Comprehensive ABC Control Rule Amendment

OPTIONS PAPER
Scoping Review

January 2019

Background

The South Atlantic Fishery Management Council (Council) Scientific and Statistical Committee (SSC) developed an acceptable biological catch (ABC) control rule (CR) in 2008, based on the concept of using uncertainty and risk traits to determine the acceptable risk of overfishing. The acceptable risk of overfishing is specified as the P-Star (P*) value that is applied through assessment projections to develop the yield values that provide the ABC. During consideration by the Council and development of the Comprehensive Annual Catch Limit (ACL) Amendment, the SSC added additional levels to the ABC CR to better address unassessed and data limited stocks.

The ABC CR was implemented by the Council through the Comprehensive ACL Amendment that became effective in April 2012. The Comprehensive ACL Amendment included fishery management plans (FMP) for snapper grouper, dolphin wahoo, golden crab, and Sargassum. A revision to the ABC CR for snapper grouper occurred in July 2015 when the Only Reliable Catch Stocks (ORCS) approach was add to the CR for snapper grouper stocks, through Amendment 29 to the FMP for the Snapper Grouper Fishery of the South Atlantic Region FMP (Snapper Grouper FMP).

In applying the ABC CRs as specified in the Comprehensive ACL Amendment and snapper grouper Amendment 29 to different stocks and assessments from 2012-1016, the SSC began to express concerns that the rules lacked adequate resolution to distinguish differences in uncertainty levels across assessments, did not address continued developments in data poor assessment methods, and mixed uncertainty evaluation (an SSC role under the Magnuson-Stevens Fishery Conservation and Management Act (MSA)) and risk tolerance determination (a Council role under the MSA). Additionally, the existing CR does not provide a means to make use of 2016 revisions to National Standard 1 that increased the flexibility available to regional

fishery management councils for managing catch limits by allowing carry-over of unharvested catch and phasing in of catch level changes. While the addition of the ORCS approach to the ABC CR for snapper grouper represented some progress in addressing data poor assessment developments, it did not address the other ABC CR concerns or the National Standard revisions.

Actions in this amendment

- **Action 1.** Modify the acceptable biological catch control rule.
- **Action 2.** Specify an approach for determining the acceptable risk of overfishing.
- **Action 3.** Specify an approach for determining the probability of rebuilding success for overfished stocks.
- **Action 4.** Allow phase-in of acceptable biological catch changes.
- **Action 5.** Allow carry-over of unharvested catch.

Proposed timing

Process Steps	**Dates**
Scoping webinar hearings	January 2019
Council reviews scoping comments and revise actions/alternatives	March 2019
Review and revise action/alternatives	June 2019
Approval for public hearings	June 2019
Public hearings	Summer 2019
Review public hearing comments and approve all actions/alternatives	September 2019
Final action to approve for secretarial review	December 2019

Purpose and need statement

Purpose for Actions

The purpose of this amendment is to revise the acceptable biological catch control rule; simplify incorporation of scientific uncertainty; modify the approach used to determine the acceptable risk of overfishing; and address flexibility in specifying catch levels.

Need for Actions

The need for this amendment is to ensure catch level recommendations are based on the best scientific information available, prevent overfishing while achieving optimum yield, and include flexibility in setting catch limits as allowed per recent changes to the Magnuson-Stevens Fishery Conservation and Management Act implementing regulations.

Management Plans modified by this Comprehensive Amendment

- Snapper Grouper (Amendment 25)
- Dolphin Wahoo (Amendment 2)
- Golden Crab (Amendment 5)
- Sargassum (Amendment 2)
- Coral (currently does not have a control rule)

Proposed Actions and Alternatives

Action 1 Modify the Acceptable Biological Catch Control Rules

Alternative 1 (No Action). Acceptable biological catch for included species will continue to be specified as per the control rule specified by the Comprehensive Annual Catch Limit Amendment (**Table 2.1**) for the Dolphin Wahoo, Golden Crab, and Sargassum Fishery Management Plans, and Amendment 29 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region (**Table 2.2**). There is no acceptable biological catch control rule for the Fishery Management Plan for Coral, Coral Reefs, and Live/Hardbottom Habitats of the South Atlantic Region.

Alternative 2. Specify an acceptable biological catch control rule that establishes categories based on the type of information and the scientific uncertainty evaluation available for a stock. The Scientific and Statistical Committee may deviate from the acceptable biological catch control rule when necessary due to data or assessment circumstances that cannot be adequately addressed by the approved acceptable biological catch control rule. In the case of overfished stocks, the acceptable biological catch will be based on the rebuilding plan chosen by the Council.

Options to consider for **Alternative 2**:

- **Option 1**. Define acceptable biological catch based on the yield available at 75% of the fishing mortality rate that provides maximum sustainable yield for any assessment category if an acceptable overfishing limit probability distribution cannot be derived.

- **Option 2**. When requested by the Council, the Scientific and Statistical Committee will specify the acceptable biological catch for up to 5 years as both a constant value across years and as individual annual values for the same period of years.

Alternative 3. Specify the acceptable biological catch control rule to be consistent with the control rule specified in Amendment 29 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region, modified such that the Scientific and Statistical Committee will evaluate scientific uncertainty and determine the uncertainty adjustment values for Tiers 1 and 2 of Level 1. Tiers 3 and 4 of Level 1 will be deleted and the Council will specify a risk tolerance for overfishing that will provide a P* adjustment of 0 to 20% that will be added to the uncertainty adjustment of the SSC. The acceptable biological catch will be based on the accepted probability of overfishing selected by the Council, as modified by the sum of the scientific uncertainty and risk tolerance adjustments applied by the Scientific and Statistical Committee and the South Atlantic Fishery Management Council, and derived by applying the chosen overfishing probability to a stock projection analysis.

DISCUSSION:

Alternative 1, no action, is summarized in **Tables 2.1** and **2.2** The only difference in **Tables 2.1** and **2.2** is that **Table 2.2** includes the ORCS approach implemented for the Snapper Grouper FMP as Level 4, with the unassessed stocks provisions subsequently renumbered as Level 5.

Table 2.1. ABC control rule specified by the Comprehensive ACL Amendment for the Snapper Grouper, Dolphin Wahoo, and Sargassum FMPs. Parenthetical values in Level 1 indicate (1) the maximum adjustment value for a dimension; and (2) the adjustment values for each tier within a dimension.

Level 1 – Assessed Stocks	
Tier	**Tier Classification and Methodology to Compute ABC**
1. Assessment Information (10%)	1. Quantitative assessment provides estimates of exploitation and biomass; includes MSY-derived benchmarks. (0%) 2. Reliable measures of exploitation or biomass, no MSY benchmarks, proxy reference points. (2.5%) 3. Relative measures of exploitation or biomass, absolute measures of status unavailable. Proxy reference points. (5%) 4. Reliable catch history. (7.5%) 5. Scarce or unreliable catch records. (10%)
2. Uncertainty Characterization (10%)	1. Complete. Key determinant – uncertainty in both assessment inputs and environmental conditions are included. (0%) 2. High. Key determinant – reflects more than just uncertainty in future recruitment. (2.5%) 3. Medium. Uncertainties are addressed via statistical techniques and sensitivities, but full uncertainty is not carried forward in projections. (5%) 4. Low. Distributions of F_{MSY} and MSY are lacking. (7.5%) 5. None. Only single point estimates; no sensitivities or uncertainty evaluations. (10%)
3. Stock Status (10%)	1. Neither overfished nor overfishing. Stock is at high biomass and low exploitation relative to benchmark values. (0%) 2. Neither overfished nor overfishing. Stock may be in close proximity to benchmark values. (2.5%) 3. Stock is either overfished or overfishing. (5%) 4. Stock is both overfished and overfishing. (7.5%) 5. Either status criterion is unknown. (10%)
4. Productivity and Susceptibility Analysis (10%)	1. Low risk. High productivity, low vulnerability, low susceptibility. (0%) 2. Medium risk. Moderate productivity, moderate vulnerability, moderate susceptibility. (5%) 3. High risk. Low productivity, high vulnerability, high

	susceptibility. (10%)
Level 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.	
Level 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.	
Level 4 – Unassessed Stocks.	
OFL and 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 catch levels, risk, and actions to consider for bycatch and directed components.	

Table 2.2. Acceptable biological catch control rule specified for Snapper Grouper by Amendment 29 to the Snapper Grouper FMP. Parenthetical values in Level 1 indicate (1) the maximum adjustment value for a dimension; and (2) the adjustment values for each tier within a dimension.

Level 1 – Assessed Stocks	
Tier	**Tier Classification and Methodology to Compute ABC**
1. Assessment Information	1. Quantitative assessment provides estimates of

(10%)	exploitation and biomass; includes MSY-derived benchmarks. (0%) 2. Reliable measures of exploitation or biomass, no MSY benchmarks, proxy reference points. (2.5%) 3. Relative measures of exploitation or biomass, absolute measures of status unavailable. Proxy reference points. (5%) 4. Reliable catch history. (7.5%) 5. Scarce or unreliable catch records. (10%)
2. Uncertainty Characterization (10%)	1. Complete. Key determinant – uncertainty in both assessment inputs and environmental conditions are included. (0%) 2. High. Key determinant – reflects more than just uncertainty in future recruitment. (2.5%) 3. Medium. Uncertainties are addressed via statistical techniques and sensitivities, but full uncertainty is not carried forward in projections. (5%) 4. Low. Distributions of F_{MSY} and MSY are lacking. (7.5%) 5. None. Only single point estimates; no sensitivities or uncertainty evaluations. (10%)
3. Stock Status (10%)	1. Neither overfished nor overfishing. Stock is at high biomass and low exploitation relative to benchmark values. (0%) 2. Neither overfished nor overfishing. Stock may be in close proximity to benchmark values. (2.5%) 3. Stock is either overfished or overfishing. (5%) 4. Stock is both overfished and overfishing. (7.5%) 5. Either status criterion is unknown. (10%)
4. Productivity and Susceptibility Analysis (10%)	1. Low risk. High productivity, low vulnerability, low susceptibility. (0%) 2. Medium risk. Moderate productivity, moderate vulnerability, moderate susceptibility. (5%) 3. High risk. Low productivity, high vulnerability, high susceptibility. (10%)
Level 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.	
Level 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.	
Level 4 – 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.	
Level 5 – Unassessed Stocks.	

OFL and 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":

5. Will catch affect stock?
   NO: Ecosystem Species (Council did this already, ACL Amend)
   YES: Go to 2

6. 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

7. 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.

8. 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 catch levels, risk, and actions to consider for bycatch and directed components.

Both the Council and SSC have held extensive discussions on potential ABC CR modifications. The following bullets summarize prior recommendations and discussion points made in support of the overall ABC CR modifications proposed in **Action 1**.

- The existing CR is overly prescriptive and formulaic with regard to Tier 1 (assessed stocks), thus preventing the SSC from adequately addressing uncertainty differences across stocks or from responding to new methods and techniques.
- The CR is too prescriptive with regard to Tiers 2 and 3 (unassessed stocks), calling upon specific methods, which have in some cases been surpassed by recent developments.
- Some assessment information factors of Tier 1 (assessed stocks) are not appropriate for the stocks addressed under the CR's Tier 1, and overlap with stocks assigned to other tiers (e.g., includes an adjustment for 'scarce or unreliable catch records' that is inappropriate now that the rule includes tiers addressing catch-only stocks)
- The current rule mixes uncertainty evaluation (an SSC responsibility) with risk tolerance (a Council responsibility); and relies upon the SSC to make recommendations with regard to both components.
- Language and definitions have become unclear over time, particularly with multiple use of the word "Tiers."

- The Council recommended that the SSC consider removing status from consideration in the CR. The Council cited two considerations in support of this request. The first is that status determinations (overfished and overfishing) are made by the National Marine Fisheries Service (NMFS), not the SSC. The second consideration is that the basis for a status determination is an assessment output, not a characteristic of the assessment approach or the data. Therefore, status of the stock is not a component to the underlying assessment uncertainty that should be addressed by the CR. The Council considers that stock status is more appropriately considered when it considers its risk tolerance for a stock.
- The SSC recommends removing stock status from the factors it should consider when evaluating uncertainty and applying the ABC CR. Stock status is determined by NMFS on a timeline that is out of Council or SSC control, and therefore a final determination may not be available when the SSC is required to apply the CR. Additionally, the SSC considers it more appropriate for the Council to consider stock status when determining the acceptable risk of overfishing.
- The SSC recommends removing stock productivity and susceptibility to overfishing traits from the evaluation of uncertainty, because such factors are included in the stock assessment parameters and are more appropriate to risk evaluation than uncertainty evaluation. The SSC further recommends that the Council consider stock productivity and susceptibility traits when determining the acceptable risk of overfishing, and that the SSC be given an opportunity to provide updated information when the Council applies or updates risk levels.

Alternative 2

The SSC recommended categorizing assessed stocks based on the information provided to evaluate and characterize assessment uncertainty, which led to **Alternative 2**.

Category Descriptions for **Alternative 2**:

- Category 1. The stock is assessed and scientific uncertainty is adequately incorporated. The P* will be applied to the assessment outputs to provide an ABC consistent with the chosen level of overfishing risk. The specifics of how the P* is applied to the assessment information will vary depending on how uncertainty is expressed in the assessment. For example:
    - If the assessment provides a distribution of overfishing limit yield values, the acceptable biological catch can be derived by applying the acceptable risk of overfishing to the assessment overfishing limit distribution.
    - If the assessment provides a distribution of fishing mortality values that achieve maximum sustainable yield (i.e., F_{MSY}), the ABC can be derived by applying the fishing mortality rate associated with the chosen P* to a population projection to derive estimates of fishery yield.
- Category 2. The stock is assessed, but scientific uncertainty is not adequately evaluated or some assessment outputs may be lacking. The SSC will adjust the assessment measures of uncertainty (e.g., coefficient of variation, F_{MSY} distribution, or overfishing limit (OFL) distribution) as necessary to adequately address scientific uncertainty. ABC is derived by applying the acceptable risk of overfishing to the assessment information.

- Category 3. The stock is assessed; however, scientific uncertainty is not adequately evaluated, and the SSC is not able to address uncertainty by modifying the available measures of uncertainty. The SSC will develop uncertainty measures it considers adequate for the assessment, such as a coefficient of variation, F_{MSY} distribution, or OFL distribution as necessary to derive the ABC that reflects scientific uncertainty and the Council's risk tolerance, or apply a direct buffer to OFL (or an OFL proxy) to derive the ABC recommendation.
- Category 4: No acceptable stock assessment is available. The OFL and ABC will be based on the expert judgment of the SSC. The SSC will consider available information and the Council's risk tolerance when applying its expert judgment.

The Council may choose any of the Options (below) under **Alternative 2** to refine and modify how **Alternative 2** is applied. Options do not replace **Alternative 2** categories (**Table 3**).

Option 1 provides an alternative basis for ABC for stocks lacking some of the information necessary for the SSC to apply a risk tolerance level to assessment results. If selected, this option would provide additional guidance to the SSC in setting ABC for the Category 3 and 4 stocks described for **Alternative 2** (**Table 3**).

Option 2 is proposed for **Alternative 2** to allow the SSC to specify a constant ABC value for multiple years. Providing the ABC as both annual and fixed values is necessary for the Council to evaluate the effects of the fixed ABC. Under this option, the Council would be expected to request the number of years (up to 5) for which annual and fixed ABC values are desired. To avoid delay in ABC recommendations, such requests should be made prior the SSC considering an ABC recommendation, with adequate advance notice for preparing the necessary stock projections. Circumstances that could lead to the Council to request a constant multi-year ABC include addressing severe social and economic consequences, addressing information that is available through other sources such as Fishery Performance Reports, and providing stability for the fishery.

TABLE 3 – ABC Control rule proposed through Alternative 2.

Category	Criteria	ABC Determination
Category 1.	Stock is assessed; scientific uncertainty is adequately incorporated	The P* is applied to the assessment information to derive ABC.
Category 2.	Stock is assessed; scientific uncertainty is not adequately evaluated or some assessment outputs may be lacking.	The SSC will adjust the measures of uncertainty, P* will then be applied to the assessment information.
Category 3.	The stock is assessed; scientific uncertainty is not adequately evaluated and cannot be addressed by adjusting the available uncertainty measures.	The SSC will develop uncertainty measures as necessary to apply the P* to the available assessment information. Alternatively, the SSC may apply a direct buffer to the overfishing limit (or an overfishing limit proxy) to derive the ABC.
Category 4	No acceptable stock assessment is available	The OFL and ABC will be based on the expert judgment of the SSC. The SSC will consider available information and the Council's risk tolerance when applying its expert judgment. Techniques that may be considered by the SSC in developing its judgment include, but are not limited to: Data limited assessment models: may provide OFL or ABC or proxies thereof, and varying types of uncertainty distributions. Only Reliable Catch Stocks (ORCS): applied using a catch statistic, a scalar derived from the risk of overexploitation, and the Council's risk tolerance level Council SSC 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?

Example of P* affects under varying conditions

Life history data were simulated for a hypothetical reef fish-like species to illustrate the changes in fishing mortality (F) and allowable biological catch (ABC) for various values of probability of overfishing (P*) and levels of scientific uncertainty, expressed as the coefficient of variation (CV) of F_{MSY}. A normal distribution of error about F_{MSY} was assumed for this example. Typical output from South Atlantic stock assessments comes from the Monte-Carlo Bootstrap (MCB) analysis and often results in slightly skewed error distributions that do not exactly conform to a normal distribution. Nonetheless the output tables below illustrate some key patterns in the results. Both F and ABC decrease as P* decreases and CV increases (Table 1). The rate of this decrease gets larger as the OFL is reduced (e.g. OFL = 75% F_{MSY}) (Table 2). The reason OFL might be less than FMSY would be if the stock biomass were at low levels and/or the stock were under a rebuilding plan. We did not compute the exact stock status condition for this example, as it would have required more complicated assumptions about a type and shape of stock-recruit curve.

Table 1. Results from a hypothetical reef fish species showing fishing mortality (F) (panel a) and allowable biological catch (ABC) in weight (panel b) as a function of different assumed input values for probability of overfishing (P*) and coefficient of variation (CV) of F_{MSY}. In this example the overfishing limit (OFL) is assumed to be at F_{MSY} = 0.38.

a)

	P*						
CV	**0.2**	**0.25**	**0.3**	**0.35**	**0.4**	**0.45**	**0.5**
0.2	0.31	0.33	0.34	0.35	0.36	0.37	0.38
0.3	0.28	0.3	0.32	0.33	0.35	0.36	0.38
0.4	0.25	0.28	0.3	0.32	0.34	0.36	0.38
0.5	0.22	0.25	0.28	0.3	0.33	0.35	0.38
0.6	0.19	0.22	0.26	0.29	0.32	0.35	0.38
0.7	0.15	0.2	0.24	0.28	0.31	0.34	0.38
0.8	0.12	0.17	0.22	0.26	0.3	0.34	0.38

b)

	P*						
CV	**0.2**	**0.25**	**0.3**	**0.35**	**0.4**	**0.45**	**0.5**
0.2	1326	1329	1331	1333	1334	1335	1335
0.3	1312	1321	1327	1331	1333	1334	1335
0.4	1289	1308	1320	1327	1332	1334	1335
0.5	1253	1288	1309	1322	1330	1334	1335
0.6	1202	1261	1296	1316	1327	1333	1335
0.7	1128	1224	1277	1308	1324	1332	1335
0.8	1023	1174	1254	1297	1321	1332	1335

Table 2. Results from a hypothetical reef fish species showing fishing mortality (F) (panel a) and allowable biological catch (ABC) in weight (panel b) as a function of different assumed input values for probability of overfishing (P*) and coefficient of variation (CV) of F_{MSY}. In this example the overfishing limit (OFL) is assumed to be at 75% F_{MSY} = 0.28.

a)

	P*						
CV	**0.2**	**0.25**	**0.3**	**0.35**	**0.4**	**0.45**	**0.5**
0.2	0.24	0.24	0.25	0.26	0.27	0.28	0.28
0.3	0.21	0.23	0.24	0.25	0.26	0.27	0.28
0.4	0.19	0.21	0.22	0.24	0.25	0.27	0.28
0.5	0.16	0.19	0.21	0.23	0.25	0.26	0.28
0.6	0.14	0.17	0.19	0.22	0.24	0.26	0.28
0.7	0.12	0.15	0.18	0.21	0.23	0.26	0.28
0.8	0.09	0.13	0.16	0.2	0.23	0.25	0.28

b)

	P*						
CV	**0.2**	**0.25**	**0.3**	**0.35**	**0.4**	**0.45**	**0.5**
0.2	1274	1283	1291	1298	1303	1308	1312
0.3	1244	1263	1277	1289	1298	1306	1312
0.4	1203	1236	1260	1278	1292	1303	1312
0.5	1151	1203	1239	1266	1286	1301	1312
0.6	1083	1162	1215	1252	1279	1298	1312
0.7	995	1112	1186	1236	1271	1295	1312
0.8	880	1049	1152	1218	1262	1292	1312

Alternative 3

Alternative 3 is a slight modification of the existing CR. It adds the ORCS approach, and divides the adjustment factors of the current CR into uncertainty considerations, addressed by the SSC, and risk tolerance considerations, addressed by the Council.

Reconsideration of ABC Recommendations

Situations may arise for which the Council decides it is necessary and appropriate to remand an ABC recommendation to the SSC for reconsideration or clarification, due to new information or changing circumstances. In such instances, the Council will provide a written statement to the SSC requesting clarification or reconsideration of the ABC recommendation that includes the Council's justification for the remand, guidance on timing of the SSC's consideration of the request, and any documentation that led the Council to request the remand. Circumstances which could lead to the Council remanding an ABC recommendation include, but are not limited to:

- New information becomes available after the SSC makes a recommendation (e.g. through an Advisory Panel (AP), Fishery Performance Reports, new analysis/research, management change, updated or revised catch info).
- A mistake is found in the analysis or inputs that were used to support the ABC.

- The Council changes its risk determination.
- The SSC did not address the Council's request or TORs related to the ABC recommendation and supporting information.
- The SSC did not have a majority present when making the recommendation.
- The SSC's justification for the ABC is not clearly stated (particularly when based on expert judgement, modified uncertainty levels (categories 2-4), or ABC Control Rule deviations).

SSC Deviation from the ABC Control Rule

The SSC may provide an ABC that deviates from strict application of the approved ABC Control Rule if necessary to address scientific uncertainty or available information. If the SSC deviates from the ABC Control rule, it must describe in writing why the deviation was necessary, how the alternative ABC recommendation is derived, and how the alternative ABC addresses scientific uncertainty and the Council's specified risk tolerance.

Other Alternatives Discussed by the Council and SSC

Establish an Ecosystem Component Category

This alternative would create an additional category to address Ecosystem Component stocks identified by the Council under the MSA guidelines. This approach was opposed by the SSC because these stocks are not subject to the full suite of fishing level specifications, such as OFL and ABC, and therefore would not be subject to the same control rule provisions as other stocks in the fishery management unit. Including them in the ABC CR would add confusion and unnecessary complexity.

Establish and identify categories based on data levels

- Data labels, particularly "Data poor" can be negative, misleading.
- Many stocks defy clear categorization by data – relative quality can vary greatly across the available data types.
- There are no accepted standards for the typical data descriptors: (rich, limited, moderate, poor, complete, etc.)
- Characterizing assessments and stocks by data levels may infer inappropriate or undesired quality or reliability conclusions.
- Data availability is not the salient point to determining how ABC is derived; assessment information and uncertainty evaluations are.

Establish and identify categories based on assessment levels or types

- Assessment science is always changing, so model types and descriptions can become outdated or limiting (as shown in the purpose and need regarding data limited approaches).
- Assessment outputs and their reliability is more important to deriving the ABC than the particular type or class of model.
- There can be considerable overlap in the outputs of various assessment models, as well as variations in which outputs are reliable and useful for any particular assessment.

- Characterizing assessments and stocks by assessment type may infer inappropriate or undesired quality or reliability conclusions, and lead to efforts to simply move stocks "up" the hierarchy.
- The assessment type or label is not the salient point to determining how ABC is derived: Assessment information and uncertainty evaluations are.

SSC Recommendations:

- The SSC supported modifying the ABC CR as described in Alternative 2.
- The SSC recommended not including ecosystem component stocks in the ABC CR provisions.
- The SSC did not support designing the ABC CR solely around data or assessment categories or levels, and recommended that the treatment of uncertainty was a more robust and useful categorization approach.
- The SSC supports allowing constant ABC recommendations for 3-5 years.
- The SSC recommends addressing circumstances when the Council can remand, or ask the SSC to reconsider, an ABC recommendation, and developing rules or guidelines to address ABC remands.

Action 2 Specify an approach for determining the acceptable risk of overfishing.

Alternative 1 (No Action). The acceptable risk of overfishing is determined by the acceptable biological catch control rule criteria that are evaluated by the Scientific and Statistical Committee.

Alternative 2. The South Atlantic Fishery Management Council will specify the acceptable risk of overfishing. The existing acceptable biological catch control rule provisions addressing stock status and the productivity and susceptibility analysis (Tier 1, Dimensions 3 and 4), will be deleted, and the South Atlantic Fishery Management Council will specify a risk tolerance for overfishing that will provide a P* adjustment of 0 to 20% that will be added to the uncertainty adjustment of the SSC, considering advice from the Scientific and Statistical Committee and the South Atlantic Fishery Management Council's advisory panels.

Alternative 3. The South Atlantic Fishery Management Council will specify the acceptable risk of overfishing based on three stock biomass levels and three stock risk ratings. The Scientific and Statistical Committee will evaluate a stock's risk category each time the stock is assessed.

Option 1. Allow the highest risk level when stock biomass exceeds 110% of the biomass at maximum sustained yield, and use 110% of the maximum sustained yield biomass level to evaluate the biomass midpoint for defining the boundary between the moderate and low risk levels.

Option 2. Allow the Council to deviate from the default risk levels by 0.1 for an individual stock, based on its expert judgment, new information, or recommendations by the Scientific and Statistical Committee or other expert advisors. Risk tolerance may not exceed 0.5.

Option 3. Assign unassessed stocks to the moderate biomass level, unless there is a recommendation from the Scientific and Statistical Committee that justifies a different level.

Alternative 4. Specify risk tolerance for each stock directly, considering recommendations of the Scientific and Statistical Committee and the Council's advisory panels. Risk tolerance may not exceed 0.5.

DISCUSSION:

Summary table of risk tolerance levels based on stock-specific risk ratings and biomass levels.

Risk rating (Stock Specific)	Council's Default Risk Tolerance: accepted risk of overfishing (P* values)		
	High Biomass Biomass exceeds B_{MSY} (or 110% B_{MSY} per Option 1)	**Moderate Biomass** Biomass is ABOVE the midpoint between B_{MSY} and MSST	**Low Biomass** Biomass is below the midpoint between B_{MSY} and MSST
low	0.45	0.45	0.4
medium	0.45	0.4	0.3
high	0.4	0.3	0.2

The SSC intends to review preliminary stock risk ratings at the October 2018 meeting.

The SSC noted that stock biomass typically exhibits some trend over time. The terminal biomass of the stock assessment would likely be used to determine the risk tolerance level, in the same way the terminal values are used to determine stock status. However, the biomass trajectory should also be considered by the SSC when recommending ABC values, particularly if multi-year fixed ABCs are applied. The SSC further recommends that the Council consider basing risk tolerance on the expected biomass level at the end of the fixed ABC period if necessary to ensure an acceptable overfishing risk over the period covered by the ABC recommendation. Whether this results in a higher or lower risk tolerance would depend on whether the trajectory is increasing or decreasing and whether it crosses one of the thresholds for risk tolerance.

EXAMPLE: B_{MSY} for hypothetical medium risk stock X is 1000, and the minimum stock size threshold (MSST) is 500. The midpoint between B_{MSY} and MSST is therefore 750. The terminal biomass estimate is 800, placing the stock above the B_{MSY}-MSST midpoint and in the moderate biomass range, resulting in a risk tolerance of 0.4. However, in this example the Council requested a 5 year fixed ABC, and due to recent poor recruitment the short term biomass trajectory is downward. In year 5 the stock biomass is projected to be 600, below the midpoint and therefore placing the stock in the low biomass level, resulting in a risk tolerance of 0.3. In this situation, the SSC would base the ABC on the 0.3 risk tolerance, to address declining stock biomass over the ABC period.

Other factors the Council may consider in establishing the acceptable level of risk for a stock include the expected time that would elapse between assessments, whether there is a reliable index of stock abundance, overall management performance relative to catch limits (i.e., whether or not the management program constrains harvest to the ACL), overall assessment and recruitment trends, social and economic considerations, and recent information provided by Fishery Performance Reports.

Additionally, the Council may consider the reliability of information available to support management and recommended catch levels, as well as to evaluate management performance. In

selecting management actions and establishing risk tolerance, the Council should consider the effects its actions may have on scientific information, to avoid exacerbating existing scientific uncertainty. For example, harvest moratoriums typically increase scientific uncertainty because they eliminate the fishery dependent data sources that are often the primary source of information available. When confronted with high uncertainty, the Council may consider incremental actions and management changes, coupled with a specific period over which to evaluate the fishery response. The SSC should consider that there can be a distinction between best scientific information available and suitability for management when evaluating available data.

Alternative 2 represents a slight modification in the existing practices. It would not address the concerns raised by the SSC regarding the information used to determine productivity and susceptibility, and would not address the concern that using a stock's overfishing status to determine the accepted risk of overfishing for that stock creates an unnecessarily large buffer.

Alternative 3 would base risk tolerance on stock specific traits, through the assigned risk rating, and on the stocks biomass. It allows the Council to determine the risk level, and provides flexibility for the SSC and APs to provide recommendations for the Council to consider. By including biomass considerations, it addresses National Standard 1 guidance to consider reducing fishing mortality as stock biomass declines.

Under **Alternative 3**, stocks would be assigned a risk rating of high, moderate, or low by the Council, considering the recommendations of the SSC and the Council's APs. Stock risk ratings would be evaluated each time a stock is assessed, and at other times when necessary to incorporate new information. Both the Council and the SSC may initiate an evaluation of risk ratings.

Risk tolerance values for each biomass and stock category would be set by the Council, considering recommendations from the SSC and other Council APs. Stock biomass used to determine risk would be based on stock assessment results or the expert judgement of the SSC, and categorized as high, moderate, or low. For all stock risk ratings, the highest risk tolerance would be allowed when biomass exceeds the maximum sustained yield (MSY) biomass level. The risk tolerance would be reduced to the moderate level when biomass is below the MSY biomass level, and further reduced to low risk tolerance when biomass is below the midpoint between the maximum sustained yield biomass level and the MSST.

For all stock risk ratings, the highest risk tolerance would be allowed when biomass exceeds the MSY biomass level. The risk tolerance would be reduced to the moderate level when biomass is below the MSY biomass level, and further reduced to low risk tolerance when biomass is below the midpoint between the MSY biomass level and the MSST considering recommendations from the SSC and other Council APs. The SSC will evaluate a stock's risk category each time the stock is assessed.

Under **Alternative 3, Option 1** provides a higher degree of precaution, by raising the biomass level at which the highest risk rating is allowed. **Option 2** provides the Council

flexibility to deviate from the specified risk levels. **Option 3** provides guidance for assigning risk levels when stock biomass is unknown. It includes a default value as well as flexibility for an alternative SSC recommendation.

Alternative 4 is the simplest approach, but also potentially the most difficult to implement as it provides little guidance to the Council on the appropriate risk level. It could be difficult to establish risk levels that adequately reflect stock productivity differences, and risk it not related to stock biomass.

SSC Recommendation:

- The SSC supports varying risk tolerance by biomass levels and considering the PSA risk categories for assigning stock risk ratings.
- The SSC recommends including preliminary risk ratings in the draft amendment, and finalizing those ratings once the amendment is approved.
- The SSC recommends evaluating risk ratings as part of each stock assessment, and also when necessary to address new information that becomes available for a stock.
- The SSC recommends considering social and economic considerations when evaluating risk tolerance. Fishery Performance reports may be useful to identify factors.

Action 3 Specify an approach for determining the probability of rebuilding success for overfished stocks

Alternative 1 (No Action). Do not specify an approach for determining the probability of rebuilding success for overfished stocks.

Alternative 2. When developing a stock rebuilding plan, the South Atlantic Fishery Management Council will specify a probability of rebuilding success, considering the recommendations of the appropriate fishery management plan advisory panel and the Scientific and Statistical Committee.

Alternative 3. When developing a stock rebuilding plan, the South Atlantic Fishery Management Council will specify a probability of rebuilding success based on the stock risk rating. The rebuilding probability will be set at 80% for high risk stocks, 70% for moderate risk stocks, and 60% for low risk stocks. The South Atlantic Fishery Management Council may deviate from these levels by 10% to address unforeseen or unique circumstances. Stocks will be assigned a risk rating of high, moderate, or low by the South Atlantic Fishery Management Council, considering the recommendations of the Scientific and Statistical Committee and the South Atlantic Fishery Management Council's advisory panels.

DISCUSSION:

This action addresses the need to develop a process for specifying rebuilding probability for overfished stocks. If the Council took no action (**Alternative 1**) the rebuilding probability would need to be at least 50%, per MSA requirements.

Alternative 2 provides the most flexibility, as it allows the Council to set the rebuilding probability directly. It does not provide any specific guidance or criteria and therefore could lead to difficulties in implementing consistent approaches to rebuilding that adequately address differences in stock biology and productivity.

Alternative 3 ties the rebuilding probability to stock risk levels. This provides consistency across the methods used to address overfishing (ABC specifications) and overfished conditions (rebuilding plans and rebuilding probabilities).

SSC Recommendation:

The SSC supports specifying rebuilding probabilities and considering stock risk categories.

Action 4 Allow phase-in of acceptable biological catch changes

Sub-Action 4.1. Establish criteria specifying when phase-in is allowed.

Alternative 1 (No Action). No phase-in of ABC changes is allowed.

Alternative 2. A llow phase-in when a new acceptable biological catch is less than X% of the existing acceptable biological catch.

Option 1. X=70%

Option 2. X=80%

Option 3. X=90%

Alternative 3. Allow phase-in when stock biomass exceeds a specific level

Option 1. if stock biomass exceeds the minimum stock size threshold

Option 2. if the stock biomass is greater than the midpoint between the biomass that provides maximum sustainable yield and the minimum stock size threshold.

Sub-Action 4.2. Specify the approach for phase-in of acceptable biological catch changes.

Alternative 1 (No Action). No phase-in of ABC changes is allowed.

Alternative 2. Phase-in acceptable biological catch changes over 3 years.

- Year 1: modified acceptable biological catch may not exceed the overfishing limit.
- Year 2: modified acceptable biological catch equals one-half the difference between the overfishing limit and the new acceptable biological catch recommendation.
- Year 3: modified acceptable biological catch equals the original recommended year 3 acceptable biological catch (based on the projections and analyses that triggered the phase-in).
- Subsequent years: acceptable biological catch is based on revised projections that account for the phase-in during years 1-3.

Alternative 3. Phase-in acceptable biological catch changes over 2 years.

- Year 1: modified acceptable biological catch may not exceed the overfishing limit.
- Year 2: modified acceptable biological catch equals one-half the difference between the overfishing limit and the new acceptable biological catch recommendation.
- Year 3 and beyond: acceptable biological catch is based on revised projections that account for the phase-in during years 1 and 2.

Alternative 4. Phase-in acceptable biological catch changes over 1 year.

- Year 1: modified acceptable biological catch may not exceed the overfishing limit.
- Year 2: acceptable biological catch is based on revised projections that account for the phase-in during year 1.

DISCUSSION:

This action addresses flexibility allowed under the revised National Standard 1 guidelines. Phase in of the ABC is an option the Council can consider to address the social and economic impacts from management changes. Adopting this flexibility does not require the Council to phase-in all ABC changes, nor does adopting one approach prevent the Council for choosing a more restrictive schedule of ABC phase-in. When considering whether or not to phase-in an ABC change, the Council should compare and contrast the risk to the stock against the perceived social and economic benefits of the alternative ABC. Management strategy evaluations may be used to quantify such trade-offs. The Council may consult with its scientific and fishery advisors to help develop a rationale for phase-in.

Relevant National Standard 1 Guidance:

> *Phase-in ABC control rules. Large changes in catch limits due to new scientific information about the status of the stock can have negative short-term effects on a fishing industry. To help stabilize catch levels as stock assessments are updated, a Council may choose to develop a control rule that phases in changes to ABC over a period of time, not to exceed 3 years, as long as overfishing is prevented each year (i.e., the phased-in catch level cannot exceed the OFL in any year). In addition, the Councils should evaluate the appropriateness of phase-in provisions for stocks that are overfished and/or rebuilding, as the overriding goal for such stocks is to rebuild them in as short a time as possible.*

To simplify the analysis and evaluation of alternatives under this action, sub-actions are used to address criteria and process alternatives separately. Therefore, the alternatives under each sub-action can be evaluated relative to each other.

Sub-Action 4.1 provides guidance for when phase-in would be allowed, addressing the National Standard guidance directing the Council to consider when phase-in is appropriate. **Sub-Action 4.1-Alternative 2** bounds the amount of change required in ABC to justify phase-in. This alternative would address the National Standard language referencing "large changes in catch limits." Options under **Sub-Action 4.1-Alternative 2** specify different levels of ABC change. **Sub-Action 4.1-Alternative 3** would address stock biomass considerations. **Option 1** would allow phase-in when a stock is not overfished (biomass exceeds MSST). **Option 2** is more conservative, only allowing phase-in if the biomass is between MSST and the MSY level.

Sub-Action 4.2 provides alternatives for the duration of the phase-in and guidance on determining revised catch levels that will prevent overfishing in years following phase-in. The Council could choose multiple alternatives under this Sub-Action to maximize flexibility and address the availability of updated stock information.

The alternatives provide possible maximum years over which phase-in is applied and do not prevent the Council from using a shorter period. However, because each alternative provides specific details for how the ABC is revised following phase-in, for this action the Council should consider selecting multiple alternatives to provide flexibility in phase-in periods, rather than selecting a single alternative that represents the maximum phase in period the Council is willing to consider. Selecting multiple alternatives would also give the Council flexibility to address the SSC recommendation that assessment schedules be considered when evaluating the timing of a phase-in approach and the updated analyses required to evaluate phase-in effects on the stock.

For example, the Southeast Fisheries Science Center (SEFSC) is considering improvements in the timing for delivering stock assessment information that could result in the Council receiving annual information for select stocks. However, given that the SEFSC has not yet implemented the accelerated delivery of assessment information, the Council cannot consider applying these sub-actions on a stock by stock basis at this time.

Sub-Action 4.2-Alternative 2 provides for a phase in over 3 years, which is the maximum phase in period allowed by the MSA guidelines. The phase in period is shortened for **Sub-Action 4.2-Alternative 3** (2 years) and **Sub-Action 4.2-Alternative 4** (1 year). Considering possible timing of assessment information, and the time required to prepare updated analyses and stock projections to evaluate the impact of phase-in, the maximum phase-in and evaluation period of **Sub-Action 4.2-Alternative 2** would likely be appropriate for those stocks expected to have longer intervals between assessment updates. At the other end of the range, the short evaluation period of **Sub-Action 4.2-Alternative 4** would be appropriate for stocks expected to receive annual updates of assessment information.

As shown in Table XX, the longer phase in of **Sub-Action 4.2-Alternative 2** results in the largest reduction of total catch over time. The cost, or reduction in total catch over the 4 year period illustrated, is lowest for the lowest phase in period proposed in **Sub-Action 4.2-Alternative 4**.

The SSC liaison and Committee chair may work with Council staff to request the projection analyses necessary for the SSC and Council to evaluate and implement phase-in a timely manner.

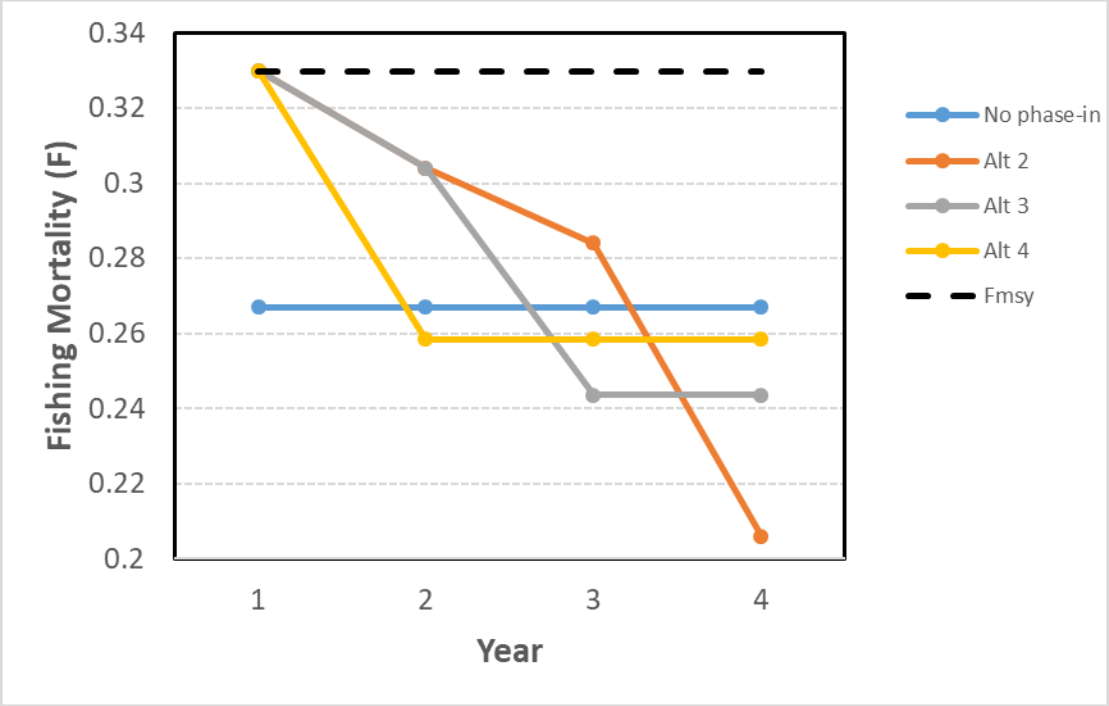
Hypothetical example of ABC phase-in

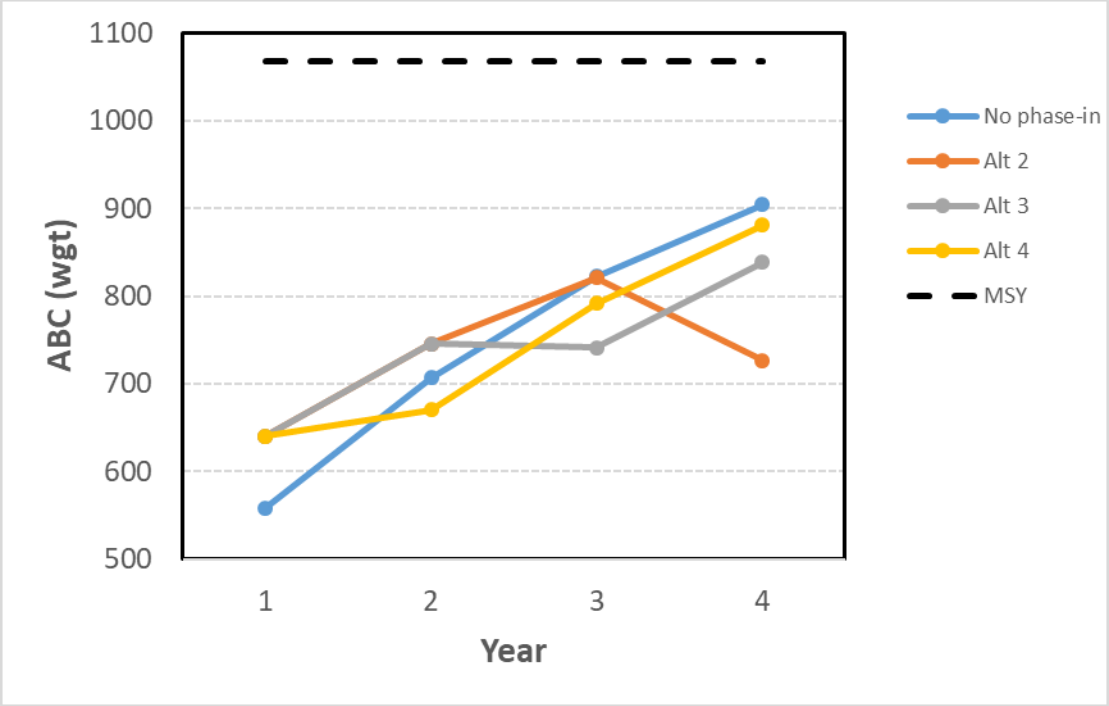
Population dynamics were simulated for a hypothetical fish species. Benchmarks for the stock were determined to be F_{MSY} (OFL) = 0.33, MSY = 1068 (wgt), and SSB_{MSY} = 2668 (mature wgt).

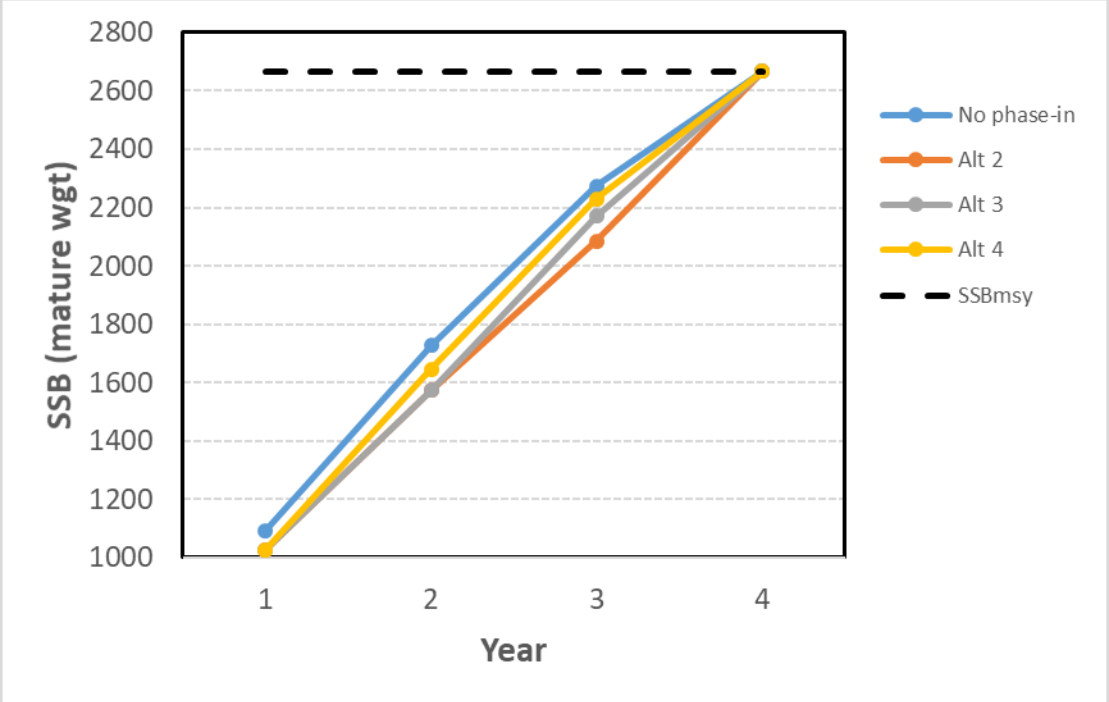
Starting conditions for the stock in year 0 were in an overfishing and overfished state (F=0.8 and SSB = 645), with landings at 924 (wgt). In this example the stock is rebuilding to SSB_{MSY} by year 4. SSB and Yield are increasing over time in this example. The No phase-in alternative is an F-rebuild that rebuilds the stock to SSB_{MSY} in year 4. All alternatives rebuild the stock in year 4.

Fishing Mortality (F)					
Year	**No phase-in**	**Alt 2**	**Alt 3**	**Alt 4**	**F_{MSY}**
1	0.267	0.33	0.33	0.33	0.330
2	0.267	0.304	0.304	0.2584	0.330
3	0.267	0.284	0.2435	0.2584	0.330
4	0.267	0.206	0.2435	0.2584	0.330
ABC (wgt)					

Year	No phase-in	Alt 2	Alt 3	Alt 4	MSY
1	558	641	641	641	1068
2	707	745	745	670	1068
3	822	821	741	792	1068
4	905	727	839	881	1068
SUM	2993	2934	2966	2984	
SSB (mature wgt)					
Year	**No phase-in**	**Alt 2**	**Alt 3**	**Alt 4**	**SSB_{MSY}**
1	1092	1026	1026	1026	2668
2	1727	1574	1574	1647	2668
3	2274	2085	2171	2229	2668
4	2668	2667	2668	2668	2668




1100
1000
900
800
700
600
500
ABC (wgt)
1
2
3
4
Year
No phase-in
Alt 2
Alt 3
Alt 4
MSY


2800
2600
2400
2200
2000
1800
1600
1400
1200
1000
SSB (mature wgt)
1
2
3
4
Year
No phase-in
Alt 2
Alt 3
Alt 4
SSBmsy

SSC Recommendation:

- The SSC supports phase-in for stocks above MSST.
- Assessment frequency should be considered when evaluating phase-in. It is important to avoid 'chasing down' stock reductions. Additionally, long phase-in periods may not be compatible with frequent assessments as the basis for ABC recommendations will change before the prior ABC is reached.
- Management Strategy Evaluations and economic considerations may be useful for evaluating phase-in situations.

Action 5 Allow carry-over of unharvested catch

Sub-Action 5.1. Establish criteria specifying circumstances when unharvested catch can be carried over from one year to increase the available harvest in the next year.

Alternative 1 (**No Action).** No carry over will be allowed.

Alternative 2. Carry-over of unharvested catch will be allowed if the stock is neither overfished nor experiencing overfishing.

Alternative 3. Carry-over of unharvested catch will be allowed if the stock biomass exceeds the midpoint between the Bmsy and MSST biomass levels and the stock is not experiencing overfishing.

Alternative 4. Carry-over of unharvested catch will be allowed for a fishery sector if that fishery sector has experienced a regulatory closure due to catch exceeding that sector's annual catch limit at least once in the previous 3 years.

Alternative 5. Carry-over of unharvested catch will be allowed for a fishery sector if total landings of all fishery sectors over the previous 3 years are less than the landed catch component of ABC for all fishery sectors over those same years.

Alternative 5. Carry-over will not be allowed when ABC changes are phased-in.

Sub-Action 5.2. Specify limits on the amount of unharvested catch that may be carried over from one year to increase the available harvest in the next year.

Alternative 1 (No Action). There will be no carry-over of unharvested catch.

Alternative 2. Allow carry-over of unharvested catch for an individual fishery sector using the buffer between the annual catch limit and the acceptable biological catch.

Alternative 3. Allow carry-over of unharvested catch for an individual fishery sector that results in an adjusted annual catch limit that exceeds the original acceptable biological catch for the year for which the unharvested catch is carried-over,. .

Option 1. If the overfishing limit is unknown, the revised acceptable biological catch may not exceed 105% of the original acceptable biological catch.

Option 2. If the overfishing limit is unknown, the revised acceptable biological catch may not exceed 110% of the original acceptable biological catch.

Option 3. If the overfishing limit is unknown, the revised acceptable biological catch may not exceed 120% of the original acceptable biological catch.

Option 4. If the overfishing limit is unknown, no carry-over is allowed.

Alternative 4. Allow carry-over of unharvested catch for an individual fishery sector of up to 25% of the sector annual catch limit. .

Sub-Action 5.3. Specify an approach for implementing acceptable biological catch and annual catch limit modifications to support carrying over unharvested catch from one year into the next year.

Alternative 1 (No Action). No carry over is allowed.

Alternative 2. Use the framework approaches as provided in each fishery management plan.

Alternative 3. Implement an expedited approach to address carry-over of unharvested catch.

DISCUSSION:

This action addresses flexibility allowed under the revised National Standard 1 guidelines. Carry-over that does not exceed the original ABC can be accommodated under existing rules, using the buffer between the ACL and ABC. However, for many Council stocks, ACL=ABC, so there is no buffer available. Per the National Standard 1 guidance, an ABC CR may include provisions to increase the ABC in the next year to address an ACL underage.

Relevant National Standard 1 Guidance:

> *Carry-over ABC control rules. An ABC control rule may include provisions for the carry-over of some of the unused portion of an ACL (i.e., an ACL underage) from one year to increase the ABC for the next year, based on the increased stock abundance resulting from the fishery harvesting less than the full ACL. The resulting ABC recommended by the SSC must prevent overfishing and must consider scientific uncertainty consistent with the Council's risk policy. Carry-over provisions could also allow an ACL to be adjusted upwards as long as the revised ACL does not exceed the specified ABC. When considering whether to use a carry-over provision, Councils should consider the likely reason for the ACL underage. ACL underages that result from management uncertainty (e.g., premature fishery closure) may be appropriate circumstances for considering a carry-over provision. ACL underages that occur as a result of poor or unknown stock status may not be appropriate to consider in a carry-over provision. In addition, the Councils should evaluate the appropriateness of carry-over provisions for stocks that are overfished and/or rebuilding, as the overriding goal for such stocks is to rebuild them in as short a time as possible.*

The intent of carry-over provisions is to enable the Council to ensure a species can make use of its full ACL. Ideally, in-season adjustments would be made to allow full use of an ACL and alleviate the need for carry over. These carry-over provisions provide additional flexibility when in-season adjustments are not possible, perhaps due to regulatory or data timelines. When considering carry over, the Council must develop rationale that addresses scientific uncertainty and its risk tolerance, and indicates that the carry-over would not result in overfishing. The Council should also consider the impacts of the carry over on rebuilding plans when appropriate. The Council should consult with its scientific and fishery advisors in developing a rationale for carry-over.

Any revised ABC resulting from carry-over would remain in place for one year and may not exceed the OFL, and evaluations of carry-over for future years would be based on the original ABC, not the temporary revised acceptable biological. If the carry-over results in an ACL that exceeds the original ABC for the year for which the unharvested catch is carried-over, the ABC for that year would be revised upwards to accommodate the temporary increase in ACL. Evaluations of possible carry-over for future years would be based on the original ABC, not the temporary revised ABC.

Under the existing ABC CR, the Council could ask the SSC to consider recommending a temporary, higher ABC to accommodate carry-over. This approach is not particularly efficient,

given the timing of Council and SSC meetings. The overall purpose of this action is to develop criteria to guide when carry-over can be allowed while preventing overfishing, and develop an efficient process that would accommodate minor, temporary increases in an ABC to support carry over. Overfishing is prevented as long as the revised ABC stays below OFL, so no increased ABC due to carry over can exceed the annual OFL. As stated in the National Standard guidance, the Council will consider the need for, and consequences of, carry-over, in its justification and request. The Council may consult its scientific and fishery advisors as needed to define and evaluate the justification for carry-over. It is the Council's intent that carry-over would be applied on a sector by sector basis, and that the amount that may be carried over may not exceed the amount of unharvested catch in the prior year. Unharvested catch will be evaluated using the same units of measurement (e.g., weight or numbers) used to specify catch limits for the sector.

The Final Rule addressing carry-over allowances indicates that Councils must state in its FMP when carry over can and cannot be used. This is addressed through the criteria in **Sub-Action 5.1**. The FMP must also state how overfishing is prevented. **Sub-Action 5.1** provides guidance on circumstances when carry-over would be allowed. The alternatives address the National Standard guidance requiring Councils to consider the reason for carry-over and the appropriateness of carry-over for different stock status conditions. **Sub-Action 5.2** addresses the amount of unused catch that could be carried over. Alternatives provide limits on the amount of carry-over, thereby addressing the level of risk and uncertainty. **Sub-Action 5.3** addresses the process by which catch limits would be modified to accommodate carry-over.

Several Alternatives are considered in **Sub-Action 5.1** to provide guidance on when carry-over can be applied. Under **Sub-Action 5.1-Alternative 1**, no carry-over would be allowed. **Sub-Action 5.1-Alternatives 2** and **3** address stock status conditions, with **Sub-Action 5.1-Alternative 3** allowing carry-over when biomass is higher than the overfished standard (MSST) applied in **Sub-Action 5.1-Alternative 2**. **Sub-Action 5.1-Alternative 4** addresses carry-over following catch-based regulatory closures for an individual fishery sector. A sector must have experienced a catch-based regulatory closure during the prior 3 years to be considered eligible for carry-over. **Alternative 5** considers carry-over for a fishery sector, similar to **Sub-Action 5.1-Alternative 4**, but bases the criteria for allowing carry-over on the catch history over the entire fishery during the prior 3 years. This alternative would be evaluated by comparing the sum of the landings component of ABC over the prior 3 years to the sum of landings over those 3 years, for all fishery sectors combined. If different sector ACLs are specified in different catch units (e.g., one in pounds and another in numbers), landings will be evaluated based on the units used to specify ABC and apply sector allocations to determine ACL. Note that for most Council-managed fisheries, the landings component of the ABC will equal the ACL.

Sub-Action 5.2, Alternative 1 would not allow for carry over. For **Sub-Action 5.2, Alternative 2**, the amount of catch that could be carried over is limited by, and may not exceed, the ABC. For **Sub-Action 5.2, Alternative 3**, the original ABC for the carry-over year would be revised upwards to accommodate the temporary increase in ACL. The revised ABC would remain in place for one year and may not exceed the OFL, and evaluations of carry-over for future years would be based on the original ABC, not the temporary revised ABC.

The expedited approach of **Sub-Action 5.3-Alternative 3** would operate as follows. The Council would consider the need for and benefits of carry over during a scheduled Council meeting. If the Council decides carry over would be beneficial to a species and would not result in overfishing, it would notify the Regional Administrator of the recommendation for carry-over in a letter indicating that the criteria and guidance of this amendment are met. The letter would include the Council's analysis of the relevant biological, economic, and social information necessary to meet the criteria and guidance and support the Council's request. If the Regional Administrator concurs that the Council's recommendations are consistent with the objectives of the FMP, the MSA, and all other applicable law, the Regional Administrator would be authorized to implement the Council's request through publication of appropriate notification in the *Federal Register*, providing appropriate time for additional public comment as necessary.

Hypothetical example of ABC carryover

Population dynamics were simulated for a hypothetical fish species. Benchmarks for the stock were determined to be F_{MSY} (OFL) = 0.33, MSY = 1068 (wgt), and SSB_{MSY} = 2668 (mature wgt). Because stock status is important in determining the constraints for carryover, we simulated the initial stock conditions in two ways.

In the first starting condition the stock in year 0 is in an overfishing and overfished state (F=0.8 and SSB = 645), with landings at 924 (wgt). In this example the stock is rebuilding to SSB_{MSY} by year 4. Using a 100 (wgt) carryover from year 1 to year 2, we compare the F and ABC values to the case where no carryover occurred. In both cases the stock reaches the same target biomass, SSB_{MSY} in year 4. Note that this scenario is similar to the phase-in example.

Original ABC advice					**100 (wgt) carryover in year 2**			
Year	**Full F**	**ABC (wgt)**	**SSB**		**Year**	**Full F**	**ABC (wgt)**	**SSB**
1	0.267	558	1092		**1**	0.203	458	1164
2	0.267	707	1727		**2**	0.312	807	1748
3	0.267	822	2274		**3**	0.264	813	2272
4	0.267	905	2668		**4**	0.264	896	2668
	SUM	2993				**SUM**	2975	

In the second starting condition the stock in year 0 is at 75% SSB_{MSY} (F=0.41 and SSB = 2001), with landings at 1057 (wgt). In this example the stock is constrained by the OFL (expressed as the yield provided at MFMT (F=0.33)) in most years. Using a 100 (wgt) carryover from year 1 to year 2, we compare the F and ABC values to the case where no carryover occurred. Under this scenario the full 100 (wgt) carryover is not possible because of the OFL constraint. Instead only 33 (wgt) carryover is allowable for the ABC in year 2, fishing at the OFL level.

Original ABC advice					100 (wgt) carryover in year 2			
Year	**Full F**	**ABC (wgt)**	**SSB**		**Year**	**Full F**	**ABC (wgt)**	**SSB**
1	0.33	940	2168		**1**	0.275	840	2290
2	0.33	985	2334		**2**	0.33	1018	2456
3	0.33	1016	2459		**3**	0.33	1039	2549
4	0.33	1037	2540		**4**	0.33	1052	2600
	SUM	3978				**SUM**	3949	

SSC Recommendation:

- The SSC supported this action if applied to stocks that are neither overfished nor overfishing, and have catch close to the ACL.
- The SSC commented that species' biology is a factor, and the stock consequences of carry-over will differ between short-lived and long-lived stocks.
- The SSC recommended requesting updated stock projections to evaluate carry-over and to provide a basis for ABC recommendations in years after carry-over occurs.
- The SSC recommended considering the precision of catch estimates when allowing carry-over of a percentage of the ACL (Sub-Action 2, Alternative 3).
- The SSC recommended adding a terms of reference to future assessment reviews and ABC recommendations addressing whether carry-over should be allowed for a stock. The SSC could then consider the stock's condition and trend, past management and fishery trends, and recommended whether carry-over would result in an unacceptable risk of overfishing during the period covered by the ABC recommendation.
- The SSC recommended considering the B_{MSY}-MSST midpoint as a threshold for carry-over. Carry-over would not be allowed if the stock biomass is below the midpoint (or estimated to fall below the midpoint during the period covered by the ABC recommendation).

Appendices

Definitions

ABC Control Rule (ABC CR)	A policy for establishing a limit or target catch level that is based on the best scientific information available and is established by the Council in consultation with its SSC.
Accountability Measure (AM)	Management controls to prevent ACLs, including sector-ACLs, from being exceeded, and to correct or mitigate overages of the ACL if they occur.
Allowable Biological Catch (ABC)	A level of a stock or stock complex's annual catch, which is based on an ABC control rule that accounts for the scientific uncertainty in the estimate of OFL, any other scientific uncertainty, and the Council's risk policy.
Annual Catch Limit (ACL)	A limit on the total annual catch of a stock or stock complex, which cannot exceed the ABC, that serves as the basis for invoking accountability measures. An ACL may be divided into sector-ACLs (*see* paragraph (f)(4) of this section).
Annual Catch Target (ACT)	An amount of annual catch of a stock or stock complex that is the management target of the fishery, and accounts for management uncertainty in controlling the catch at or below the ACL.
Approaching an Overfished Condition	A stock or stock complex is approaching an overfished condition when it is projected that there is more than a 50 percent chance that the biomass of the stock or stock complex will decline below the MSST within two years.
Buffer	Informal term often used by the SSC when referring to the difference between OFL and ABC. Related to the level of assessment uncertainty. May be expressed in absolute values or as a percentage of OFL.
Catch	The total quantity of fish, measured in weight or numbers of fish, taken in commercial, recreational, subsistence, tribal, and other fisheries. Catch includes fish that are retained for any purpose, as well as mortality of fish that are discarded.
Fishery Performance Reports	
Coefficient of Variation (CV)	Standardized statistical measure of uncertainty, reflecting the dispersion (i.e. spread) of a probability distribution.
Optimum Yield	The amount of fish that will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities and taking into account the protection of marine ecosystems; that is prescribed on the basis of the MSY from the fishery, as reduced by any relevant economic, social, or ecological factor; and, in the case of an overfished fishery, that provides for rebuilding to a level consistent with producing the MSY in such fishery.

Overfished	A stock or stock complex is considered “overfished” when its biomass has declined below MSST.
Overfishing	Occurs whenever a stock or stock complex is subjected to a level of fishing mortality or total catch that jeopardizes the capacity of a stock or stock complex to produce MSY on a continuing basis.
Overfishing Limit (OFL)	Annual amount of catch that corresponds to the estimate of MFMT applied to a stock or stock complex's abundance and is expressed in terms of numbers or weight of fish.
Management Uncertainty	Uncertainty in the ability of managers to constrain catch so that the ACL is not exceeded, and the uncertainty in quantifying the true catch amounts (i.e., estimation errors). The sources of management uncertainty could include: Late catch reporting; misreporting; underreporting of catches; lack of sufficient inseason management, including inseason closure authority; or other factors.
Maximum Fishing Mortality Threshold (MFMT)	The level of fishing mortality (i.e. F), on an annual basis, above which overfishing is occurring. The MFMT or reasonable proxy may be expressed either as a single number (a fishing mortality rate or F value), or as a function of spawning biomass or other measure of reproductive potential.
Maximum Sustainable Yield (MSY)	The largest long-term average catch or yield that can be taken from a stock or stock complex under prevailing ecological, environmental conditions and fishery technological characteristics (*e.g.*, gear selectivity), and the distribution of catch among fleets.; actual year to year yields will vary with changes in stock size and catch characteristics.
MSY Fishing Mortality Rate	Fmsy; The fishing mortality rate that, if applied over the long term, would result in MSY.
MSY Stock Size	Bmsy; The long-term average size of the stock or stock complex, measured in terms of spawning biomass or other appropriate measure of the stock's reproductive potential that would be achieved by fishing at Fmsy.
Minimum Stock Size Threshold (MSST)	The level of biomass below which the capacity of the stock or stock complex to produce MSY on a continuing basis has been jeopardized; used to determine if a stock is overfished.
Probability Density Function (PDF)	A function that can be used to determine the likelihood of a particular value. In ABC CR use, it can provide the yield associated with a given P*.

Scientific Uncertainty	uncertainty in the information about a stock and its reference points. Sources of scientific uncertainty could include: Uncertainty in stock assessment results; uncertainty in the estimates of MFMT, MSST, the biomass of the stock, and OFL; time lags in updating assessments; the degree of retrospective revision of assessment results; uncertainty in projections; uncertainties due to the choice of assessment model; longer-term uncertainties due to potential ecosystem and environmental effects; or other factors.

ABC CONCEPTUAL DIAGRAMS & DESCRIPTION

The following figures illustrate the relationships between reference points and how OFL and ABC are derived from the yield distribution and the chosen risk tolerance (P*).

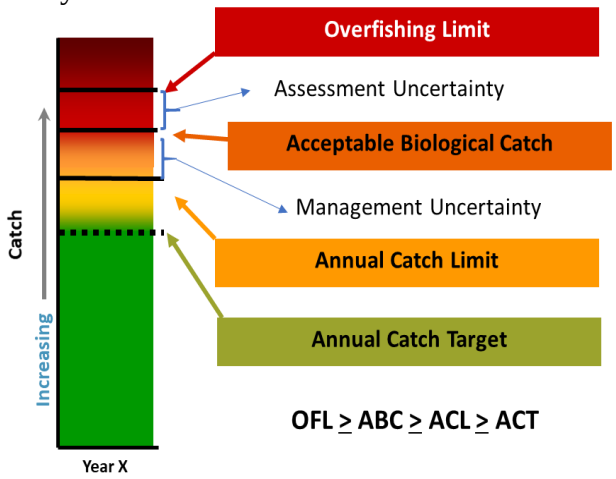


Figure 1. Illustrated general relationship between OFL, ABC, ACL, and ACT. The difference between OFL and ABC addresses assessment uncertainty, while the difference between ABC and ACL addresses management uncertainty.

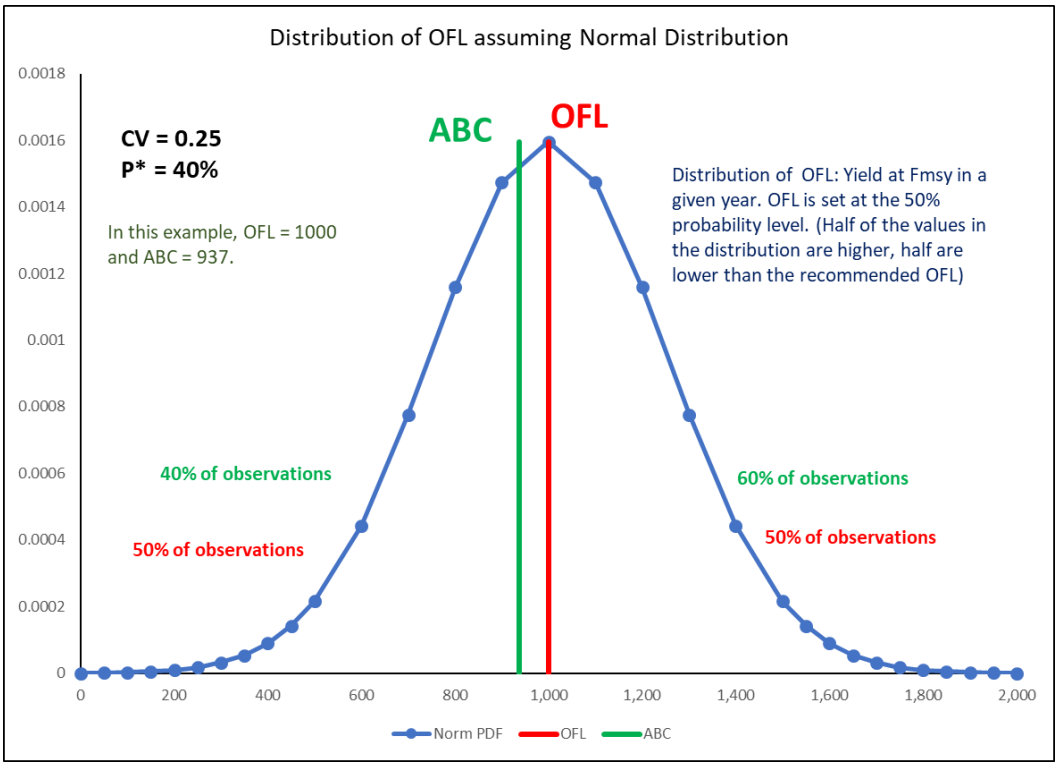


Figure 2. Example distribution illustrating OFL and ABC for a hypothetical stock with OFL=1000 pounds, a chosen risk tolerance or P* pf 40% (40% chance that overfishing occurs), and an assessment CV of 0.25.

How is ABC derived for assessed stocks under this rule?

Three basic items are required to derive an ABC from a stock assessment:

1. Estimates of productivity (i.e. MSY and OFL) and stock assessment uncertainty.

These are products of an assessment and inputs to the ABC Control Rule. Various proxies can be used for unassessed stocks, such as SPR (spawning potential ratio) levels, or Fmax.

a. Estimated yield (OFL) and, ideally, a distribution of its uncertainty or a PDF.

b. Assessment CV that can be applied to the OFL distribution

2. A risk tolerance for overfishing (e.g., P*).

This is set by the Council, as guided by the ABC Control Rule. Typically, the Council will provide risk tolerance guidance for the SSC to use when applying the ABC CR.

a. The Council will specify a risk rating for each stock (Action 2).

The SSC and relevant AP will provide guidance and recommendations for consideration by the Council.

b. The SSC will evaluate the biomass level of the stock, either through the use of assessment results or, in the case of unassessed stocks, application of its best judgement as informed by other information as may be available.

c. The risk tolerance is determined based on the combination of the stock risk rating and the stock biomass (Action 2).

3. A method for applying the risk tolerance to the assessment results.

This is addressed by the SSC, guided by the ABC Control Rule, and forms the basis of the ABC recommendation.

a. Direct approach: distribution of OFL used to derive ABC

The P* is applied to the distribution (PDF) of the estimated overfishing level (OFL). MSY or the OFL is based on the midpoint (50^{th} percentile) of the estimated stock yield at FMSY. ABC is based on a different percentile, determined by the P* value. For example, if the risk of overfishing is 30%, P*=0.3 and ABC is determined by the 30^{th} percentile of the OFL yield. The difference between ABC and OFL will vary across assessments, and will depend on the observed OFL distribution.

This is the approach used most often for assessed SAFMC stocks.

(To come: some example OFL distributions)

b. Indirect approach: CV and assumed distribution of OFL used to derive ABC

If the distribution of OFL is not available, or not considered adequate for determining ABC, the ABC can be derived from a measure of assessment uncertainty (CV) and an assumed distribution of OFL. The type of distribution assumed (e.g., normal or log-normal) determines its shape. The CV determines how widely the distribution spreads. Thus, high CV distributions are broad and

flat, encompassing many values; while low CV distributions are narrow and steep, encompassing fewer values with many more values centered closely around a mode or median.

Once a CV and type of distribution is decided, the buffer between ABC and OFL can be determined for any risk level. In fact, the buffer can be determined in advance for any combination of CV, distribution, and risk tolerance (P*). To derive ABC, the buffer calculated by the CV, distribution, and P* is applied to the OFL. For example, if a CV of 0.5 and a log-normal distribution of OFL are assumed, the ABC buffer will be 53%. If the OFL were 100,000 pounds, the OFL would be 47,000 pounds.