

Mid-Atlantic Fishery Management Council ABC Control Rule Framework and Risk Policy

The Mid-Atlantic Fishery Management Council recently approved an Omnibus Amendment for submission to the Secretary of Commerce which contains proposed measures to comply with the new ACL/AM provisions contained in the Magnuson Stevens Reauthorization Act of 2006. To meet the requirement for ABC control rules, the Council has worked with its Scientific and Statistical Committee (SSC) to develop a framework for application of ABC control rules for all the managed resources under its purview subject to this requirement. The alternative approved by the Council represents a pre-agreed upon framework that the SSC will use to develop ABC recommendations to the Council. An important component of this framework was the adoption of a formal risk policy that prescribes the Council's tolerance for risk of overfishing (i.e., probability of overfishing), expressed as a function of stock size relative to B_{msy} and vulnerability to overfishing based on life history characteristics.

ABC Control Rule Framework

A multi-level approach will be used for setting an ABC for each Mid-Atlantic stock, based on the overall level of scientific uncertainty associated with its assessment. The stock assessment will be required to provide estimates of the maximum fishing mortality threshold (MFMT) and future biomass, the probability distributions of these estimates, the probability distribution of the overfishing limit (OFL; level of catch that would achieve MFMT given the current or future biomass), and a description of factors considered and methods used to estimate their distributions. The multi-level approach defines four levels of overall assessment uncertainty defined by characteristics of the stock assessment and determination by the SSC that the uncertainty in the probability distribution of OFL adequately represents best available science. The procedure used to determine ABCs is different in each level of the methods framework. The SSC will determine to which level the assessment for a particular stock belongs when setting single or multi-year ABC specifications and a description of the justification for assignment to a level will be provided with the ABC recommendation. The ABC recommendations should be more precautionary as an assessment moves from level 1 to level 4. Recommendations for ABC may be made for up to 3 years for all of the managed resources except spiny dogfish which may be specified for up to 5 years. The rationale for assigning an assessment to a level will be reviewed each time an ABC determination is made.

The levels of stock assessments, their characteristics, and procedures for determining ABCs are defined as follows:

Level 1: Level 1 represents the highest level to which an assessment can be assigned. Assignment of a stock to this level implies that all important sources of uncertainty are fully and formally captured in the stock assessment model and the probability distribution of the OFL calculated within the assessment provides an adequate description of uncertainty of OFL. Accordingly, the OFL distribution will be estimated directly from the stock assessment. In addition, for a stock assessment to be assigned to Level 1, the SSC must determine that the OFL

probability distribution represents best available science. Examples of attributes of the stock assessment that would lead to inclusion in Level 1 are:

- Assessment model structure and any treatment of the data prior to inclusion in the model includes appropriate and necessary details of the biology of the stock, the fisheries that exploit the stock, and the data collection methods;
- Estimation of stock status and reference points integrated in the same framework such that the OFL calculations promulgate all uncertainties (stock status and reference points) throughout estimation and forecasting;
- Assessment estimates relevant quantities including F_{MSY} ¹, OFL, biomass reference points, stock status, and their respective uncertainties; and
- No substantial retrospective patterns in the estimates of fishing mortality (F), biomass (B), and recruitment (R) are present in the stock assessment estimates.

The important part of Level 1 is that the precision estimated using a purely statistical routine will define the OFL probability distribution. Thus, all of the important sources of uncertainty are formally captured in the stock assessment model. When a Level 1 assessment is achieved, the assessment results are likely unbiased and fully consider uncertainty in the precision of estimates. Under Level 1, the ABC will be determined solely on the basis of an acceptable probability of overfishing (P^*), determined by the Council's risk policy (see alternatives in section 5.2.2), and the probability distribution of the OFL.

Level 2: Level 2 indicates that an assessment has greater uncertainty than Level 1. Specifically, the estimation of the probability distribution of the OFL directly from the stock assessment model fails to include some important sources of uncertainty, necessitating expert judgment during the preparation of the stock assessment, and the OFL probability distribution is deemed best available science by the SSC. Examples of attributes of the stock assessment that would lead to inclusion in Level 2 are:

- Key features of the biology of the stock, the fisheries that exploit it, or the data collection methods are missing from the stock assessment;
- Assessment estimates relevant quantities, including reference points (which may be proxies) and stock status, together with their respective uncertainties, but the uncertainty is not fully promulgated through the model or some important sources may be lacking;
- Estimates of the precision of biomass, fishing mortality rates, and their respective reference points are provided in the stock assessment; and
- Accuracy of the MFMT and future biomass is estimated in the stock assessment by using *ad hoc* methods.

In this level, ABC will be determined by using the Council's risk policy (see alternatives in section 5.2.2), as with a Level 1 assessment, but with the OFL probability distribution based on the specified distribution in the stock assessment.

¹ With justification, F_{MSY} may be replaced with an alternative maximum fishing mortality threshold to define the OFL.

Level 3: Attributes of a stock assessment that would lead to inclusion in Level 3 are the same as Level 2, except that

- 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.

Assessments in this level are judged to over- or underestimate the accuracy of the OFL. The SSC will adjust the distribution of the OFL and develop an ABC recommendation by applying the Council's risk policy (see alternatives in section 5.2.2) to the modified OFL probability distribution. The SSC will develop a set of default levels of uncertainty in the OFL probability distribution for this level based on literature review and a planned evaluation of ABC control rules. A control rule of 75 percent of F_{MSY} may be applied as a default if an OFL distribution cannot be developed.

Level 4: Stock assessments in Level 4 are deemed to have reliable estimates of trends in abundance and catch, but absolute abundance, fishing mortality rates, and reference points are suspect or absent. Additionally, there are limited circumstances that may not fit the standard approaches to specification of reference points and management measures set forth in these guidelines (i.e., ABC determination). In these circumstances, the SSC may propose alternative approaches for satisfying the NS1 requirements of the Magnuson-Stevens Act than those set forth in the NS1 guidelines. In particular, stocks in this level do not have point estimates of the OFL or probability distributions of the OFL that are considered best available science. In most cases, stock assessments that fail peer review or are deemed highly uncertain by the SSC will be assigned to this level. Examples of potential attributes for inclusion in this category are:

- Assessment approach is missing essential features of the biology of the stock, characteristics of data collection, and the fisheries that exploit it;
- Stock status and reference points are estimated, but are not considered reliable;
- Assessment may estimate some relevant quantities including biomass, fishing mortality or relative abundance, but only trends are deemed reliable;
- Large retrospective patterns usually present; and
- Uncertainty may or may not be considered, but estimates of uncertainty are probably substantially underestimated.

In this level, a simple control rule will be used based on biomass and catch history and the Council's risk policy.

The SSC will determine, based on the assessment level to which a stock is classified, the specifics of the control rule to specify ABC that would be expected to attain the probability of overfishing specified in the Council's risk policy. The SSC may deviate from the above assessment level framework or level criteria and recommend an ABC that differs from the result of the ABC control rule calculation, but must provide justification for doing so.

Council Risk Policy

The risk policy alternative adopted by the Council would be applied to all of the managed resources under MAFMC management jurisdiction. In addition to the risk alternative described below, the following would also apply. For managed resources that are under rebuilding plans, the upper limit on the probability of exceeding the rebuilding F would be 50 percent unless modified to a lesser value (i.e. higher probability of not exceeding rebuilding F) through a rebuilding plan amendment. In addition, if no OFL is available (i.e. No F_{MSY} or F_{MSY} proxy provided through the stock assessment to identify it) and no OFL proxy is provided by the SSC at the time of ABC recommendations, then an upper limit (cap) on allowable increases in catch levels will be established. Catch levels may not be increased until an OFL has been identified. This policy is designed to prevent catch from being increased when there are no criteria available to determine if overfishing will be occurring for the upcoming fishing year. To reduce the risk of overfishing, the Council policy would be to not increase catch in the absence of an OFL.

Under the alternative adopted by the Council, a stock replenishment threshold defined as the ratio of $B/B_{MSY} = 0.10$, will be utilized to ensure the stock does not reach low levels from which it cannot recover (see Figure below). The probability of overfishing will be 0 percent if the ratio of B/B_{MSY} is less than or equal to 0.10. Probability of overfishing increases linearly for stock defined as typical as the ratio of B/B_{MSY} increases, until the inflection point of $B/B_{MSY} = 1.0$ is reached and a 40 percent probability of overfishing is utilized for ratios equal to or greater than 1.0. Probability of overfishing increases linearly for stock defined as atypical as the ratio of B/B_{MSY} increases, until the inflection point of $B/B_{MSY} = 1.0$ is reached and a 35 percent probability of overfishing is utilized for ratios equal to or greater than 1.0. An atypical stock has a life history strategy that results in greater vulnerability to exploitation, and whose life history has not been fully addressed through the stock assessment and biological reference point development process.

