Inventory of ABC Control Rule Tier Systems

Following the inclusion of OFLs, ABCs, and ACLs into the Magnuson-Stevens Act, regional Fishery Management Councils developed tiered systems to categorize stocks based on data availability. These tiers also served to standardize modeling methods used, OFL/ABC buffers, and management decisions. Only the New England Regional Fishery Management Council (Council) and its SSC does not use a tier system to structure their ABC control rules. They use a Risk Policy Assessment (adopted in June 2016) to determine uncertainty and risk in setting management policies. As of February 2019, The Caribbean Fishery Management Council is still in the process of developing their island-based FMPs and ABC control rule.

The details of each tier vary by Council, but generally each Council/SSC has three or more tiers. The first tier, "Tier 1," has the most data available, is considered data rich, and uncertainty around stock indicators is low. As tiers progress, uncertainty becomes higher, stock metrics such as F, B, and M cannot be calculated directly, and catch numbers become less reliable or are missing for significant periods. These "lower" tiers are considered data limited, and have necessitated larger buffers between OFL and ABC to reduce the risk of overfishing occurring. Some councils divide tiers up further to allow greater flexibility in setting ABC and OFL depending on uncertainty level, and the SSC's expert opinion.

Table 1. Summary of Tiered ABC Control Rule Systems

Council	Tier level	Conditions of Use	Method to Determine OFL	Method to Determine ABC
MAFMC[1]	1	The SSC determines that the assessment OFL and the assessment's treatment of uncertainty are acceptable, based on the following: (i) All important sources of scientific uncertainty are captured in the stock assessment model; (ii) The probability distribution of the OFL is calculated within the stock assessment and adequately describes the OFL uncertainty; (iii) The stock assessment model structure and treatment of the data prior to use in the model include relevant details of the biology of the stock, fisheries that exploit the stock, and data collection methods; (iv) The stock assessment provides the following estimates:	The OFL probability distribution is analytical derived from an assessment and accepted by the SSC.	Apply the acceptable probability of overfishing from the MAFMC's risk policy found in 50 CFR 648.21(a) through (d) to the probability distribution of the OFL.

[1] See 50 CFR 648.20 and 648.21; See also the final rule implementing the MAFMC's Omnibus Acceptable Biological Catch Framework Adjustment, 83 FR 15511; April 11, 2018.

		Fishing mortality rate (F) at MSY or an acceptable proxy maximum fishing mortality threshold (MFMT) to define OFL, biomass, biological reference points, stock status, OFL, and the respective uncertainties associated with each value; and (v) No substantial retrospective patterns exist in the stock assessment estimates of fishing mortality, biomass, and recruitment.		
	2	The SSC determines the assessment OFL is acceptable and the SSC accepts the assessment team's modifications to the analytically-derived OFL probability distribution, based on the following: (i) Key features of the stock biology, the fisheries that exploit it, and/or the data collection methods for stock information are missing from, or poorly estimated in, the stock assessment; (ii) The stock assessment provides reference points (which may be proxies), stock status, and uncertainties associated with each; however, the uncertainty is not fully promulgated through the stock assessment model and/or some important sources of uncertainty may be lacking; (iii) The stock assessment provides estimates of the precision of biomass, fishing mortality, and reference points; (iv) The accuracy of the minimum fishing mortality threshold and projected future biomass is estimated in the stock	OFL probability distribution is modified by the assessment team and accepted by the SSC.	Determined by applying the acceptable probability of overfishing from the MAFMC's risk policy found in 50 CFR 648.21(a) through (d) to the probability distribution of the OFL as modified by the assessment team.

		assessment using ad hoc methods; and (v) The modified OFL probability distribution provided by the assessment team acceptably addresses the uncertainty of the assessment.		
	3	The SSC determines the assessment OFL is acceptable but the SSC derives the appropriate uncertainty for OFL based on meta-analysis and other considerations. This requires the SSC to determine that the stock assessment does not contain an estimated probability distribution of OFL or the OFL probability distribution in the stock assessment is judged by the SSC to not adequately reflect uncertainty in the OFL estimate.	OFL probability distribution that is modified by the SSC.	An ABC for stocks with an OFL probability distribution that is modified by the SSC will be determined by either: (i) Applying the acceptable probability of overfishing from the MAFMC's risk policy to the SSC-adjusted OFL probability distribution. The SSC will use default assignments of uncertainty in the adjusted OFL probability distribution based on literature review and valuation of control rule performance; or, (ii) If the SSC cannot develop an OFL probability distribution, a default control rule of 75 percent of the F_{MSY} value will be applied to derive ABC.
	4	The SSC determines that the OFL cannot be specified given the available information.	The SSC determines that the OFL cannot be specified given the available information.	Determined by using control rules based on biomass and catch history and application of the MAFMC's risk policy found in 50 CFR 648.21(a) through (d).
GMFMC[2]	1	A quantitative assessment provides both an estimate of OFL based on MSY or its proxy and a probability density function of OFL that reflects scientific uncertainty.	OFL = yield resulting from applying F_{MSY} or its proxy to estimated biomass	Appropriate level of risk (P*) set using a risk determination table that calculates a P* based on the level of information and uncertainty in the stock assessment. (ABC = yield at P*)
	2[3]	An assessment exists but does not provide an estimate of MSY or its proxy. Instead, the assessment provides a measure of OFL based on alternative	Available from alternative methodology	The buffer between OFL and ABC will be based on the probability density function around the OFL and the level of risk of exceeding the OFL selected by the Council. a. Risk of exceeding OFL = 50% b. Risk of exceeding OFL = 40% c. Risk of exceeding OFL = 30% (default)

[2] The Gulf Council's ABC control rule was established by their final 2011 Generic Annual Catch Limits/Accountability Measures Amendment for the Gulf of Mexico Fishery Management Council's Red Drum, Reef Fish, Shrimp, Coral and Coral Reefs, Fishery Management Plans (http://gulfcouncil.org/wp-content/uploads/Final-Generic-ACL-AM-Amendment-September-9-2011-v.pdf). The Gulf Council is in the process of developing carry-over provisions within their ABC control rule. A June 2018 version of the draft document is available on the Council's website: http://gulfcouncil.org/wp-content/uploads/E-6-Draft-Generic-Amendment-for-Quota-Carryover-and-Framework-Modification-061318.pdf

[3] Changes in the trend of a stock's landings or a stock complex's landings in three consecutive years shall trigger a reevaluation of their acceptable biological catch control rule determination under Tiers 2, 3a, or 3b.

		methodology. A probability density function can be calculated to estimate scientific uncertainty in the model-derived overfishing limit measure. This density function can be used to approximate the probability of exceeding the OFL, thus providing a buffer between the OFL and ABC.		Set ABC = OFL - buffer at risk of exceeding OFL
	3a[4]	No assessment is available, but landings data exist. The probability of exceeding OFL in a given year can be approximated from the variance about the mean of recent landings to produce a buffer between the OFL and ABC. Based on expert evaluation of BSIA, recent historical landings are without trend, landings are small relative to stock biomass, or the stock is unlikely to undergo overfishing if future landings are equal to or moderately higher than the mean of recent landings. For stock complexes, the determination of whether a stock complex is in Tier 3a or 3b will be made using all the information available, including stock specific catch trends.	Set the OFL equal to the mean of recent landings plus two standard deviations. A time series of at least ten years is recommended to compute the mean of recent landings, but a different number of years may be used to attain a representative level of variance in the landings	ABC set using a buffer from the OFL that represents an acceptable level of risk due to scientific uncertainty. The buffer will be predetermined for each stock or stock complex by the Council with advice from the SSC as: a. ABC = mean of the landings plus 1.5* standard deviation (risk of exceeding OFL = 31 %) b. ABC = mean of the landings plus 1.0 * standard deviation (risk of exceeding OFL = 16%). This is the default. c. ABC = mean of the landings plus 0.5 * standard deviation (risk of exceeding OFL = 7%) d. ABC = mean of the landings (risk of exceeding OFL = 2.3 %)
	3b[5]	No assessment is available, but landings data exist. Based on expert evaluation of the BSIA, recent landings may be unsustainable.	Set the OFL equal to the mean of landings. A time series of at least ten years is recommended to compute the mean of recent landings, but a different number of years may be used to attain a representative level of variance in the landings.	Set ABC using a buffer from the OFL that represents an acceptable level of risk due to scientific uncertainty. The buffer will be predetermined for each stock or stock complex by the Council with advice from its SSC as: e. ABC = 100% of OFL f. ABC = 85% of OFL g. ABC = 75% of OFL (default) h. ABC = 65% of OFL

[4] Changes in the trend of a stock's landings or a stock complex's landings in three consecutive years shall trigger a reevaluation of their acceptable biological catch control rule determination under Tiers 2, 3a, or 3b.

[5] Changes in the trend of a stock's landings or a stock complex's landings in three consecutive years shall trigger a reevaluation of their acceptable biological catch control rule determination under Tiers 2, 3a, or 3b.

CFMC[6] (proposed ABC Control Rule from Action 4 (**Preferred Alternative 3**) in Island-based FMP	1	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).	MFMT = F_{MSY} (or proxy) MSST = 0.75*SSB_{MSY}(or proxy) OFL = catch at MFMT	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} d = 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. [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.
	2	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	MFMT = F_{MSY} (or proxy) MSST = 0.75*SSB_{MSY}(or proxy) OFL = catch at MFMT	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)**.**
	3	Relatively data-limited or out-of-date assessments	MFMT = F_{MSY} (or proxy) MSST = 0.75*SSB_{MSY}(or proxy) OFL = catch at MFMT	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 $\sigma \geq 2\sigma_{min}$) b. where ABC = buffer * OFL, where buffer must be $\leq$ 0.9 [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. [2]Acceptable probability of overfishing determined by Council.

[6] The Caribbean Fishery Management Council is developing island-based FMPs and revising tiers 4a and 4b of their ABC control rule. The description of tiers 4a and 4b in Table 1 is from their draft Island Based FMPs which have not been finalized or approved yet.

	4a	No accepted[5] 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 Scientific and Statistical Committee (SSC) consensus[6] cannot be reached on the use of Tier 4a, Tier 4b should be used. [5]Accepted means that the assessment was approved by the SSC as being appropriate for management purposes. [6]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.	MSY_{proxy} = long-term yield at F_{MSY} proxy MFMT = F_{MSY} proxy OFL = none Sustainable Yield Level (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 $\leq$ 3 depending on perceived degree of exploitation, life history and ecological function.	ABC = *buffer* * SYL, where *buffer* must be $\leq$ 0.9 (e.g., 0.9, 0.8, 0.75, 0.70…) based on the SSC's determination of scientific uncertainty[7]. [7]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.
	4b	No accepted[5] assessment, but the stock has relatively high vulnerability to fishing pressure (see definition in Tier 4a), or SSC consensus[6] cannot be reached on the use of Tier 4a. [5]Accepted means that the assessment was approved by the SSC as being appropriate for management purposes. [6]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.	MSY_{proxy} = long-term yield at F_{MSY} proxy MFMT = F_{MSY} proxy OFL = None 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 = *buffer* * SYL, where *buffer* must be $\leq$ 0.9 (e.g., 0.9, 0.8, 0.75, 0.70…) based on the SSC's determination of scientific uncertainty[7]. [7]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.
	1	Those stocks which have been recently	OFL calculated by applying $F_{45\%}$ (or other established MSY proxy) to the	The SSC quantifies the variability in biomass estimates (sigma) for Category 1 species from

		assessed with a catch-at-age or catch-at-length analysis and judged to be informative for deciding stock-specific harvest specifications by the SSC.	best estimate of current biomass. This estimate of current biomass can be for a single year or the avg of the present and several future years.	stock assessments and the Council chooses the P* as described below to determine the size of scientific uncertainty buffer. The percent reduction that defines the scientific uncertainty buffer and the ABC can be determined by translating the estimate sigma to a range of overfishing (P*) values. Each P* value is then mapped to its corresponding buffer fraction[8]. The Council then determines the preferred level of risk aversion by selecting an appropriate P* value, accordingly. The upper limit of P* values considered will be 0.45.
PFMC[7]	2	Stocks with data-moderate quantitative assessments that are less robust and more uncertain than Category 1 assessments, but do inform stock status by including at least one time series index of relative abundance. Detailed biological information is not routinely available or used in assessments of these stocks.	OFL typically established on basis of data-moderate assessments which uses a historical catch-based approach coupled with at least one index of relative abundance.	P* approach is allowed and is the only approach that has been used since implementation of the new harvest management framework 2011 under Amendment 23. In such cases, the SSC recommends a value for sigma, which is typically larger than an associated sigma for category 1 stocks, and the Council chooses the P* value to determine the size of the scientific uncertainty buffer. The other approaches that can be considered are: - Apply a buffer of 0.25 for category 2 stocks, or - Set the value of sigma for category 2 stocks to two times the coefficient of variation (CV) for Category 1 stocks. These specific values are not based on a formal analysis of assessment outcomes and could change substantially when the SSC reviews additional analyses.
	3	Stocks which are incidentally landed & are not usually listed separately on fish landings receipts, or stocks where info from fish-independent surveys lacking b/c of low abundance or b/c not vulnerable to survey sampling gears	OFL established based on a historical catch-based approach (e.g., average catch, DCAC, DB-SRA) or qualitative information, including advice from the Council's advisory entities.	P* approach is allowed and is the only approach that has been used since implementation of the new harvest management framework 2011 under Amendment 23. In such cases, the SSC recommends a value for sigma, which is typically larger than an associated sigma for category 1 or 2 stocks, and the Council chooses the P* value to determine the size of the scientific uncertainty buffer. The other approaches that can be considered are: - apply a buffer of 0.5, or - set the value of sigma to 4x the CV for Category 1 stocks. These values are not based on a formal analysis of assessment outcomes, and could change substantially when the SSC reviews additional analyses.
SAFMC[9]	1	Assessed Stocks.	Provides pdf of OFL.	A scoring system is used to determine P* and includes the following criteria: assessment

[7] The ABC control rule described here is from the Pacific Fishery Management Council's Pacific Coast Groundfish Fishery Management Plan. https://www.pcouncil.org/groundfish/fishery-management-plan/

[8] Since estimated OFLs are median estimates, there is a 50% probability that the OFL is overestimated. Therefore, a P* of 0.5 equates to no scientific uncertainty or, in other words, the ABC is set equal to the OFL.

[9] The South Atlantic Council's ABC control rule was specified by their 2011 Comprehensive Annual Catch Limit Amendment for the Snapper Grouper, Dolphin Wahoo, and Sargassum FMPs. Amendment 29 (approved in 2015) to the Snapper Grouper FMP provides that level 4 can be used for stocks within that FMP. The South Atlantic Council is in the process of revising their ABC control rule. A June 2018 version of their current white paper is

				information, uncertainty characterization, stock status, and productivity and susceptibility analysis.
	2	Unassessed Stocks. Reliable landings and life history information available	OFL derived from "Depletion-Based Stock Reduction Analysis" (DBSRA).	ABC derived from applying the assessed stocks rule to determine the adjustment factor if possible, or from expert judgment if not possible.
	3	Unassessed Stocks. Inadequate data to support DBSRA		ABC derived directly from "Depletion-Corrected Average Catch" (DCAC). Done when only a limited number of years of catch data for a fishery are available. Requires a higher level of "informed expert judgment" than Level 2.
	4[10]	Unassessed Stocks. Only Reliable Catch Stocks.	OFL and ABC derived on a case-by-case basis. Apply ORCS approach using a catch statistic, a scalar derived from the risk of overexploitation, and the Council's risk tolerance level.	
	5	Unassessed Stocks.	OFL derived on a case-by-case basis.	ABC derived on a case-by-case basis. Stocks with very low landings that show very high variability in catch estimates (mostly caused by the high degree of uncertainty in recreational landings estimates), or stocks that have species identification issues that may cause unreliable landings estimates. Use "decision tree": 1. Will catch affect stock? NO: Ecosystem Species (Council did this already, ACL Amend) YES: Go to 2 2.. Will increase (beyond current range of variability) in catch lead to decline or stock concerns? NO: ABC = 3rd highest point in the 1999-2008 time series YES: Go to 3 3. Is stock part of directed fishery or is it primarily bycatch for other species? Directed: ABC = Median 1999-2008 Bycatch/Incidental: If yes, go to 4. 4. Bycatch. Must judge the circumstance: If bycatch in other fishery: what are trends in that fishery? What are the regulations? What is the effort outlook? If the directed fishery is increasing and bycatch of stock of concern is also increasing, the Council may need to find a means to reduce interactions or mortality. If that is not feasible, will need to impact the directed fishery. The SSC's intention is to evaluate the situation and provide guidance to the Council on possible

available on the Councils' website:
http://safmc.net/download/Briefing%20Book%20Council%20Mtg%20June%202018/Tab%2009%20-%20ABC%20Control%20Rule%20Committee/Tab09_A1_ABCCR-OptsPaper-June2018.pdf

[10] Level 4 of the South Atlantic Council's ABC control rule is only available to the Snapper-Grouper FMP. See Amendment 29 to the Snapper Grouper FMP.

				catch levels, risk, and actions to consider for bycatch and directed components.
WPFMC [11]	1	Data used are reliable and complete enough to utilize statistical-based stock assessment models. Reliable estimates of MSY, F_{MSY}, B_{MSY}, and B_t are available. Measures of the uncertainty of F_{MSY}, B_t and B_{t+k} and OFL_{t+k} must be available directly	OFL is estimated as $OFL=B_y[F_{MSY}/(F_{MSY}+M)][1-\exp(F_{MSY}+M)]$	ABC = P_{p^*}(OFL), where P_{p^*} is the P* percentile of the probability distribution of OFL. The Council advises the SSC on the acceptable P*.
	2	Measures of uncertainty of OFL are not as reliable or are not available from a single model. Reliable data used are obtained through some separate analysis. The methods often involve resampling or ad hoc methods. The assessments involve the use of F_{MSY} proxies, usually $F_{30\%}$ and $F_{60\%}$. The data may not be as reliable or complete as in Tier 1, though still of sufficient quality to provide fully usable stock assessments	OFL calculated by applying $F_{30\%}$ (or $F_{60\%}$, or other established F_{MSY} proxy) to the best estimate of current biomass.	ABC is estimated using the equation in Tier 1, with the uncertainty estimates coming from re-sampling (i.e., method for estimating and re-estimating probability distributions such as bootstrapping). The Council advises the SSC on the acceptable P*.
	3	The available data are not sufficient for the use of model-based assessment tools. Data are sufficient to apply the DCAC-SRA or DCAC, with M, but other life history information is lacking. These tools are to be applied to long-lived species where the natural mortality coefficient M should be less than 0.20 and recruitment should not be highly episodic	OFL calculated using the equation in Tier 1. Uncertainty in OFL is estimated using Monte Carlo simulation.	ABC is estimated using the equation in Tier 1, with the uncertainty estimates coming from Monte Carlo simulation. The Council advises the SSC on the acceptable P*.
	4	Used for species or species assemblages with stock assessments	None	The ABC is set at 0.70 F_{MSY} (= yield 91% OFL = 91% MSY = ABC; see Walters et al. 2005).

[11] The ABC control rule described here is the same for all of the Western Pacific Council's Fishery Ecosystem Plan. As an example, see the Council's Omnibus Amendment for the Western Pacific Region to establish a Process for Specifying Annual Catch Limits and Accountability Measures. http://www.wpcouncil.org/fishery-plans-policies-reports/hawaii-fishery-ecosystem-plan/

		and/or MSY estimates, but no current harvest.		An alternative target fishing mortality value may be specified if additional data or modeling is available to support it, or the Council chooses to be more precautionary.
	5	Catches may be small and/or the catch history may contain gaps or be too variable. Catch history may also be lacking in consistently stable periods or periods with consistent trends for using DCAC-SRA or DCAC. Hence, there is no basis for estimating a reliable MSY or OFL	None	If B > Bmsy Limit catch = 1.00*Median Recent Catch If B Above MSST but below B_{MSY} Limit catch = 0.67*Median Recent Catch If B Below MSST (i.e. overfished) Limit catch = 0.33*Median Recent Catch In some instances the 0.75 multiplier has been implemented, e.g., slipper lobster see 2016 SAFE report at http://www.wpcouncil.org/wp-content/uploads/2017/06/Hawaii-FEP-SAFE-Report-2016-Final.pdf
NPFMC[12]	1[13]	Reliable point estimates are available for B and B_{MSY} and reliable probability density function (pdf) of F_{MSY}	1a) Stock status: $B/B_{MSY} > 1$ F_{OFL} = mA , the arithmetic mean of the pdf 1b) Stock status: $\alpha < B/B_{MSY} \leq 1$ $F_{OFL} = mA \times (B/B_{MSY} - \alpha)/(1-\alpha)$ 1c) Stock status: $B/B_{MSY} \leq \alpha$ $F_{OFL} = 0$	1a) Stock status: $B/B_{MSY} > 1$ $maxF_{ABC}$ = mH, the harmonic mean of the pdf 1b) Stock status: $\alpha < B/B_{MSY} \leq 1$ $maxF_{ABC} = mH \times (B/B_{MSY} - \alpha)/(1 - \alpha)$ 1c) Stock status: $B/B_{MSY} \leq \alpha$ $maxF_{ABC} = 0$
	2	Reliable point estimates are available for B, B_{MSY} , F_{MSY}, $F_{35\%}$, and $F_{40\%}$; where $F_{X\%}$ 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	2a) Stock status: $B/B_{MSY} > 1$ $F_{OFL} = F_{MSY}$ 2b) Stock status: $\alpha < B/B_{MSY} \leq 1$ $F_{OFL} = F_{MSY} \times (B/B_{MSY} - \alpha)/(1 - \alpha)$ 2c) Stock status: $B/B_{MSY} \leq \alpha$ $F_{OFL} = 0$	2a) Stock status: $B/B_{MSY} > 1$ $maxF_{ABC} = F_{MSY} \times (F_{40\%} / F_{35\%})$ 2b) Stock status: $a < B/B_{MSY} \leq 1$ $maxF_{ABC} = F_{MSY} \times (F_{40\%} / F_{35\%}) \times (B/B_{MSY} - \alpha)/(1 - \alpha)$ 2c) Stock status: $B/B_{MSY} \leq \alpha$ $maxF_{ABC} = 0$
	3	Reliable point estimates are available for B,	3a) Stock status: $B/B_{40\%} > 1$ $F_{OFL} = F_{35\%}$	3a) Stock status: $B/B_{40\%} > 1$ $maxF_{ABC} = F_{40\%}$

[12] The ABC control rule described here is for the North Pacific Council's Bering Sea/Aleutian Islands and Gulf of Alaska Groundfish FMPs. For example, see: https://www.npfmc.org/bering-seaaleutian-islands-groundfish/. Crab and scallop stocks are managed under a separate tier system, see: https://www.npfmc.org/wp-content/PDFdocuments/fmp/CrabFMPOct11.pdf and https://www.npfmc.org/wp-content/PDFdocuments/fmp/Scallop/ScallopFMP2014.pdf

[13] For tiers 1-3, the coefficient α is set at 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 *BMSY* 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.

		$B_{40\%}$, $F_{35\%}$, and $F_{40\%}$; where $B_{40\%}$ refers to the long-term average biomass that would be expected under average recruitment and F= $F_{40\%}$	3b) Stock status: $\alpha < B/B_{40\%} \leq 1$ $F_{OFL} = F_{35\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)$ 3c) Stock status: $B/B_{40\%} \leq \alpha$ $F_{OFL} = 0$	3b) Stock status: $\alpha < B/B_{40\%} \leq 1$ $maxF_{ABC} = F_{40\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)$ 3c) Stock status: $B/B_{40\%} \leq \alpha$ $maxF_{ABC} = 0$
	4	Reliable point estimates are available for B, $F_{35\%}$, and $F_{40\%}$	$F_{OFL} = F_{35\%}$	$maxF_{ABC} = F_{40\%}$
	5	Reliable point estimates are available for B and natural mortality rate M	$F_{OFL} = M$	$maxF_{ABC} = 0.75 \times M$
	6	Reliable catch histories are available from 1978	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	maxABC= 0.75 × OFL