FLEXIBLE STATUS DETERMINATION CRITERIA EXAMPLES AND THEIR APPLICATION WHITE PAPER

BACKGROUND

Reporting on the status of fisheries is a fundamental part of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and it is a critical component of sustainable fisheries management in the United States. The MSA requires fishery management plans (FMPs) to specify "objective and measurable criteria for identifying when a fishery to which the plan applies is overfished," (MSA section 303(a)(10)). The National Standard 1 (NS1) guidelines explain that FMPs should describe how objective and measurable status determination criteria (SDC) will be specified to determine both overfishing and overfished status (50 CFR 600.310(b)(1)(ii)). Applying the SDC set forth in a FMP, the Secretary of Commerce determines if overfishing is occurring and if the stock or stock complex is overfished or approaching an overfished condition[1] (MSA section 304(e)). The MSA requires actions following many stock status determinations making this process particularly important.

Under the NS1 guidelines, in most cases, overfishing status is determined using one of the following methods: 1) A stock is subject to overfishing if the fishing mortality (F) exceeds the maximum fishing mortality rate (MFMT) or reasonable proxy; or 2) a stock is subject to overfishing if the amount of fish caught is greater than the overfishing limit (OFL).

Overfished status is usually determined by comparing biomass (B) or spawning stock biomass (SSB) to the minimum stock size threshold (MSST) or reasonable proxy, where the stock is overfished if it is below the MSST. The SDC for both overfishing and overfished determinations should be based on the stock or stock complex's capacity to produce the maximum sustainable yield (MSY) or reasonable proxy (50 CFR 600.310(e)(2)(ii)(A)(1) and (2)).

Regional Fishery Management Councils (Councils) include SDC in FMPs that they recommend to NOAA Fisheries for approval and the agency develops SDC for Secretarial FMPs (e.g., Atlantic Highly Migratory Species; MSA section 303(a)(10)). Stock assessments[2] analyze available data, typically using statistical models, and recommend stock status (i.e., whether the stock is subject to overfishing, overfished, or approaching an overfished condition) based on numerical estimates associated with FMP-established SDC. The Assistant Administrator for NOAA Fisheries[3] – through delegated authority – makes official overfishing and overfished stock status determinations (MSA section 304(e))[4].

[1] Stocks that are approaching an overfished condition are projected to be overfished within two years.
[2] In addition to stock assessments, other alternative methods specified in the FMP can be used to support stock status.
[3] Known informally as NOAA Fisheries, the official name of the agency in legislation and regulations is the National Marine Fisheries Service (NMFS).
[4] The agency makes stock status determinations consistent with NMFS Procedure 01-101-09, titled "*Procedures to Determine Stock Status and Rebuilding Progress*."

Based on outcomes from a stock assessment, scientists may recommend using new or different criteria than the SDC specified in an FMP because they regard the new criteria as a better indicator of stock status. These new criteria are evaluated during the peer review process. Based on the peer review and evaluation by NOAA Fisheries and the applicable Council's Scientific and Statistical Committee (SSC), NOAA Fisheries determines whether they are now the best scientific information available (BSIA) to support a stock status determination. Because status determinations must be based on the SDC in the FMP per the MSA, NOAA Fisheries does not use these new criteria for official stock status determinations until they are adopted in an FMP.[5] Adopting new SDC can result in delays in updating stock status determinations because amending an FMP can be a lengthy process. Several Councils have adopted flexible overfishing and overfished SDC in their FMPs that enable more timely stock status determinations in such situations. This document explores examples of these flexible SDC.

Terminology

Below is the terminology used in this document, and includes definitions from or based on the NS1 guidelines (50 CFR 600.310) and widely accepted working definitions.

1. Status determination criterion/criteria (SDC) – the measurable and objective factor(s)--maximum fishing mortality threshold (MFMT), overfishing limit (OFL), and minimum stock size threshold (MSST), or their proxies--that are used to determine if overfishing has occurred, or if the stock or stock complex is overfished (50 CFR 600.310(e)(2)(i)(A)). FMPs describe how overfishing and overfished status is determined relative to each SDC (e.g., a stock is subject to overfishing if fishing mortality exceeds MFMT).
2. Reference points – In the NS1 guidelines, "reference points" are defined as SDC, MSY, optimum yield (OY), acceptable biological catch (ABC), and annual catch limit (50 CFR 600.310(b)(2)(iv)).[6] For purposes of this document, the term is used to describe the specific limit reference points contained in the overfishing and overfished SDC.
3. Reference level – the basis (e.g., catch, fishing mortality (F), or stock size) for the SDC. For example, the reference level for MFMT could be based on F_{MSY} or an F_{MSY} proxy, such as $F_{35\%}$, and the reference level for MSST could be based on B_{MSY} or a B_{MSY} proxy, such as $B_{35\%}$ (where MSST = ½ B_{MSY} or the B_{MSY} proxy).
4. Numerical estimates of the reference level – the most recent numerical estimate of MFMT, OFL, and MSST. For example, 0.451 is the numerical estimate of the fishing mortality rate at the MFMT (based on the F_{MSY} proxy of $F_{35\%}$) and 24,780.5 metric tons is the numerical estimate of the stock size at the MSST (based on the SSB_{MSY} proxy of ½ $B_{35\%}$).[7]

[5] See MSA section 304(e)(1). NOAA Fisheries does use such stock assessment results, consistent with National Standard 2 and its guidelines, to inform decisions about catch levels and other conservation and management measures.

[6] Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the OY from each fishery for the U.S. fishing industry. 16 U.S.C. 1851(a)(1).

[7] From the 2023 stock assessment for summer flounder: https://apps-nefsc.fisheries.noaa.gov/saw/sasi.php.

5. Reasonable proxy – a reference level that serves as a surrogate exploitation rate that would achieve the same practical effect as fishing at the F_{MSY} level, support a yield close to MSY, and have a low probability of reducing the stock to an overfished level.[8]

OVERVIEW AND ORGANIZATION

This document outlines examples of flexible SDC that Councils have adopted in their FMPs and NOAA Fisheries has approved. Flexible approaches allow for more expedient stock status determinations if scientists recommend alternative SDC that are a better indicator of stock status, consistent with the BSIA and regulatory process.[9] Stock status determinations based on flexible SDC include extensive opportunity for input and review through the stock assessment and Council and NOAA Fisheries processes, ensuring that the SDC are consistent with the BSIA and regulatory process. These approaches can improve timeliness and management efficiency by making new SDC more rapidly available, reduce administrative burdens by front-loading flexibility into FMPs, and ensure consistency with BSIA requirements. Examples outlined in this document are non-exhaustive.

The document outlines three examples of flexible SDC from Council-developed/ NOAA Fisheries-approved FMPs:

- Example 1 – Adaptable SDC: New England and the Mid-Atlantic Councils.
- Example 2 – Plan B/Plan A: Mid-Atlantic and Western Pacific Councils.
- Example 3 – Tiers: North Pacific and Caribbean Councils.

For each flexible SDC type, the document provides a description of the approach and simplified examples of the actual SDC to demonstrate how they could be applied in different contexts. Appendices A-C contain specific SDC-related text from FMPs adopted between 1999 - 2020. Examples outlined in this document are non-exhaustive and not intended to preclude consideration of other approaches, including combining or modifying those described in the examples.

[8] Clark, W.G. 1993. The effect of recruitment variability on the choice of a target level of spawning biomass per recruit. In Proceedings of the International Symposium on Management Strategies for Exploited Fish Populations. Edited by G. Kruse, R.J. Marasco, C. Pautzke, and T.J. Quinn, II. University of Alaska Fairbanks, Alaska Sea Grant College Program Report 93-02, Fairbanks, Alaska. pp. 233–246.

[9] NMFS Procedure 01-101-10, titled "*NOAA Fisheries Framework for Determining that Stock Status Determinations and Catch Specifications are based on the Best Scientific Information Available,*" describes a framework with specific steps (i.e., BSIA process) for ensuring that management actions are based on BSIA. Within this document, the term 'BSIA process' is used to reflect the steps described in the procedural directive.

EXAMPLE 1 – ADAPTABLE SDC: NEW ENGLAND AND THE MID-ATLANTIC COUNCILS[10]

- ❖ In this method, overfishing and overfished SDC within FMPs are specified to be adaptable to accommodate changes to the BSIA. This approach can expedite stock status determinations if the BSIA process recommends a different MSY proxy (reference level), or endorses switching from an MSY proxy to a direct estimate, or vice versa.

How the New England and Mid-Atlantic Councils apply this Approach:

- The overfishing and overfished SDC in the FMPs are specified as adaptable because a different reference level determined to be the BSIA can be used without amending the FMP. For example, the SDC specifies that *MSST = ½ B_{MSY} or a reasonable proxy* and that *MFMT = F_{MSY} or a reasonable proxy*.
- Because MSST and MFMT are defined in the FMP as either a specific reference level or a reasonable proxy, NOAA Fisheries can make stock status determinations based on any reasonable proxy accepted through the BSIA process. For example, if existing MSST and MFMT are based on a direct estimate of MSY and NOAA Fisheries accepts new reference levels based on an MSY proxy through the BSIA process, those MSY proxy reference levels will be automatically adopted and used to support stock status without an FMP amendment.
- The FMP outlines the BSIA and regulatory documentation process for adopting reference levels, following the completion of a stock assessment.

Simplified examples of adaptable overfishing and overfished SDC:

- **Overfishing SDC Example:**
  - *A stock or stock complex is subject to overfishing when fishing mortality exceeds the MFMT, set at F_{MSY} or a reasonable proxy, based upon the BSIA consistent with National Standard 2.*
  - *If the stock assessment recommends a new reasonable proxy for stock status determinations, which NOAA Fisheries accepts for management consistent with the BSIA process, this proxy will become the new overfishing reference level and stock status determinations will be based on the numerical estimate of the new MFMT reference level.*
- **Overfished SDC Example:**
  - *A stock or stock complex is overfished when stock size is below the MSST, set at ½ B_{MSY} or a reasonable proxy, based upon the BSIA consistent with National Standard 2.*

[10] See Appendix A for the specific FMP text adopted in the Atlantic Herring FMP Framework Adjustment 6 (NEFMC, 2019), the Tilefish, Atlantic Bluefish, and the Mackerel, Squid, and Butterfish FMPs Framework Adjustment – Omnibus Allowable Biological Catch Framework (MAFMC, 2018), and the Summer Flounder, Scup, and Black Sea Bass FMP Framework Adjustment 7 (MAFMC, 2007).

- *The MSST may be defined as a function of total stock biomass, spawning stock biomass, or total egg production, among other potential measurements, and may include males, females, both, or combinations and ratios thereof.*
- *If the stock assessment recommends a new reasonable proxy for stock status determinations, which NOAA Fisheries accepts for management consistent with the BSIA process, this proxy will become the new overfished reference level and stock status determinations will be based on the numerical estimate of the new MSST reference level.*

EXAMPLE 2 - PLAN B/PLAN A: MID-ATLANTIC AND WESTERN PACIFIC COUNCILS[11]

❖ This approach has been used when a data-limited or data-poor[12] method is specified to support stock status determinations (Plan B), but a more data-rich approach is expected in the future (Plan A). Including both SDC in the FMP provides a contingency method until an improved method is developed. It eliminates the need for an FMP amendment when scientific advancements, consistent with the BSIA and regulatory process, result in new recommended reference levels.

How the Mid-Atlantic and Western Pacific Councils apply this Approach:

- One approach used by the Mid-Atlantic Council is to specify Plan B overfishing and overfished SDC that represent the currently available data-limited or data-poor method for supporting status determinations and Plan A overfishing and overfished SDC that represent more data-rich SDC.
- Another approach used by the Western Pacific Council is to specify SDC that can be applied to either stock complexes or individual stocks. Plan B SDC could be used when stocks are assessed as a stock complex, and Plan A SDC are applied when individual stocks are assessed, as a result of improvements in model quality.
- Plan B SDC are used until Plan A SDC are derived and accepted consistent with the BSIA and regulatory process.

[11] See Appendix B for the specific FMP text adopted in the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan FMP Amendment 21 (MAFMC, 2020) and the Fishery Ecosystem Plan for the American Samoa Archipelago (WPFMC, 2009).

[12] *Implementing a Next Generation Stock Assessment Enterprise* defines data-limited and data-poor as follows: Data-limited models are determined to be BSIA by council SSCs, provide management advice in relative terms. They indicate whether a stock's harvest level should increase or decrease compared to previous years'. That advice typically comes as a recommended maximum amount of fish that can be harvested in a year. Data-limited assessment models do not estimate a stock's current size or minimum stock size threshold. As a result, they cannot determine whether a stock is considered to be overfished. Data limitations, related to data reliability, availability, and/or consistency, prevent the use of more advanced statistical modeling methods. Data-poor methods are used for a stock for which there is not sufficient data or information available to support even the most basic of indices and/or stock assessment models. Catch limits for data-poor stocks are generally based upon historical records of catch and/or other council-determined approaches.

- New SDC that NOAA Fisheries determines to be acceptable for management and consistent with the BSIA process – under either Plan B or Plan A – are automatically used to calculate the corresponding numerical estimates to support status determinations without an FMP amendment.

Simplified examples of potential Plan B/Plan A SDC (both Plan B and Plan A SDC are specified in the FMP):

- **Overfishing SDC Example 1:**
  - Plan B: *The stock is subject to overfishing if catch is greater than the OFL, where the OFL is based on a data-poor methodology (e.g., historical average catch).*
  - Plan A: *The Plan B OFL-based reference level is replaced when updated overfishing reference levels are available based on an accepted stock assessment consistent with the BSIA and regulatory process. The updated reference level is used to determine if the stock is subject to overfishing.*
- **Overfished SDC Example 1:**
  - Plan B: *The stock is overfished if catch is greater than the OFL for three consecutive years, where the OFL is based on a data-poor methodology (e.g., historical average catch).*
  - Plan A: *The Plan B OFL-based reference level is replaced when updated overfished reference levels are available based on an accepted stock assessment consistent with the BSIA and regulatory process. The updated reference level is used to determine if the stock is overfished.*
- **Overfishing SDC Example 2:**
  - Plan B: *A stock complex is subject to overfishing if the fishing mortality exceeds the MFMT, where MFMT is set at* F_{MSY}.
  - Plan A: *A stock is subject to overfishing if the fishing mortality exceeds the MFMT, where MFMT is set at* F_{MSY}.
- **Overfished SDC Example 2:**
  - Plan B: *A stock complex is overfished if the stock size is less than the MSST, where MSST is set at ½* B_{MSY}.
  - Plan A: *A stock is overfished if the stock size is less than the MSST, where MSST is set at ½* B_{MSY}.

EXAMPLE 3 - TIERS: NORTH PACIFIC AND CARIBBEAN COUNCILS[13]

- ❖ In this approach, the FMP establishes tiers and associated SDC, differentiated by data availability and/or quality, and stocks are assigned to the appropriate tier based on the BSIA for that stock. This approach can expedite stock status determinations because when scientific information for a stock changes, the stock can be moved to a different tier and new SDC can be applied without an FMP amendment, consistent with the BSIA and regulatory process.

How the North Pacific and Caribbean Councils apply this Approach:

- A tier system is created within the FMP, where tiers are defined in terms of data availability.[14] Each tier has associated SDC that specify a reference level based on the data availability.
- All stocks in the FMP are assigned to a tier, which ensures that all stocks have SDC, even the most data-poor stocks.
- The North Pacific Council specifies a process for assigning stocks to six tiers based on information availability, and describes how stocks move to different tiers when new information becomes available.
- The Caribbean Council specifies four tiers in their Island-based FMPs, including data rich, data moderate, data limited with an accepted stock assessment, and data limited with no accepted stock assessment.
- MSST and MFMT reference levels are assigned to a stock based on its assigned tier and determination of consistency with the BSIA and regulatory process. These levels are used to calculate the corresponding numerical estimates to support status determinations.
- In the case of the North Pacific Council, stocks can move to different tiers without an FMP amendment. In the case of the Caribbean Council, a framework amendment is required to change a stock's tier following a stock assessment (or other information) that recommends a SDC or reference level change.

[13] See Appendix C for the specific FMP text adopted in the Bering Sea / Aleutian Islands Groundfish FMP Amendment 16 (NPFMC, 1999) and the Puerto Rico, St. Thomas/St. John, and St. Croix Island-Based FMPs (CFMC, 2019).

[14] Data could include, but not be limited to, abundance estimates, natural mortality, fecundity, growth, age and/or size composition, catch history, or acceptable proxies. Reliability of these data can also be considered when defining tiers.

Simplified example of potential tiered SDC approach:

Tier	Data available	*Overfishing SDC* and **reference levels**	*Overfished SDC* and **reference levels**
1	Reliable point estimates of B, B_{MSY}, and a reliable probability density function[15] of F_{MSY}	*A stock is subject to overfishing if catch>OFL*, where: **a) OFL= F_{MSY} if B/B_{MSY}>1** **b) OFL<F_{MSY} and reduced linearly if B/B_{MSY}<1 and >MSST** **c) OFL=0 if B/B_{MSY}<MSST**	*A stock is overfished if B<MSST*, where **MSST=0.5 B_{MSY}**
2	Reliable point estimates of B, B_{MSY}, F_{MSY}, $F_{35\%}$, and $F_{40\%}$	*A stock is subject to overfishing if catch>OFL*, where: **a) OFL= F_{MSY} or $F_{35\%}$ if B/B_{MSY}>1** **b) OFL<F_{MSY} or $F_{35\%}$ and reduced linearly if B/B_{MSY}<1 and > MSST** **c) OFL=0 if B/B_{MSY}<MSST**	*A stock is overfished if B<MSST*, where: **MSST=0.5 B_{MSY} or $B_{35\%}$**
3	Reliable point estimates of B, $B_{40\%}$, $F_{35\%}$, and $F_{40\%}$	*A stock is subject to overfishing if catch>OFL*, where: **a) OFL= $F_{35\%}$ if B/B_{MSY}>1** **b) OFL<$F_{35\%}$ and reduced linearly if B/B_{MSY}<1 and >MSST** **c) OFL=0 if B/B_{MSY}<MSST**	*A stock is overfished if B<MSST*, where: **MSST=0.5 $B_{35\%}$**
4	Reliable point estimates of B, $F_{35\%}$, and $F_{40\%}$	*A stock is subject to overfishing if catch>OFL*, where: **OFL=$F_{35\%}$**	A stock is overfished if the stock<proxy that supports sustainability of the stock[16]
5	Reliable point estimates of B and the natural mortality rate (M)	*A stock is subject to overfishing if catch>OFL*, where: **OFL=M**	A stock is overfished if the stock<proxy that supports sustainability of the stock[16]
6	Reliable catch history from a specified time period	*A stock is subject to overfishing if catch>OFL*, where: **OFL=average catch from a specified time period**	A stock is overfished if the stock<proxy that supports sustainability of the stock[16]

[15] A reliable probability density function allows for a reliable estimate of F_{MSY} and uncertainty, which is represented by the probability density distribution. The uncertainty is used to calculate the buffer between the OFL and ABC.

[16] NS1 guidelines (600.310(e)(2)(ii)) stipulate that when data are not available to specify SDC based on MSY or MSY proxies, alternative types of SDC that promote sustainability of the stock or stock complex can be used and specified in the FMP. For example, SDC could be based on recent average catch, fish densities derived from visual census surveys, length/weight frequencies, or other methods. If alternative types of SDC are used, the SDC must be measurable and objective and the Council should explain in the FMP how the approach will promote sustainability of the stock or stock complex on a long term basis, consistent with NS1.

CONCLUSION

Determining and reporting on the status of fisheries is a critical component of sustainable fisheries management in the United States. Flexible overfishing and overfished SDC have been adopted in various FMPs, enabling more timely stock status determinations in situations where new science emerges. Procedures that document the regulatory process ensure transparency and consistency. As this document outlines, flexible SDCs can be structured so that new reference levels, determined to be BSIA and acceptable for management, can be quickly adopted without an FMP amendment, a process that may take several years. Shortening the time lag between our science and management processes can improve management efficiency, reduce administrative burdens, and ensure faster application to management, with benefits to fish stocks and our ocean ecosystems. Prompt stock status decisions are especially important if stocks are overfished or subject to overfishing and timely development of new management measures is necessary to address the stock status.

APPENDIX A - ADAPTABLE SDC

Example 1: Atlantic Herring FMP Framework Adjustment 6 (NEFMC, 2019)
Text is copied directly from the FMP:

The stock will be considered overfished if stock biomass is less than ½ the stock biomass associated with the MSY level or a proxy (e.g., SSB_{MSY} or SSB_{MSY} proxy).

The stock will be considered subject to overfishing if the estimated fishing mortality rate exceeds the fishing mortality rate associated with the MSY level or a proxy (e.g., F_{MSY} or F_{MSY} proxy).

Rationale: Over time, the parameters[1] used to assess the Atlantic herring stock have changed, as well as the relevant projections completed to evaluate stock status and set catch levels. This definition is consistent with many overfishing and overfished definitions used in the region, as well as the upper biomass threshold of the proposed Amendment 8 ABC control rule. This definition is more flexible, because it would incorporate any estimate of biomass (B, SSB, or relevant proxy), whatever is used in the stock assessment and considered the best available science. The current assessment (2018) defines FMSY proxy as F40%, but that may not be the case in future assessments. This definition is also less complex than the existing definition, because it does not include a 5-year projection to define overfishing. Projections beyond three years are generally unreliable for a short- to medium-lived fish like herring.

The Council decided not to define what the parameter is within the definition; instead, the parameter is very general and does not specify the method used to develop the parameter from the last assessment. What that means is a future assessment could use and approve a new parameter and it would be used in the overfishing definition automatically. Under the process described in this alternative, the Council would not need to develop an action to adjust the overfishing/overfished definition, if a new parameter was used and approved in a subsequent assessment. The specific parameters used for MFMT and MSST will be that recommended by the most recent stock assessment. New parameters, or a parameter's numerical estimate, will automatically be adopted in the next fishing year following the assessment. To be clear, the method used to define the parameter (i.e., F_{MSY} proxy in Assessment 1 may be based on $F_{40\%}$, and F_{MSY} proxy in Assessment 2 may be based on $F_{50\%}$), as well as the parameter value can change automatically under this definition (i.e., F_{MSY} proxy in Assessment 1 may be 0.2, but in a subsequent assessment F_{MSY} proxy = 0.3). The Council identified this alternative as preferred, because it is more consistent with the recent herring assessment and Amendment 8. In addition, it would require no Council action to modify the definition if future stock assessments recommend different parameters for defining stock status.

[1] The FMP does not define "parameter," but it is interpreted to mean the reference level in this context.

Example 2: Tilefish, Atlantic Bluefish, and the Mackerel, Squid, and Butterfish FMPs Framework Adjustment – Omnibus Acceptable Biological Catch Framework (MAFMC, 2018)
Text is copied directly from the FMP:

The biological status determination criteria for each of the species managed under the fishery management plans would be automatically based upon the best scientific information consistent with National Standards 1 and 2. Summer flounder, scup, black sea bass, surfclam, ocean quahog, and spiny dogfish are already handled this way. This action would institute the above procedure for bluefish, tilefish, mackerel, longfin squid, Illex squid, and butterfish. Since best available science requirements have dictated that accepted assessment information be utilized by the SSC in setting quotas, new assessment information has been utilized immediately for quota setting but this would clarify and simplify the administrative procedures for doing so.

Streamlining the adoption of new accepted/approved biological status determination criteria for bluefish, tilefish, mackerel, longfin squid, Illex squid, and butterfish should have no biological or socioeconomic impacts since the best available science must be and already is used for Council decision making. This alternative would improve management efficiency and clarity since executing a separate management action to adopt new biological status determination criteria can take several months chronologically and several weeks of staff time by both Council and National Marine Fisheries Service (NMFS) staffs.

The maximum fishing mortality (F) threshold for each of the species under a fishery management plan is defined as F Maximum Sustainable Yield (F_{MSY}) (or a reasonable proxy thereof) as a function of productive capacity, and based upon the best scientific information consistent with National Standards 1 and 2. Summer flounder, scup, black sea bass, surfclam, ocean quahog, and spiny dogfish are already handled this way. This action would thus institute the above procedure to bluefish, tilefish, mackerel, longfin squid, Illex squid, and butterfish.

The fishing mortality rate associated with maximum sustainable yield (MSY) is F_{MSY} (maximum fishing mortality threshold). A reasonable proxy of F_{MSY} may be defined as a function of (but not limited to): total stock biomass, spawning stock biomass, total egg production, and may include males, females, both, or combinations and ratios thereof which provide the best measure of productive capacity for each of the species managed under the fishery management plan. Exceeding the established fishing mortality threshold constitutes overfishing as defined by the MSA.

The minimum stock size threshold for each of the species under an FMP is defined as ½ Biomass at MSY (B_{MSY} or a reasonable proxy thereof). The minimum stock size threshold (½Biomass at MSY) or a reasonable proxy may be defined as a function of (but not limited to): total stock biomass, spawning stock biomass, total egg production, and may include males, females, both, or combinations and ratios thereof which provide the best measure of productive capacity for each of the species managed under the fishery management plans. The minimum stock size threshold is the

level of productive capacity associated with the relevant ½ MSY level and based upon the best scientific information consistent with National Standards 1 and 2.

Should the measure of productive capacity for the stock or stock complex fall below this minimum threshold, the stock or stock complex will be considered overfished. The target for rebuilding is specified as B_{MSY} (or reasonable proxy thereof) at the level of productive capacity associated with the relevant MSY level, under the same definition and constraints of productive capacity as specified for the minimum stock size threshold.

Specific definitions or modifications to the status determinations criteria, and their associated values, would result from the most recent peer-reviewed stock assessments and their panelist recommendations. The Northeast Regional Stock Assessment workshop/ Stock Assessment Review Committee (SAW/SARC) process is the primary mechanism utilized in the Northeast Region at present to review scientific stock assessment advice, including status determination criteria, for federally-managed species. There are also reviews which can occur outside the SARC process that are subject to rigorous peer-review and may also result in scientific advice to modify or change the existing stock status determination criteria. Reviews outside the SARC process could be conducted by any of the following listed below, as deemed appropriate by the managing authorities.

- MAFMC SSC Review
- MAFMC Externally Contracted Reviews with Independent Experts (e.g., Center for Independent Experts - CIE)
- NOAA Fisheries Internally Conducted Review (e.g., Comprised of NOAA Fisheries Scientific and Technical Experts from NOAA Fisheries Science Centers or Regions)
- NOAA Fisheries Externally Contracted Review with Independent Experts (e.g., CIE)
- TRAC (Transboundary Resources Assessment Committee)

The scientific advice developed on stock status determination criteria is then provided to the Council's SSC. The SSC uses this information to develop acceptable biological catch (ABC) recommendations which address scientific uncertainty based on the information provided in the peer reviewed assessment of the stock. These recommendation are then provided to the Council.

From the Final Rule (83 FR 15511, Apr. 11, 2018): This change in Council operations improves management efficiency by automatically incorporating new peer-reviewed status determination criteria instead of requiring a separate management action to adopt them within these three FMPs.

Example 3: Summer Flounder, Scup, and Black Sea Bass FMP Framework Adjustment 7 (MAFMC, 2007)

Text is copied directly from the FMP:

The definitions for status determination criteria for these three species are broadened under this alternative to allow for greater flexibility in incorporating changes to the definitions of the maximum fishing mortality threshold and/or minimum stock size threshold as the best scientific information consistent with National Standards 1 and 2 becomes available. As such, the following describes the potential sources of peer reviewed scientific advice on status determination criteria and the current process of how that scientific advice will move forward in the development of management advice through the Council's annual specification process.

Specific definitions or modifications to the status determinations criteria, and their associated values, would result from the most recent peer-reviewed stock assessments and their panelist recommendations. The Northeast Regional Stock Assessment workshop/ Stock Assessment Review Committee (SAW/SARC) process is the primary mechanism utilized in the Northeast Region at present to review scientific stock assessment advice, including status determination criteria, for federally-managed species. There are also periodic reviews which occur outside the SARC process that are subject to rigorous peer-review and may also result in scientific advice to modify or change the existing stock status determination criteria.[1]

These periodic reviews outside the SARC process could be conducted by any of the following listed below, as deemed appropriate by the managing authorities.

- MAFMC Science and Statistical Committee (SSC) Review
- MAFMC Externally Contracted Reviews with Independent Experts (e.g., Center for Independent Experts - CIE)
- NMFS Internally Conducted Review (e.g., Comprised of NMFS Scientific and Technical Experts from NMFS Science Centers or Regions)
- NMFS Externally Contracted Review with Independent Experts (e.g., Center for Independent Experts - CIE)

ASMFC Externally Contracted Reviews with Independent Experts (e.g., Center for Independent Experts - CIE)The scientific advice provided with respect to status determination criteria could follow three scenarios (Figure 1; first column). First, it is possible that the panelists participating in the peer-review reach consensus with respect to maintaining the current definitions of status determination criteria for summer flounder, scup, or black sea bass. There may be updates to the values associated with those same definitions based on the input of more recent information as well (i.e., additional year's data); however, the Council is not required to undertake any specific action when this occurs, as using the updated values is consistent with National Standard 2. In this case

[1] For example, in 2006 scientific advice on summer flounder status determination criteria was provided through a NMFS internally conducted review at the "Summer Flounder Assessment and Biological Reference Point Update for 2006". The review panel was composed of experts from NMFS and academia.

the scientific advice can then move forward such that management advice can be developed. Under the second potential scenario for scientific advice (Figure 1; second column), the peer-review recommends changes or different definitions of the status determination criteria, and the panelists reach consensus as to how these status determination criteria should be modified or changed. This scientific advice can move forward such that management advice can be developed. Under these first two potential scenarios, consensus has been reached and therefore the scientific advice moving forward to the Council's management advisory groups should be clear.

The third potential scenario (Figure 1; third column) is the peer review scientific advice with respect to the incorporation to status determination criteria is split (consensus is not reached) or uncertain recommendations are provided (weak consensus). The scientific advice provided by the reviewers may be particularly controversial. In addition, the scientific advice may not be specific enough to provide adequate guidance as to how the maximum fishing mortality threshold and/or minimum stock size threshold should be defined or what resulting management advice should be developed from these changes. Under these circumstances, the Council may engage their SSC or a subset of SSC members with appropriate expertise, to review the information and recommendations provided by the peer-review group. Based on the terms of reference provided to the SSC, they may prepare a consensus report clarifying the scientific advice for the Council as to what the status determination criteria should be (e.g., modify, change, or maintain the same definitions). At that point the scientific advice on how the status determination criteria should be defined will be clear, and can move forward such that management advice can be developed.

Currently, the first step in the development of management advice through the Council process occurs at the Monitoring Committee's for these species, as implemented under Amendments 2, 8, and 9 to the FMP. In addition, the Council's Industry Advisory groups are often engaged to provide additional management recommendations to the Council. The Council can then utilize the management advice from their advisory groups in developing their own recommendations put forward through the annual regulatory process of setting the annual specifications for the upcoming fishing year, which is the primary mechanism for adjusting management measures to meet the goals of the FMP.

The recommendations from the Council can move forward in the annual specification package (including an EA/RIR/IRFA) to NMFS for implementation under their regulatory process. The EA/RIR/FRFA in the annual specification document currently provides a thorough analysis of this information and the extent to which the information is applied.

The 2006 reauthorization of the Magnuson-Stevens Act contains language which states that "Each scientific and statistical committee shall provide its Council ongoing scientific advice for fishery management decisions" (section 600.302 (g)(1)(B)). The guidance that will result from the reauthorized Magnuson-Stevens Act on this issue is not yet clear, nor has any formal guidance been developed. The Council may consider changing the process under which these advisory groups are

utilized in the future, depending on how the reauthorized act is interpreted.[2] Action taken, if any, to modify the present process of developing management advice from the peer-reviewed scientific advice received, and the manner in which Council advisory groups are utilized would be intended to improve the manner in which management advice is developed by the Council. Modification to the current management process to more fully incorporate the SSC may require an amendment, modification to the Council's standard operating procedures (SOPs), or both.

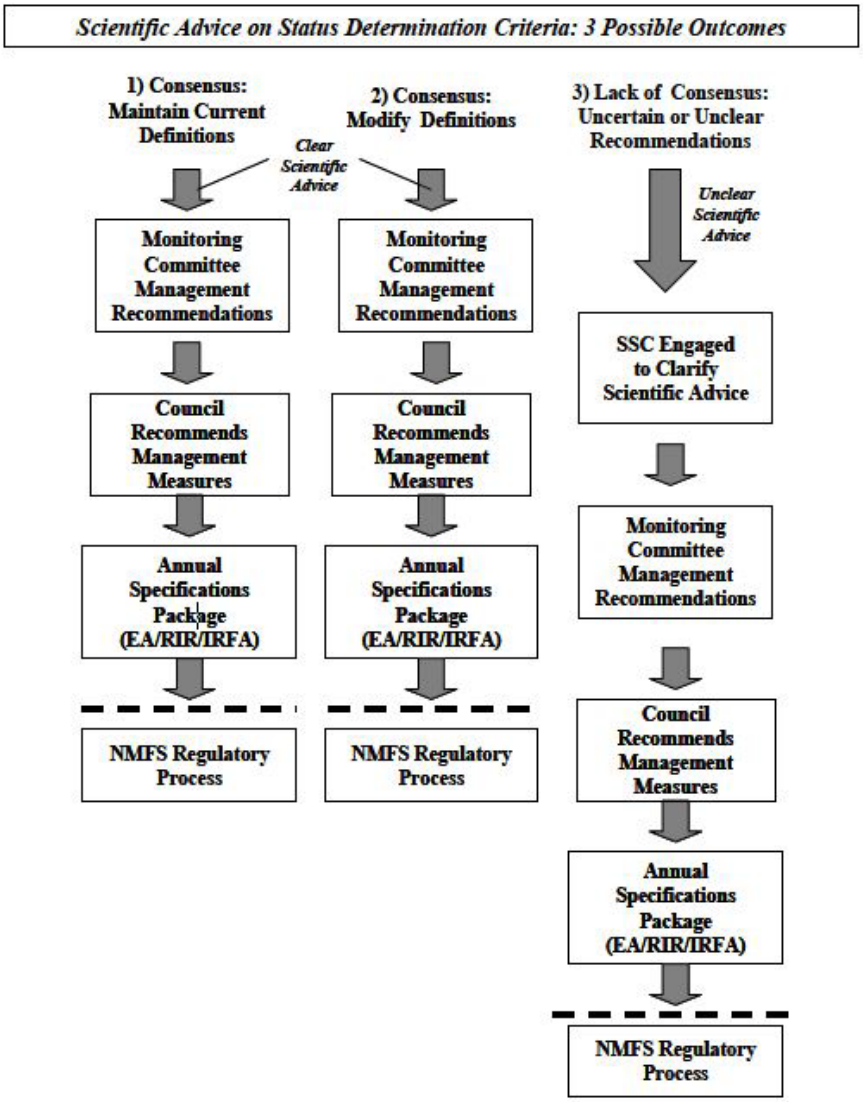

Figure 1. Process for incorporation of peer-reviewed scientific advice on stock status determination criteria into the annual management process for summer flounder, scup, and black sea bass.

[2] For example, the Council may consider utilizing the SSC or a subset of SSC members with appropriate expertise, independently or in conjunction with the species Monitoring Committee in the development of management advice based on the scientific recommendations provided by a peer-review group.

APPENDIX B – PLAN B/PLAN A

Example 4: Atlantic chub mackerel - Amendment 21 to the Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan (MAFMC, 2020)
Text is copied directly from the FMP:

SDCs will be defined and automatically updated based on the latest stock assessment that is peer reviewed and accepted for use in management, consistent with the process used for all other stocks in the Council's FMPs (MAFMC 2018a). A peer-reviewed and accepted stock assessment is not currently available for chub mackerel; therefore, the Council must use proxy metrics for SDCs.

SDCs are metrics for determining if a stock is overfished or experiencing overfishing. If the Council manages chub mackerel as a stock in the fishery, SDCs will be defined and automatically updated based on the latest stock assessment that is peer reviewed and accepted for use in management, consistent with the process used for all other stocks in the Council's FMPs (MAFMC 2018a). A peer-reviewed and accepted stock assessment is not currently available for chub mackerel; therefore, the Council must use proxy metrics for SDCs.

Under the Council's ABC control rule for a stock with a typical life history, biomass at or above biomass at maximum sustainable yield, and an OFL coefficient of variation (CV) of 150%, the ABC is 76% of the OFL. This control rule is intended to be used to derive an ABC from an OFL, taking into account the Council's risk policy and scientific uncertainty. This approach was used to work backwards from the ABC to derive an overfishing SDC for chub mackerel (i.e., the ABC was divided by 0.76). Although stock status is unknown[1] as there is no stock assessment, it is assumed that biomass is currently at or above biomass at maximum sustainable yield given the scale of the fisheries and the SSC's recent discussions (MAFMC 2018b). An OFL CV of 150% was assumed to be appropriate given notable data limitations. The SSC typically uses a default OFL CV of 100% but has used a 150% CV in situations with high levels of uncertainty associated with knowledge of the stock (e.g., surf clams in December 2018). The resulting proposed chub mackerel proxy overfishing SDC is 3,026 mt (6.67 million pounds). In other words, when more than 3,026 mt of chub mackerel are harvested from Maine through the east coast of Florida in a given year, overfishing is assumed to have occurred.

The proposed overfished SDC is three consecutive years of catch above 3,026 mt (6.67 million pounds). That is, if catch exceeds 3,026 mt in three consecutive years, then the stock would be presumed overfished. An overfished designation triggers a requirement for a rebuilding plan.

[1] As of 2024, the status of Atlantic chub mackerel was updated and is now listed as not subject to overfishing and not overfished, based on a catch/OFL comparison.

Example 5: Fishery Ecosystem Plan for the American Samoa Archipelago (WPFMC, 2009)
Text is copied directly from the FMP:

Overfished: A stock or stock complex is considered "overfished" when its biomass has declined below a level that jeopardizes the capacity of the stock or stock complex to produce maximum sustainable yield on a continuing basis.

Overfishing: (to overfish) occurs whenever a stock or stock complex is subjected to a level of fishing mortality or total annual catch that jeopardizes the capacity of a stock or stock complex to produce maximum sustainable yield on a continuing basis. Stock Status Determination Process

Stock status determinations involve three procedural steps. First, the appropriate MSY, target, or rebuilding reference points are specified. However, because environmental changes may affect the productive capacity of the stocks, it may be necessary to occasionally modify the specifications of some of the reference points or control rules. Modifications may also be desirable when better assessment methods become available, when fishery objectives are modified (e.g., OY), or better biological, socioeconomic, or ecological data become available.

Second, the values of the reference points are estimated and third, the status of the stock is determined by estimating the current or recent values of fishing mortality and stock biomass or their proxies and comparing them with their respective reference points.

The second step (including estimation of M, on which the values of the overfishing thresholds will be dependent) and third step will be undertaken by NMFS based on the latest results published annually in the Stock Assessment and Fishery Evaluation (SAFE) report. In practice, the second and third steps may be done simultaneously—in other words, the reference point values could be re-estimated as often as the stocks' status. No particular stock assessment period or schedule is specified, but in practice the assessments will likely be conducted annually in coordination with the preparation of the annual SAFE report.

The best information available is used to estimate the values of the reference points and to determine the status of stocks in relation to the status determination criteria. The determinations are based on the latest available stock and fishery assessments. Information used in the assessments includes logbook data, creel survey data, vessel observer data, and the findings of fishery-independent surveys when they are conducted.

MSY Control Rule

The overfishing criteria and control rules specified are applied to individual species within the multi-species stock whenever possible. Where this is not possible, they will be based on an indicator species for the multi-species stock. It is important to recognize that individual species will be affected differently based on this type of control rule, and it is important that for any given species fishing mortality does not exceed a level that would lead to its becoming depleted. Currently, no indicator species are used for the four bottomfish multi-species stock complexes (American Samoa, CNMI, Guam and Hawaii). Instead, the control rules are applied to each of the

four stock complexes[1] as a whole. For the seamount groundfish stocks, armorhead serves as the indicator species.

[1] In American Samoa, bottomfish have been managed as a complex, but following a 2023 benchmark stock assessment, a new rule will change this to seven single-species stocks and two, two-species complexes.

APPENDIX C – TIERS

Example 6: Bering Sea / Aleutian Islands Groundfish FMP – Amendment 56 (NPFMC, 1999)
Text is copied directly from the FMP:

Specification of OFL begins with the MFMT (also known as the OFL control rule). The MFMT is prescribed through a set of six tiers which are listed below in descending order of preference, corresponding to descending order of information availability. The SSC will have final authority for determining whether a given item of information is "reliable" for the purpose of this definition, and may use either objective or subjective criteria in making such determinations.

For tier (1), a "pdf" refers to a probability density function. For tiers 1 and 2, if a reliable pdf of B_{MSY} is available, the preferred point estimate of B_{MSY} is the geometric mean of its pdf. For tiers 1 to 5, if a reliable pdf of B is available, the preferred point estimate is the geometric mean of its pdf. For tiers 1 to 3, the coefficient α is set at a default value of 0.05. This default value was established by applying the 10 percent rule suggested by Rosenberg et al. (1994) to the 1/2 B_{MSY} reference point. However, the SSC may establish a different value for a specific stock or stock complex as merited by the best available scientific information. For tiers 2 to 4, a designation of the form "$F_{X\%}$" refers to the fishing mortality rate (F) associated with an equilibrium level of spawning per recruit equal to X% of the equilibrium level of spawning per recruit in the absence of any fishing. If reliable information sufficient to characterize the entire maturity schedule of a species is not available, the SSC may choose to view spawning per recruit calculations based on a knife-edge maturity assumption as reliable. For tier 3, the term $B_{40\%}$ refers to the long-term average biomass that would be expected under average recruitment and $F=F_{40\%}$.

Tier 1 Information available: reliable point estimates of B and B_{MSY} and reliable pdf of F_{MSY}.
- 1a) Stock status: $B/B_{MSY} > 1$
  $F_{OFL} = mA$, the arithmetic mean of the pdf
- 1b) Stock status: $a < B/B_{MSY} \leq 1$
  $F_{OFL} = mA \times (B/B_{MSY} - a)/(1 - a)$
- 1c) Stock status: $B/B_{MSY} \leq a$
  $F_{OFL} = 0$

Tier 2 Information available: reliable point estimates of B, B_{MSY}, F_{MSY}, $F_{35\%}$, and $F_{40\%}$.
- 2a) Stock status: $B/B_{MSY} > 1$
  $F_{OFL} = F_{MSY}$
- 2b) Stock status: $a < B/B_{MSY} \leq 1$
  $F_{OFL} = F_{MSY} \times (B/B_{MSY} - a)/(1 - a)$
- 2c) Stock status: $B/B_{MSY} \leq a$
  $F_{OFL} = 0$

Tier 3 Information available: reliable point estimates of B, $B_{40\%}$, $F_{35\%}$, and $F_{40\%}$.
- 3a) Stock status: $B/B_{40\%} > 1$
  $F_{OFL} = F_{35\%}$
- 3b) Stock status: $a < B/B_{40\%} \leq 1$
  $F_{OFL} = F_{35\%} \times (B/B_{40\%} - a)/(1 - a)$

3c) Stock status: $B/B_{40\%} \leq a$

$F_{OFL} = 0$

Tier 4 Information available: reliable point estimates of B, $F_{35\%}$, and $F_{40\%}$.

$F_{OFL} = F_{35\%}$

Tier 5 Information available: reliable point estimates of B and natural mortality rate M.

$F_{OFL} = M$

Tier 6 Information available: reliable catch history from 1978 through 1995.

OFL = the average catch from 1978 through 1995, unless an alternative value is established by the SSC on the basis of the best available scientific information.

With the exception of Tier 6, the MFMT is applied to the best estimate of stock size (which may or may not be age structured) for the coming year to produce the OFL, which is expressed in units of catch biomass. In the case of Tier 6, the MFMT is already expressed in units of catch biomass, meaning that the MFMT and the OFL are identical.

Determination of "Overfishing" Status

The OFL for a given calendar year is specified at the end of the preceding calendar year on the basis of the most recent stock assessment. For each stock and stock complex, a determination of status with respect to "overfishing" is made inseason as the fisheries are monitored to prevent exceeding the TAC and annually as follows: If the catch taken during the most recent calendar year exceeded the OFL that was specified for that year, then overfishing occurred during that year; otherwise, overfishing did not occur during that year.

Determination of "Overfished" Status

A stock or stock complex is determined to be "overfished" if it falls below the MSST. According to the National Standard Guidelines definition, the MSST equals whichever of the following is greater: One-half the MSY stock size, or the minimum stock size at which rebuilding to the MSY level would be expected to occur within 10 years, if the stock or stock complex were exploited at the MFMT.

The above definition raises two questions: 1) How is the definition to be applied when "the MSY level" cannot be estimated? 2) In the context of an age-structured assessment, what is the meaning of the phrase, "the minimum stock size at which rebuilding to the MSY level would be expected to occur within 10 years?" These questions are addressed in this FMP as follows:

1) Direct estimates of B_{MSY} (i.e., "the MSY level") are available for Tiers 1 and 2. For Tier 3, no direct estimate of B_{MSY} is available, but $B_{35\%}$ is used as a proxy for B_{MSY}. For Tiers 4-6, neither direct estimates of B_{MSY} nor reliable estimates of B_{MSY} proxies are available. Therefore, the "overfished" status of stocks and stock complexes managed under Tiers 4-6 is undefined.

2) For a stock assessed with an age-structured model (as is typically the case for stocks and stock complexes managed under Tiers 1-3), there is more than one stock size or numbers-at-age vector at which rebuilding to the MSY level would be expected to occur in exactly 10 years. Generally, there is no limit to the range of numbers-at-age vectors that satisfy this constraint, and each of these

vectors corresponds to a stock size. Therefore, stock status in Tiers 1-3 is determined annually as follows:

a. If current spawning biomass is estimated to be below ½ B_{MSY}, the stock is below its MSST.

b. If current spawning biomass is estimated to be above B_{MSY}, the stock is above its MSST.

c. If current spawning biomass is estimated to be above ½ B_{MSY} but below B_{MSY}, then conduct a large number of stochastic simulations by projecting the numbers-at-age vector from the current year forward under the assumption that it will be fished at the MFMT in every year, and determine status as follows:

1. If the mean spawning biomass in the 10th year beyond the current year is below B_{MSY}, the stock is below its MSST.
2. Otherwise, the stock is above its MSST.

Example 7: Puerto Rico, St. Thomas/St. John, and St. Croix Island-Based FMPs (CFMC, 2019)
Text is copied directly from the FMP:

Caribbean Fishery Management Council Acceptable Biological Catch Control Rule for stocks/stock complexes managed under the Puerto Rico FMP.

Tier 1: Data Rich	
Conditions 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 uncertainty1 and reflecting the acceptable probability of overfishing. The buffer is applied to the PDF of OFL (σ), where the PDF is determined from the assessment (where σ > σmin). 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 probability of overfishing is specified (< 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 acceptable 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 σmin (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 and reflecting the acceptable probability of overfishing a. Where the buffer is applied to the PDF of OFL when the PDF is determined from the assessment (with $\sigma > 2\sigma min$) 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) = a level of landings that can be sustained over the long-term. OFL proxy = SYL
Tier 4a **Conditions for Use**	No accepted 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 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.
Tier 4b **Conditions for Use**	No accepted assessment, but the stock has relatively high vulnerability to fishing pressure (see definition in Tier 4a Condition for Use), or SSC consensus 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 = 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.

NOTE*:* All stocks were contained in Tier 4 when the island-based FMPs were approved. While the FMPs don't explicitly state that an FMP amendment is required to move stocks between tiers, it notes the following: ***"Situations under which this open framework procedure can be used:*** *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).” Accordingly, any movement from one tier to another that changes the reference points will require an FMP amendment, as those management measures are codified in the regulations. Thus, movement from tier 4 to tier 3 will require an FMP amendment, but movement to higher tiers will depend on whether the reference points are revised.