFMC (Caribbean Fishery Management Council). 2011b. Comprehensive Annual Catch Limit (ACL) Amendment for the Fishery Management Plans of the U.S. Caribbean. Caribbean Fishery Management Council, San Juan, Puerto Rico. 407 pp.

CFMC (Caribbean Fishery Management Council). 2019a. Comprehensive Fishery Management Plan for the Puerto Rico Exclusive Economic Zone, environmental assessment, regulatory impact review, and fishery impact statement. Caribbean Fishery Management Council, San Juan, Puerto Rico. 637 pp.

CFMC (Caribbean Fishery Management Council). 2019b. Comprehensive Fishery Management Plan for the St. Thomas/ St. John Exclusive Economic Zone, environmental assessment, regulatory impact review, and fishery impact statement. Caribbean Fishery Management Council, San Juan, Puerto Rico. 507 pp.

CFMC (Caribbean Fishery Management Council). 2019c. Comprehensive Fishery Management Plan for the St. Croix Exclusive Economic Zone, environmental assessment, regulatory impact review, and fishery impact statement. Caribbean Fishery Management Council, San Juan, Puerto Rico. 509 pp.

SEDAR 57. 2019. Stock Assessment Report U.S. Caribbean Spiny Lobster Southeast Data, Assessment, and Review. North Charleston, South Carolina. https://sedarweb.org/sedar-57

Appendix A. Island-based Fishery Management Plans
Acceptable Biological Catch (ABC) Control Rule

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 MSST = 0.75*long-term Spawning Stock Biomass at MFMT (SSB_{MFMT}) 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 (σ), where the PDF is determined from the assessment (where $\sigma > \sigma_{min}$) [3]. ABC= d * OFL where d = Scalar if $B \geq B_{MSY}$; Scalar * ($B-B_{critical}$) / ($B_{MSY}-B_{critical}$) if $B < B_{MSY}$ Scalar = 1 if acceptable probability of overfishing is specified (<0.5), < 1 if not specified (=0.5). $B_{critical}$ is defined as the minimum level of depletion at which fishing would be allowed.
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 (σ) must be greater than 1.5 σ_{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 MSST = 0.75* SSB_{MFMT} or proxy OFL = Catch at MFMT
ABC	ABC determined from OFL as reduced (buffered) by scientific uncertainty[4] and reflecting the acceptable probability of overfishing[2] a. Where the buffer is applied to the PDF of OFL when the PDF is determined from the assessment (with $\sigma \geq 2\sigma_{min}$) **OR** b. Where ABC = buffer * OFL, where buffer must be ≤ 0.9
Tier 4: Data Limited: No Accepted Assessment Available	
MSY	MSY proxy = long-term yield at proxy for F_{MSY}.
SDC	MFMT = F_{MSY} proxy MSST = 0.75* SSB_{MFMT} Sustainable yield level (SYL)[5] = a level of landings that can be sustained over the long-term. OFL proxy = SYL
Tier 4a **Conditions for Use**	No accepted[6] 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[7] cannot be reached on the use of Tier 4a, Tier 4b should be used.
SYL	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. Scalar ≤ 3 depending on perceived degree of exploitation, life history and ecological function.
ABC	ABC = buffer * SYL, where buffer must be ≤ 0.9 (e.g., 0.9, 0.8, 0.75, 0.70…) based on the SSC's determination of scientific uncertainty[8].
Tier 4b **Conditions for Use**	No accepted[6] 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.
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. Scalar < 2 depending on perceived degree of exploitation, life history, and ecological function.
ABC	ABC[9] = buffer * SYL, where buffer must be ≤ 0.9 (e.g., 0.9, 0.8, 0.75, 0.70…) based on the SSC's determination of scientific uncertainty[8].
Footnotes	[1]Scientific uncertainty would take into account, but not be limited to, the species life history and ecological function. [2]Acceptable probability of overfishing determined by Council. [3]σ_{min} could be equal to coefficient of variation; σ_{min} is in a log scale. [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. [5]MSY $\geq$SYL. See Appendix G for a detailed explanation of SYL. [6]Accepted means that the assessment was approved by the SSC as being appropriate for management purposes. [7]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. [8]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. [9]The ABC for a Tier 4b stock should not exceed mean landings during the reference period.

The ABC control rule contained in each island-based fishery management plan (FMP) would replace the current ABC control rules included in the 2010 Caribbean Annual Catch Limit (ACL) Amendment (CFMC 2011a) and 2011 Caribbean ACL Amendment (CFMC 2011b), as applicable. The island-based FMPs would provide a complete revision of reference points and status determination criteria (SDC) for stocks and stock complexes included for management following a three-step process:

Step 1 adopts and applies a newly devised, 4-tiered, ABC control rule to specify SDC and ABC recommendations depending on differing levels of data availability. Beginning with Tier 4 and moving up tier levels (lower tier numbers), successful application of each tier requires an increasing amount of information. 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 Puerto Rico, St. Thomas and St. John, and St. Croix FMPs. In Tier 4, the most data-limited of the options, a maximum sustainable yield (MSY) proxy, maximum fishing mortality threshold, and minimum stock size threshold 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 a new reference point, the sustainable yield level (SYL). The SYL is a level of landings that can be sustained over the long term. SYL is intended to be used when quantitative guidance with which to set MSY or an MSY proxy is not available. The SYL would serve as a proxy for the overfishing limit and a minimum estimate of MSY where MSY is greater than or equal to SYL.

Step 2 establishes a proxy to use when F_{MSY} cannot be determined, as in Tier 4 of the ABC control rule. For all three island management areas, the Council established a proxy equal to 30% of the maximum spawning potential of a stock under conditions of no fishing mortality ($F_{30\%SPR}$).

Step 3 applies a reduction factor, reflecting the Council's estimate of management uncertainty, to the recommended ABC for each stock/stock complex to specify the ACL. The optimum yield would be set equal to the ACL for each stock/stock complex.

The tiered approached to the ABC control rule better positions the Council to take advantage of future improvements in data and analytical methodologies. Revising the reference points and SDC based on recent landings data ensures to the greatest extent practicable that an appropriate period of stable and sustainable landings is identified and used for setting management reference points and SDC.