Omnibus Acceptable Biological Catch and Risk Policy Framework Adjustment

Framework Meeting 1 Discussion Document

August 14, 2019, Philadelphia, Pennsylvania

Introduction:

In 2011, the omnibus amendment to all Mid-Atlantic Fishery Management Council (Council) fishery management plans (FMPs) implemented the Council's current risk policy and Acceptable Biological Catch (ABC) control rule to comply with the 2006 re-authorization of the Magnuson-Stevens Act (MSA). Five years after implementation, the Council reviewed possible issues relative to the current risk policy and ABC control rule and discussed potential solutions/options to the problems identified. The elements identified by the Council for further evaluation through a possible framework action were as follows:

- Adjustments to the maximum probability of overfishing value (P*)
- Constant or stepped P* (i.e. remove the linear ramping, see Figure 1)
- Alternative/different risk policies for different life histories or species groups
- Limiting response (+/-) in annual ABC changes
- Formulate an Overfishing Limit (OFL) Coefficient of Variation (CV) decision document

Since 2017, a substantial amount of work and analyses have been conducted to evaluate the elements outlined above in order to help inform the Council's deliberations regarding possible modifications to the existing risk policy. The Council will hold Framework Meeting 1 at the August 2019 Council meeting to discuss the draft risk policy alternatives. In addition, the Council and it's Scientific and Statistical Committee (SSC) recently addressed the fifth element above and finalized a decision document that provides detailed guidelines and outlines the process the SSC will use when assigning a coefficient of variation value to the overfishing limit when making ABC recommendations for Council-managed species[1].

This memo contains an overview of the Council's existing risk policy and ABC control rule and background on the Council's activities to date on the development of the risk policy framework. The memo also provides details on eight draft alternatives, including *status quo*, for review and consideration by Council. At the August meeting, the Council will provide feedback and approve draft alternatives for further analysis and evaluation. The Council will then take final action on the risk policy framework at its December 2019 Council meeting.

Overview of Current Risk Policy and ABC Control Rule:

Risk Policy

Under the current risk policy, the Council's acceptable probability of overfishing (P*) for a given stock is conditional on current stock biomass (B) relative to the biomass at maximum sustainable yield (B_{MSY}) and the life history of the species (Figure1). The P* is 0 percent (i.e., no fishing) if the ratio of B/B_{MSY} is less than or equal to a stock replenishment threshold of 0.10 to ensure the stock does not reach low levels from which it cannot recover. The probability of overfishing increases linearly for stocks defined as "typical" as the ratio of B/B_{MSY} increases, until the inflection point of $B/B_{MSY} = 1.0$ is reached (i.e., current stock biomass greater than B_{MSY}). A maximum 40 percent probability of overfishing (P* = 0.4) is utilized for ratios equal to or greater

[1] For additional information on the OFL CV guidance document, see the June 2019 Council meeting materials at: http://www.mafmc.org/briefing/june-2019

than 1.0. The same approach applies to those stocks defined as "atypical", currently applied to ocean quahog, except the maximum probability of overfishing when the B/B_{MSY} ratio is equal to or greater than 1.0 is 35 percent (P* = 0.35). The Council's SSC determines whether a stock is typical or atypical each time an ABC is recommended and whether or not the atypical life history has been fully addressed in the stock assessment.

In addition, for managed stocks that are under a rebuilding plan, the upper limit on the probability of exceeding $F_{REBUILD}$ would be 50 percent unless modified to a lower value (i.e., a higher probability, 75 percent for example, of not exceeding $F_{REBUILD}$) through a rebuilding plan amendment. If the SSC recommends a more restrictive ABC, based on the application of the Council's risk policy and ABC control rule, than the ABC derived from the use of the Council specified $F_{REBUILD}$, the SSC recommends the lower of the ABC values. Also, if no OFL is available and no OFL proxy is provided by the SSC when making an ABC recommendation, a cap on the allowable increases on the ABC is established. The ABC may not be increased until and OFL has been identified.

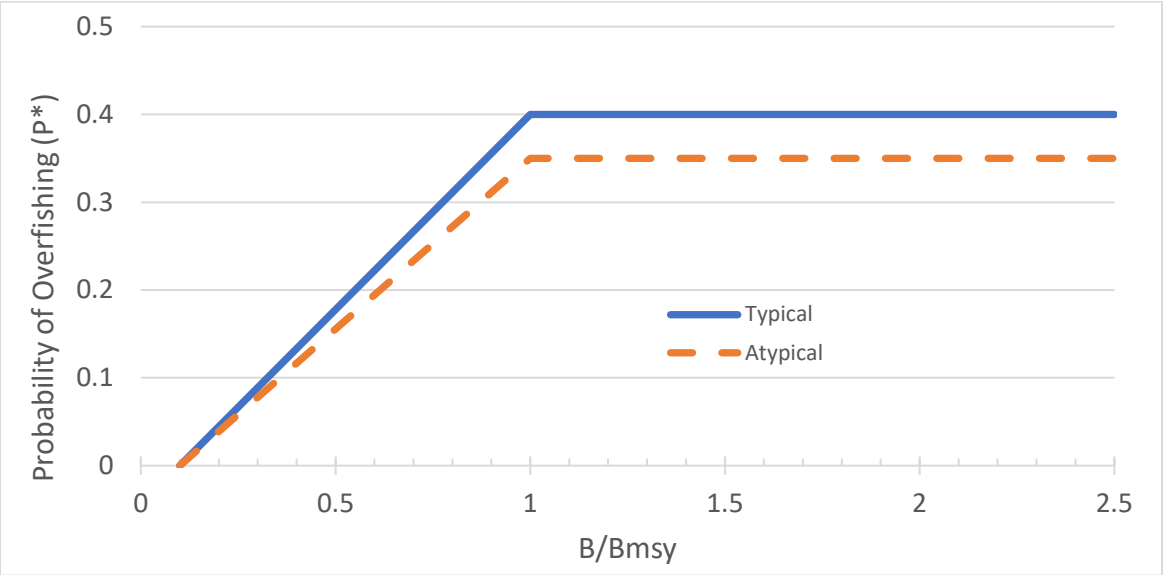

Figure 1: Current Mid-Atlantic Fishery Management Council risk policy

ABC Control Rule

The current ABC control rule utilizes a multi-level approach in setting an ABC that is based on the overall level of scientific uncertainty associated with each species stock assessment. This approach identifies four types of overall assessment uncertainty defined by characteristics of the stock assessment and other relevant information. The SSC determines which control rule type the assessment for a particular stock belongs when setting ABC specifications. Then the processes described within each type are used to calculate ABC. The four control rule types are summarized below.

- **Analytically-based ABC from stock assessment:** all important sources of uncertainty are fully and formally captured in the stock assessment model and the probability distribution of the OFL (OFL CV) estimated directly from the stock assessment is used. Under this level, the ABC will be determined solely on the basis of a P*, determined by the Council's risk policy, and the probability distribution of the OFL from the assessment. Currently, no Mid-Atlantic stocks are in this control rule type.

- **Expert-based ABC:** this level assessment has greater uncertainty than the analytically-based control rule type. Specifically, the estimation of the probability distribution of the OFL directly from the stock assessment model does not include some important sources of uncertainty, necessitating expert judgement by the assessment team during the stock assessment process to develop a probability distribution of the OFL. The OFL probability distribution developed during the assessment then needs to be deemed as best available science by the SSC. In this level, the ABC will be determined by using the Council's risk policy (P*) but with the OFL probability distribution based on the specified distribution in the stock assessment. Currently, no Mid-Atlantic stocks are in this control rule type.

- **Empirically-based ABC:** attributes of a stock assessment are the same as the expert-based control rule type, except the assessment does not contain estimates of the probability distribution of the OFL or the probability distribution provided does not, in the opinion of the SSC, adequately reflect uncertainty in the OFL estimate. The SSC then adjusts the distribution of the OFL and develops an ABC recommendation by applying the Council's risk policy (P*) to the modified OFL probability distribution. The majority of the Mid-Atlantic stocks fall under this control rule type.

- **Catch-based ABC:** assessments are deemed to have reliable estimates of trends in abundance and catch, but absolute abundance, fishing mortality rates, and reference points cannot be developed. Stocks in this level do not have point estimates of the OFL or probability distributions of the OFL that are considered best available science. For stocks in this level, the SSC will use ad hoc types of control rules based on biomass and catch history and the Council's risk policy. Longfin squid and *Illex* squid currently fall under this level.

Background on Council Evaluation of Risk Policy:

A management strategy evaluation (MSE) to consider the biological and fishery yield implications of different risk policy alternatives was conducted by Dr. John Wiedenmann from Rutgers University[2]. The MSE included an evaluation of five different alternatives, including the current risk policy, assuming two different OFL CV distributions (60% and 100%) with variable natural mortality, recruitment and stock assessment data for summer flounder, scup, and butterfish.

The results of the MSE indicated that while all risk policy alternatives did limit overfishing under baseline/average conditions (median probability of overfishing below the 50% threshold

[2] For more information, see summary report and presentation in the February 2018 Council meeting materials at: http://www.mafmc.org/briefing/february-2018.

for each stock), the linear ramping P* alternatives (i.e. those like the current Council risk policy) were better at preventing overfishing and reduced the risk of a population declining to low levels. However, under "poor" conditions (i.e. above average natural mortality, below average recruitment and assessments that overestimated terminal biomass), the stepped or constant P* alternatives had nearly double the risk of overfishing and a 5-10% higher risk of stocks becoming overfished than the linear ramping alternatives. The MSE results also highlighted potential trade-offs associated with the various alternatives ability to limit overfishing and the short and long-term yield from the fishery. Generally, for a given stock, short-term yield (first 5 projection years) under varying future conditions were generally consistent across all alternatives and the maximum P* value, 0.40 versus 0.45, played a larger role in short-term yield than any specific control rule shape (constant, stepped or ramped). The results of the MSE evaluation highlighted the effectiveness of the current risk policy in preventing stocks from becoming overfished by reducing the probability of overfishing as stock size falls below B_{MSY}, particularly when environmental conditions are poor. Staff concluded the Council's current risk policy may provide for additional stock protection as environmental conditions become increasingly variable and continue to change in the Mid-Atlantic as a result of climate change and should, therefore, not be modified.

After reviewing the results of this analysis, the Council expressed interest in not only considering biological factors but to also more comprehensively consider economic and social factors and the potential implications when evaluating risk policy alternatives. However, the existing MSE did not analyze or account for different economic factors within each fishery but, the outputs from the MSE could be used in economic models to help understand the short and long-term economic impacts of the different risk policy alternatives. Therefore, the Council agreed to delay the framework action and allow time for the potential development of economic models that could evaluate the current risk policy and potential alternatives.

Building off an existing economic MSE for summer flounder[3], Dr. Doug Lipton (NMFS Office of Science and Technology) and Dr. Cyrus Teng (post-doctoral fellow with the University of Maryland) developed a summer flounder economic model to integrate with the risk policy MSE in order to evaluate the economic effects of the five different risk policy alternatives. The Council was presented with the results of this analysis at their December 2018 meeting[4]. The results indicated statistically significant differences in the total net economic benefits between the different risk policy alternatives that were evaluated with the current policy providing the most conservative approach and lowest net economic benefit. These differences were highly influenced by the starting condition of the summer flounder biomass with lower catch and, therefore, lower net economic benefit for some harvest control rules when stock biomass is below the B_{MSY}. As biomass stabilizes around B_{MSY}, there was a much smaller difference in the

[3] Hutniczak, B. et al. 2018. Valuing changes in frequency of fish stock assessments. Can. J. Fish. Aquat. Sci. 00:1-13. http://dx.doi.org/10.1139/cjfas-2018-0130

[4] For additional details, please see summary report and presentation in the December 2018 Council meeting materials at: http://www.mafmc.org/briefing/december-2018

net economic benefits between all of the alternatives as they effectively become equivalent to each other at high biomass levels.

Risk Policy Workgroup

Given all of this information, the Council decided to re-evaluate and reconsider both existing and potentially new risk policy alternatives that would assess the short and long-term trade-offs between stock biomass protection and economic yield and benefits. The Council agreed that the alternatives considered would retain the biologically based foundation of the existing risk policy of specifying a P* that is conditional on the current stock biomass relative to B_{MSY} and would not explicitly include but consider economic factors, targets or thresholds.

In addition, the Council agreed to establish a workgroup that would further develop and analyze any risk policy concepts and potential alternatives. A workgroup comprised of NOAA Fisheries staff, SSC members, academia and Council staff was formed to conduct this work. The workgroup met in early July to review and discuss draft alternatives for Council consideration and determine new and additional analyses that would need to be conducted to evaluate the alternatives being considered. Draft alternatives supported and/or developed by the workgroup are provided and discussed in more detail in the section below. This section also provides details on other relevant risk policy considerations and recommendations offered by the workgroup.

Draft Alternatives:

Council staff propose eight draft alternatives based on input from the Risk Policy Workgroup. Six of the alternatives (Alternatives 1 – 5 and 8) were previously provided to the Council during the initial framework development and two new alternatives (Alternatives 6 and 7) are offered for Council consideration. Alternative 8, removal of the typical/atypical designation, does not specify a risk policy but could be applied to any of the other seven alternatives.

Under any of the risk policy alternatives provided below, the existing language on the application of the risk policy to stocks under a rebuilding plan or for those stocks with no OFL, or OFL proxy, would remain as currently implemented (see page 3 of memo for more details).

1. **Current risk policy/*status quo* – linear ramping with a maximum P* of 0.4 when the B/B_{MSY} ratio is equal to or greater than 1.0**

This alternative would retain the existing risk policy with the acceptable probability of overfishing (P*) for a given stock conditional on current stock biomass relative to B_{MSY} and a maximum P* set at 0.4 (see Figure1). The stock replenishment threshold defined as the ratio of $B/B_{MSY} = 0.10$, is utilized to ensure the stock does not reach low levels from which it cannot recover. The probability of overfishing is 0 percent (i.e., no fishing) if the ratio of B/B_{MSY} is less than or equal to 0.10. The P* increases linearly as the ratio of B/B_{MSY} increases, until the inflection point of $B/B_{MSY} = 1.0$ is reached. A maximum P* of 0.4 or 0.35 is utilized (typical or atypical stock, respectively) for ratios equal to or greater than 1.0. The SSC determines whether a stock is typical or atypical each time an ABC is recommended.

2. **Linear ramping with a maximum P* of 0.45 when the B/B_{MSY} ratio is equal to or greater than 1.0**

Under this alternative, the Council would assume a higher level of risk (P*=0.45) than the current policy (P*=0.40) in cases where the stock biomass was greater than the B_{MSY} target biomass. Under this alternative, the P* would be variable and conditioned on current stock biomass when stock size falls below B_{MSY} as per the current rule, but would be held constant at 0.45 when stock size exceeds B_{MSY} (Figure 2A). The maximum P* of 0.45 is higher than the current Council risk policy but is lower than the 0.50 maximum allowed under the MSA.

A P* of 0 percent if the ratio of B/B_{MSY} is less than or equal to 0.10 would remain to ensure a stock does not reach low levels from which it cannot recover. It is worth noting that by increasing the maximum P* to 0.45 under this alternative, the slope of linear ramping portion to determine a P* for stocks whose biomass is less than B_{MSY} is also modified (Figure 2B). Therefore, when compared to the current risk policy, this alternative would result in slightly higher P* values (higher risk of overfishing) under the same current stock biomass when less than B_{MSY}.

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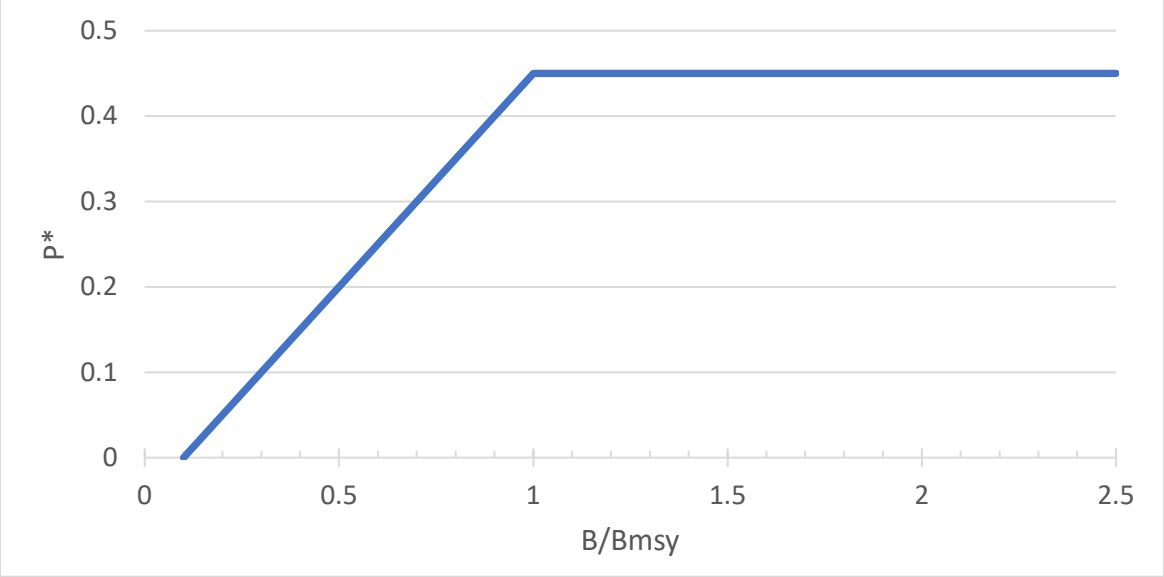

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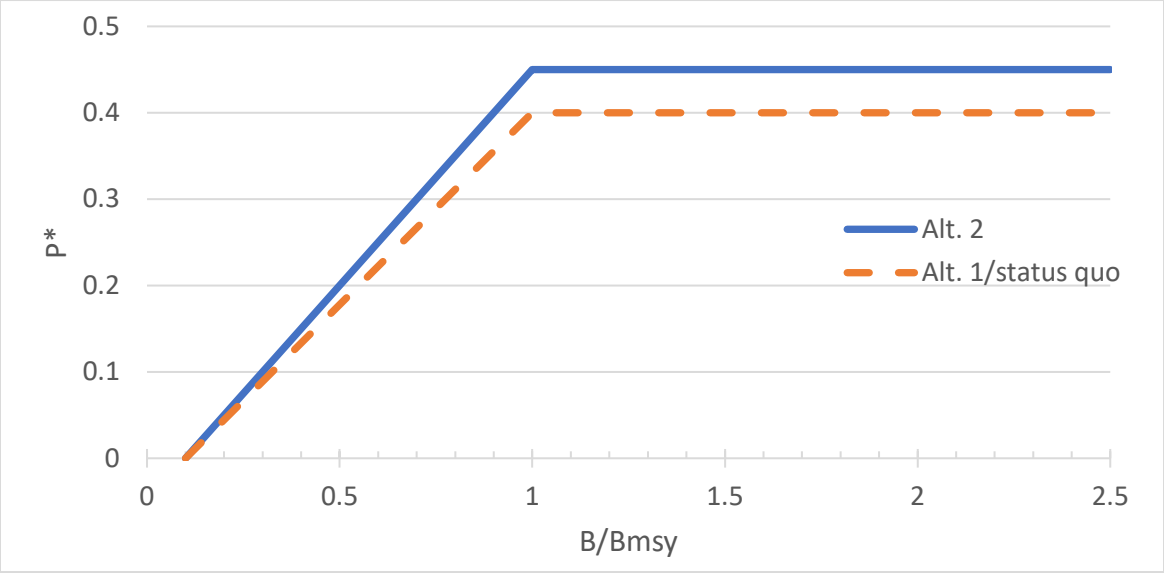

Figure 2: A) Alternative 2 with a variable probability of overfishing (P*) up to a maximum P* of 0.45 when the B/B_{MSY} ratio is equal to or greater than 1.0. **B)** Comparison between Alternative 1/*status quo* (typical life history) and Alternative 2.

3. **Constant P* equal to 0.40**

Under this alternative, the variable P* as a function of stock biomass would be removed and a constant P* equal to 0.4, the current maximum P* value, would be maintained under all circumstances (Figure 3). The P* of 0.4 would be applied regardless of current stock biomass, rebuilding status, life history etc. The current ramping of the P* conditioned on biomass is an attempt to prevent stocks from being overfished by reducing the probability of overfishing as stock size falls below B_{MSY}. However, this feature of the current risk policy is not a mandatory requirement of the MSA.

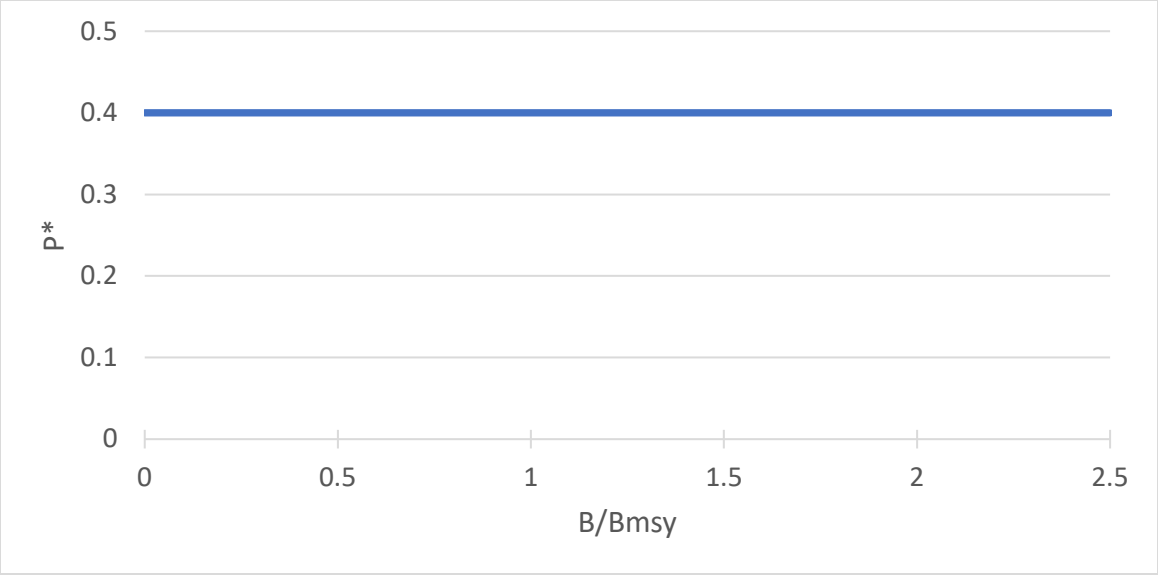

Figure 3. Alternative 3 with a constant P* equal to 0.40 under all stock biomass conditions.

4. **Two step P* - constant P* equal to 0.40 for B/B_{MSY} ratios less than 1.0 and a constant P* at 0.45 for B/B_{MSY} ratios equal to or greater than 1.0**

Under this alternative, current stock biomass relative to B_{MSY} would be considered but instead of applying a variable P* associated with the current policy, a constant P* equal to 0.40 or 0.45 would be applied depending upon the B/B_{MSY} ratio (Figure 4). For stocks whose biomass is less than B_{MSY} (B/B_{MSY} ratio less than 1.0), a constant P* equal to 0.40, the current maximum P* value, would be applied. For stocks whose biomass is equal to or greater than B_{MSY} (B/B_{MSY} ratio equal to or greater than 1.0), a constant P* equal to 0.45 would be applied. This maximum P* value is higher than the current Council risk policy maximum but lower than the 0.50 maximum allowed under the MSA.

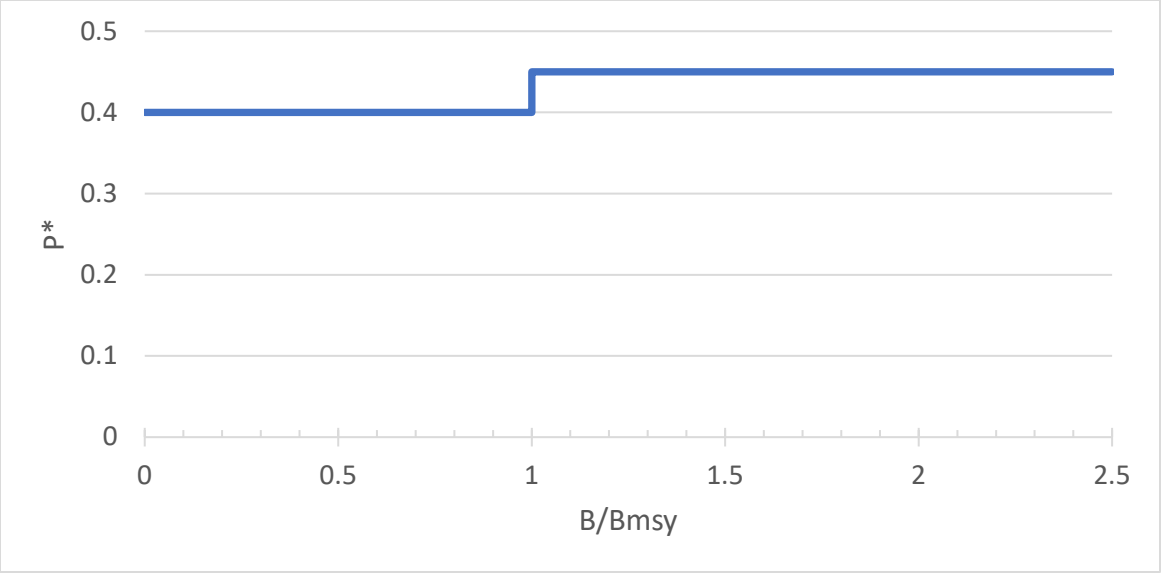

Figure 4. Alternative 4, a two-step P* with a constant P* equal to 0.40 when the B/B_{MSY} ratio is less than 1.0 and a constant P* equal to 0.45 when the B/B_{MSY} ratio is equal to or greater than 1.0.

5. **Three step P* - constant P* at 0.35 for B/B_{MSY} ratios less than 0.75, constant P* at 0.40 for B/B_{MSY} ratios between 0.75 and 1.0 and a constant P* at 0.45 for B/B_{MSY} ratios equal to or greater than 1.0**

Similar to Alternative 4, under this alternative, current stock biomass relative to B_{MSY} would be considered but instead of applying a variable P* associated with the current policy, a constant P* equal to 0.35, 0.40 or 0.45 would be applied depending upon the B/B_{MSY} ratio (Figure 5). For stocks whose biomass is more than 25 percent below B_{MSY} (B/B_{MSY} ratio less than 0.75), a lower risk would be assumed and a constant P* equal to 0.35 would be applied. When stock biomass is less than B_{MSY} but equal to or less than 25 percent below B_{MSY} (B/B_{MSY} ratio equal to or greater than 0.75 but less than 1.0), a constant P* of 0.40 would be applied. For stocks whose biomass is equal to or greater than B_{MSY} (B/B_{MSY} ratio equal to or greater than 1.0), a higher risk would be assumed and a constant P* equal to 0.45 would be applied. This alternative considers current stock biomass and would implement a lower risk tolerance under lower stock biomass conditions and increasing risk with increasing stock biomass.

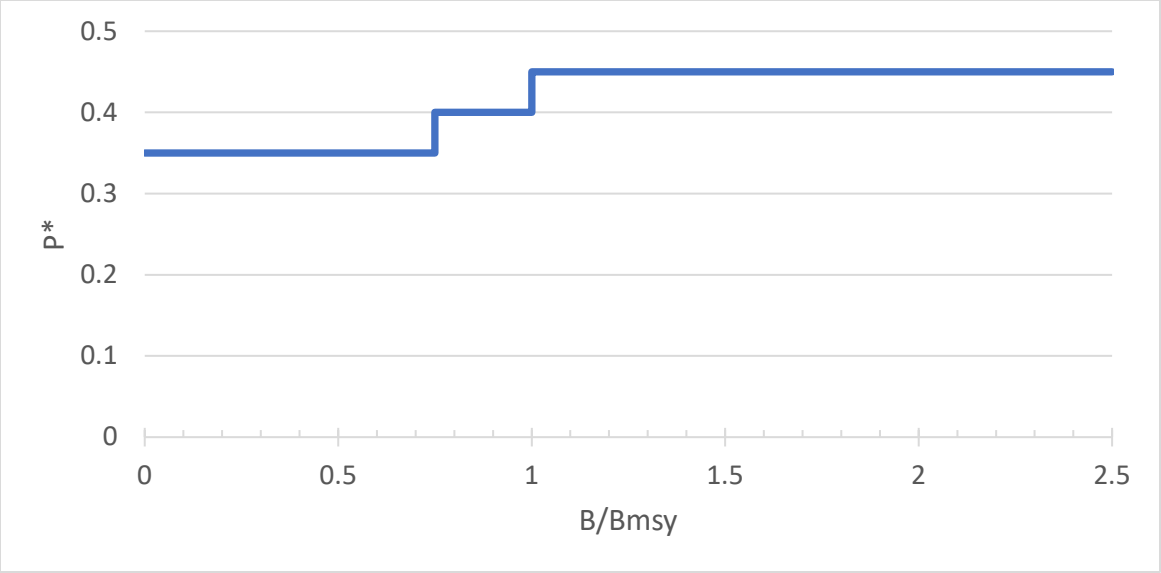

Figure 5. Alternative 5, a three-step P* with a constant P* equal to 0.35 when the B/B_{MSY} ratio is less than 0.75, a constant P* equal to 0.40 when the B/B_{MSY} ratio is greater than or equal to 0.75 but less than 1.0, and a P* equal to 0.45 when the B/B_{MSY} ratio is greater than or equal to 1.0.

6. **Linear ramping with a maximum P* of 0.40 when the B/B_{MSY} ratio is less than 1.0 and a linear ramping with a maximum P* of 0.49 when the B/B_{MSY} ratio is equal to or greater than 1.5**

Under the alternative, linear increases in the P* would occur as the ratio of B/B_{MSY} increases to a maximum of 0.40 at the inflection point of B/B_{MSY} = 1.0. This is consistent with the current risk policy. Once stock biomass exceeds B_{MSY} and the B/B_{MSY} ratio is equal to or greater than 1.0, linear increases in the P* would then occur to a maximum P* of 0.49 at the inflection point of B/B_{MSY} = 1.5. The maximum P* of 0.49 would then be applied when B/B_{MSY} ratios are equal to or greater than 1.5 (Figure 6). This alternative seeks to prevent stocks from being overfished by reducing the probability of overfishing as stock size falls below $B_{MSY;}$ while also allowing for increased risk under high stock biomass conditions that are 1.5 times greater than B_{MSY}. Consistent with the current risk policy, this alternative would also implement a P* of 0 percent if the ratio of B/B_{MSY} is less than or equal to 0.10 would remain to ensure the stock does not reach low levels from which it cannot recover.

The risk policy workgroup determined a B/B_{MSY} ratio of 1.5 indicated a very robust stock with favorable conditions that are substantially above the B_{MSY} target, even with uncertainty in the terminal biomass estimate. In addition, the workgroup noted these very high biomass conditions have not been observed frequently throughout the Council's management history. Currently, only scup and black sea bass have a B/B_{MSY} ratio greater than 1.5. Butterfish, surfclam and ocean quahog have B/B_{MSY} ratios between 1.0 and 1.5 which, under this alternative, would result in a P* between 0.4 and 0.48.

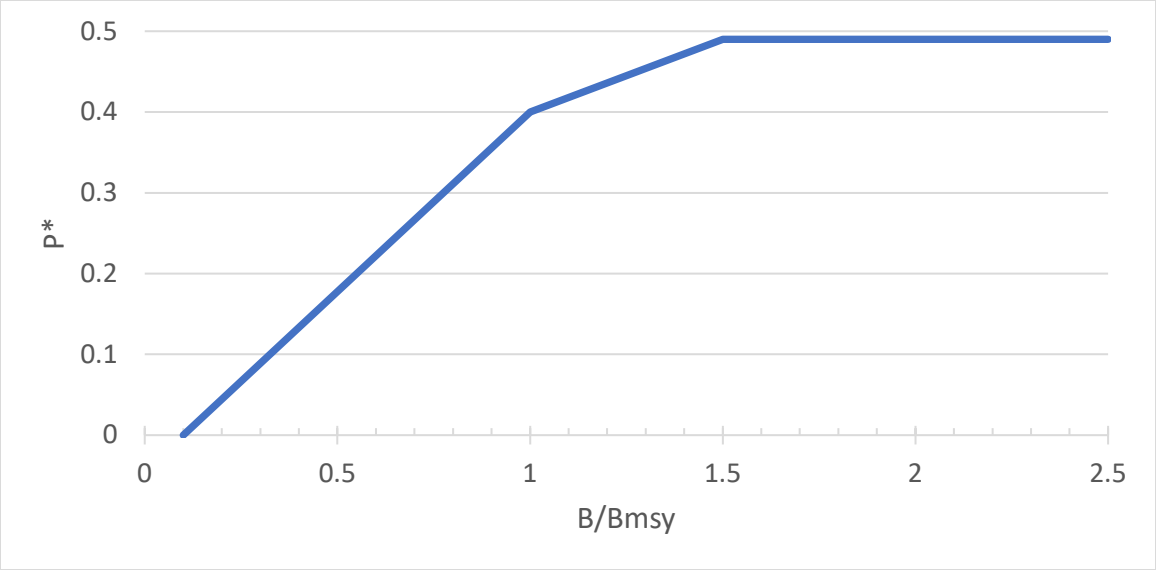

Figure 6. Alternative 6, linear ramping with a maximum P* of 0.40 when the B/B_{MSY} ratio is less than 1.0 and a linear ramping with a maximum P* of 0.49 when the B/B_{MSY} ratio is equal to or greater than 1.5.

7. **Current risk policy with a stock replenishment threshold equal to 0.3**

Under this alternative, the current risk policy would remain with the P* for a given stock conditional on current stock biomass relative to B_{MSY} and a maximum P* set at 0.4 when the B/B_{MSY} ratio is equal to or greater than 1.0; however, the P* will be set equal to 0 percent (i.e., no fishing) if the ratio of B/B_{MSY} is less than or equal to the stock replenishment threshold of 0.3 instead of the current threshold of 0.1 (Figure 7A). This alternative is more risk adverse than the current risk policy and attempts to minimize the likelihood of getting to an overfished condition and increase the probability of stock recovery in shorter period of time (Figure 7B).

The current stock replenishment threshold was determined by expert opinion but was not quantitively derived. The workgroup felt the current threshold may be too low to adequately provide for stock recovery. This alternative allows for a comprehensive evaluation to quantify the implications of the cost of closing a fishery and minimizing the risk of reaching an overfished condition under different replenishment thresholds. In addition, the trade-offs associated with the short-term loss in yield due to a reduced P* for a particular biomass could be evaluated to the quicker mid/long term increases in biomass and subsequent yield.

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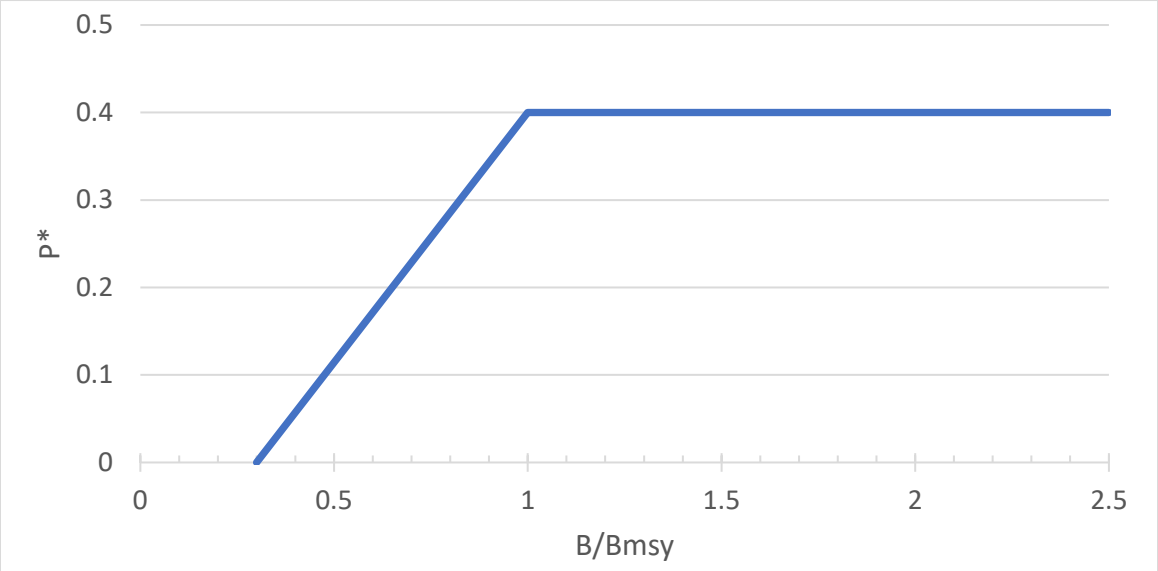

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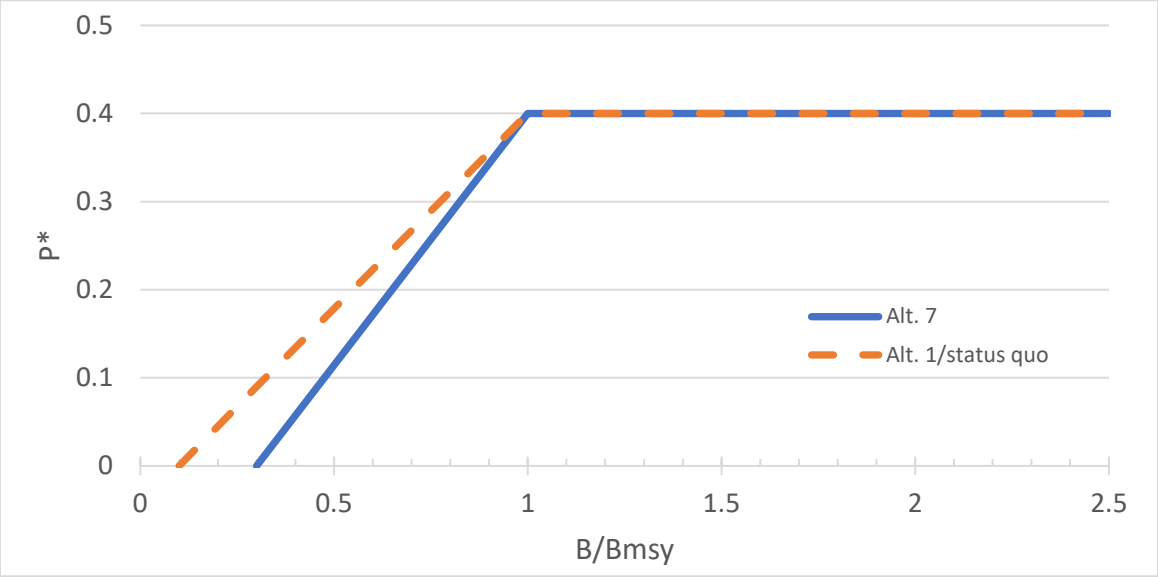

Figure 7: A) Alternative 7 with a variable probability of overfishing (P*) up to a maximum P* of 0.40 when the B/B_{MSY} ratio is equal to or greater than 1.0 and a P* of 0 if the ratio of B/B_{MSY} is less than or equal to the stock replenishment threshold of 0.3. **B)** Comparison between Alternative 1/*status quo* (typical species) and Alternative 7.

8. **Eliminate the typical/atypical distinction in the risk policy**

This measure was originally implemented by the Council reflecting the Council's lower risk tolerance for species whose life histories make them more vulnerable to over-exploitation.

Currently, ocean quahog is the only stock in which the SSC applied the atypical designation when making an ABC recommendation. Under this option, the P* would be the same for all species regardless of their life histories. Eliminating or retaining the typical/atypical designation could be implemented in conjunction with either fixed or variable P* alternatives considered here. The typical/atypical distinction could be eliminated because presumably a species vulnerability to over-exploitation is already addressed in the stock assessment and in the biological reference points selected for that species.

Other Risk Policy Workgroup considerations and recommendations

The bulleted list below highlights comments, considerations and recommendations the workgroup discussed and are offered to help the Council in their deliberations. Some comments are specific to the alternatives provided; others are more general and apply to any potential modifications to the risk policy.

- The workgroup did discuss other potential alternatives but noted that there needs to be enough distinction between the alternatives in order to effectively evaluate and quantify the biological and economic differences between the alternatives. The workgroup believes the current draft alternatives represent a sufficiently broad range of unique alternatives that are both more risk prone and risk adverse compared to the current risk policy.
- The stepped P* risk policy alternatives (Alternatives 4 and 5) create trigger points that rely on precise biomass estimates in which slight differences in biomass could result in very different P* values and, therefore, very different ABC recommendations. These trigger points can then place additional weight and scrutiny in the SSC and Council deliberations in evaluating the uncertainty in the biomass estimate and the resulting P* implications. The ramped or constant P* alternatives (Alternatives 1, 2, 3, 6 and 7) remove those trigger points.
- The workgroup recommends retaining a single risk policy applied to all Council-managed stocks. The analysis conducted to date does not show a measurable or specific benefit to implementing a different risk policy for each species, species groups, or based on different life histories. A consistent application of the risk policy across all species provides a more comprehensible and predictable process with understood outcomes. The workgroup notes that different harvest policies using the same risk policy can occur across Council-managed species given stock assessment results that incorporate different life history parameters within approved biological and fishing mortality reference points.
- The current biological and economic risk policy models do not consider the role of Council-managed forage species and their benefits to other predators and the ecosystem. The single-species models developed for the current risk policy review are not the appropriate models to answer these types of questions. A forage-based risk policy evaluation would require the development of different models and analyses and will take significant amount of time and additional Council, SSC and stakeholder input. This evaluation could be part of a future risk policy review that may include additional EAFM and economic considerations.

- The workgroup noted that while the current economic model will only evaluate the net economic benefits within the summer flounder fishery, given the current summer flounder biomass is below B_{MSY}, the implications on yield could generally be applied to the other species. In addition, the workgroup indicated the ability to provide the Council with some qualitative economic evaluation for other modeled species (scup and butterfish).
- The new Northeast Region Coordinating Council (NRCC) stock assessment process established a more frequent and predicable stock assessment schedule for Mid-Atlantic stocks. This new process will allow for increased opportunities for the Council and SSC to receive updated stock status information and respond to stock changes, through the risk policy and ABC control rule, in a timely manner.

Draft Timeline and Next Steps:

Task Description	**Date** (subject to change)
Original Initiation / Re-initiation	December 2015/ December 2018
Updates to biological and economic models to include summer flounder benchmark stock assessment information and new MRIP data	Spring 2019
Risk Policy Workgroup call to discuss draft alternatives	July 2019
Framework Meeting 1 - Council approval of draft alternatives	August 2019
Risk Policy Workgroup meetings and analysis to evaluate draft alternatives	September – November 2019
Framework Meeting 2 – Council final action and selection of preferred alternative(s)	December 2019
Finalization of framework; submission of EA to NMFS	Early 2020
EA revisions and resubmission to NMFS	Spring 2020
Proposed rule	Spring or summer 2020
Final rule	Summer or fall 2020