2.3   Action 3. ABC control rule

Alternative 1. Do not specify an OFL/ABC control rule. OFL and ABC will be set by the SSC on an ad hoc basis for each stock or stock assemblage individually.

Alternative 2. Adopt the OFL/ABC control rule described in Table 2.3.1. The indicated default P* risk level for Tier 2, or default ABC buffer levels for Tier 3a and 3b, are to be used unless specified otherwise by the Council on a stock by stock basis.

Alternative 3. Adopt an OFL/ABC control rule where the buffer between OFL and ABC will be a fixed level consisting of:
a.   ABC = 75% (or other percentage) of OFL
b.   ABC = the yield at 75% (or other percentage) of F_{MSY}

Table 2.3.1. OFL/ABC Control Rule.

Tier 1 OFL/ABC Control Rule	
Condition for Use	Quantitative assessment provides an estimate of OFL and a probability distribution function that reflects scientific uncertainty. Specific components of scientific uncertainty can be evaluated through a risk determination table.
OFL	Set OFL = Yield available by applying Fmsy (or proxy) to estimated biomass.
ABC	The Council with advice from its SSC will set an appropriate level of risk (P*) using a risk determination table that calculates a P* based on the level of information and uncertainty in the stock assessment; Set ABC = yield at P*

Tier 2 OFL/ABC Control Rule	
Condition for Use	A probability distribution function reflecting scientific uncertainty can be calculated from the variance in landings data. This distribution function can be used to take a level of risk (P*) and convert it into a buffer between OFL and ABC.
OFL	Set OFL based on a suitable method as determined by the SSC (for example, DCAC analyses, or mean, max or 75th percentile of a recent mean of a time-series of landings data - 10 years recommended). (A different number of years may be used to attain a representative level of variance in the landings.)

ABC	Calculate a probability distribution around the recent mean of a time-series of landings. The value for a given P* will be used as the buffer between OFL and ABC. The P* will be pre-determined and listed in Table 2.3.2 for each stock or stock complex by the Council with advice from its SSC as:
	    a. P* = 45%
	    b. P* = 35%
	    c. P* = 25% (default level for unassigned stocks)
	    d. P* = 15%
	Set ABC = OFL – buffer at P*

Tier 3a OFL/ABC Control Rule	
Condition for Use	A probability distribution function cannot be calculated that is useful to convert a level of risk (P*) into a buffer between OFL and ABC. Annual historical landings are small (generally averaging less than 250,000 pounds), stable over time, and in the judgment of the SSC the stock or stock complex is unlikely to undergo overfishing at current average levels or at levels moderately higher than current average levels.
OFL	Set OFL equal to the recent mean of a time-series of landings data (10 years recommended) plus two standard deviations. (A different number of years may be used to attain a representative level of variance in the landings.)
ABC	Set ABC using a buffer from OFL that represents an acceptable level of risk from scientific

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	uncertainty. The buffer will be pre-determined and listed in Table 2.3.3 for each stock or stock complex by the Council with advice from its SSC as:
	   a. ABC = mean of the landings data plus 1.5 * standard deviation
	   b. ABC = mean of the landings data plus 1.0 * standard deviation (default)
	   c. ABC = mean of the landings data plus 0.5 * standard deviation
	   d. ABC = mean of the landings data

	Tier 3b OFL/ABC Control Rule
Condition for Use	A probability distribution function cannot be calculated that is useful to convert a level of risk (P*) into a buffer between OFL and ABC. In the judgment of the SSC, current average landings may be at or near the yield at F_{MSY}.
OFL	Set OFL equal to the recent 10-year mean of the landings data. If there is a trend in the landings data, set OFL equal to the mean of the landings data adjusted to account for uncertainty due to the trend.

ABC	Set ABC using a buffer from OFL that represents an acceptable level of risk from scientific uncertainty. The buffer will be pre-determined and listed in Table 2.3.4 for each stock or stock complex by the Council with advice from its SSC as:
	   e. ABC = 100% of OFL
	   f. ABC = 85% of OFL
	   g. ABC = 75% of OFL (default level for unassigned stocks)
	   h. ABC = 65% of OFL

Discussion:

Section 600.310(f)(4) of the National Standard 1 guidelines requires that each Council establish an ABC control rule that should be based, when possible, on the probability that an actual catch equal to the stock's ABC would result in overfishing.

Under Alternative 2, Table 2.3.1 represents an OFL/ABC control rule for determining the appropriate level of risk and/or buffer to set between OFL and ABC. In all cases the annual estimate of maximum sustainable yield is the OFL. The ABC Control Rule offers three tiers of guidance for setting ABC based on the amount of information for a given stock. With less information there is greater scientific uncertainty, and therefore the buffer between OFL and ABC will be greater.

The top tier, Tier 1, is for stocks that have undergone a quantitative assessment that has produced an estimate of maximum sustainable yield and a probability distribution around the estimate. For these stocks, specific factors related to uncertainty in the assessment can be evaluated through the use of a risk determination table, and converted into an appropriate level of risk, or P*. An example of a risk determination table is given in Table 2.3.4. Different methodologies may be needed for different types of assessments. Therefore, the risk determination table is not part of the ABC control rule, but rather a methodology developed and applied by the SSC to the control rule.

Tier 2 is for stocks that have not had a quantitative assessment or for other reasons do not meet the requirements for Tier 1, but have a series of landings data from which an estimate of OFL can be derived. The control rule does not specify the methodology to use in setting OFL, but rather, the buffer between OFL and ABC. The OFL is set by the SSC based on their best judgment of the appropriate method. This could be through the use of less data intensive methods such as depletion corrected average catch (DCAC), or it could be based on a time series of landings. If based on a time series, OFL might be set conservatively at the mean of the landings, or if the SSC feels that the stock can remain stable at higher fishing levels, at the

maximum observed landings, or at some point in between. A probability distribution can be developed around the mean of time-series of landings and used to determine the size of the buffer between OFL and ABC. Although the buffer is based on the standard error around the mean of the landings, if we can determine the mean of a stable annual catch series and the related standard deviation and standard error, we can then add some number to the mean to arrive at a different OFL knowing the SD and SE should remain the same (personal communication on 7/8/2010 from Elbert Whorton, statistician, University of Texas Medical Branch). Therefore, buffers based on this method can also be used with alternative OFLs that are simply some value added to the mean. The level of risk is determined by Council policy from within the previously determined range of 15% to 45%. This level of risk is converted into an appropriate ABC based on the OFL minus the buffer determined from the probability distribution.

Tier 3a is for small stocks (generally averaging less than 250,000 pounds), that are stable over time, and in the judgment of the SSC the stock or stock complex is unlikely to undergo overfishing at current average levels or at levels moderately higher than current average levels. Under this tier, the average landings are recommended as the annual catch target, and the OFL and ABC are set above the current average. Setting the buffer at some multiple of standard deviations allows the buffer size to vary with the amount of variability of the stock since standard deviation is a measure of variability. Stocks with high variability will have a higher buffer while those with less variability will have a lower buffer. At two standard deviations above the mean, the recommended default for OFL, there is a 98 percent probability that annual landings in any given year will be below that level. ABC levels of 1.5, 1.0, and 0.5 standard deviations above the mean result in probabilities of 93%, 84% and 69% that an annual landing will exceed the value. At mean landings, the value will be exceeded 50% of the time. These are not probabilities of overfishing, but rather, probabilities that ABC will be exceeded and, assuming ACL = ABC, accountability measures will be triggered.

Tier 3b is for stocks that do not meet the requirements of either Tier 1 or Tier 2, and in the judgment of the SSC the current fishing levels may be at or near maximum sustainable yield, or may not be sustainable over time. At this tier, the mean of the landings becomes the OFL, and the ABC is set to some lower value. A statistically valid probability distribution around the OFL estimate cannot be determined. For these stocks a fixed percentage between OFL and ABC is adopted as a buffer to represent scientific uncertainty. The default buffer level for each stock is to set ABC at 75% of OFL unless a different risk level is determined by Council policy.

Testing of Buffer Levels Under Different Tiers

As the tier levels increase from Tier 2 to Tier 3s and Tier 3b, the increasing uncertainty should result in larger buffers between OFL and ABC. However, this is not intuitive from looking at the control rule, particularly since the catch levels under Tier 2 may be either higher or lower than under Tier 3a or Tier 3b depending upon the method selected for determining OFL in Tier 2 (Tiers 3a and 3b each have a defined fixed method). Scientific uncertainty is reflected in the size of the buffer between OFL and ABC, rather than the absolute values. To test whether Tier 3a and Tier 3b produce a higher buffer between OFL and ABC than Tier 2, OFL and ABC was calculated under each of the methods for two randomly selected stocks, vermilion snapper and lane snapper, using the landings data and P* probability distributions that were available to the SSC at their July 2010 meeting. As shown in Tables 2.3.2 and 2.3.3, in both cases, at the default risk levels, the Tier 3a buffer was greater than Tier 2, and the Tier 3b buffer was greater than Tier 3a, indicating that the control rule does account for greater scientific uncertainty with the more data poor methods.