CHECKLIST FOR FMP AMENDMENTS

(3 August 1998)

This checklist addresses questions that should be considered in making amendments to FMPs in order to comply with National Standard 1 of the SFA, following NMFS' National Standard Guidelines. Most items in the checklist make reference to specific sections in the document "Technical Guidance on the Use of Precautionary Approaches to Implementing National Standard 1 of the Magnuson-Stevens Fishery Conservation and Management Act" (NOAA Technical Memorandum F/SPO-??, 1998), which should be consulted for further elaboration.

At least 2 topics should be discussed in developing the required FMP amendments:

(1) Status Determination Criteria (SDC), and
(2) Optimum Yield (OY).

In the case of overfished stocks, Councils will also need to address a third topic:

(3) Rebuilding plans.

Annex 1 provides a hypothetical example that addresses SDC and OY.

(1) Status Determination Criteria

1. What is the level of available knowledge for the stock? (Section 2.2)

The level of "data-richness" or "information-richness" for a stock is an important consideration. The purpose of developing Status Determination Criteria is to monitor the status of the stock by comparing the results of stock assessments against the definitions of overfishing and overfished condition. Therefore, it would be impractical to develop the SDC as if the stock's dynamics were well understood, when, in fact, the information provided by the stock assessment could be viewed as "data-poor" or "data-moderate". The three levels of data-richness identified in Section 2.2 are meant as a guide to classify stocks into rough categories. The important issue is not so much to decide whether a stock is data-poor or data-rich, but rather to ensure that its status with respect to the SDC can be assessed. Of course, the adequacy of the SDC and the ability to monitor the stock will be improved by increasing the level of available knowledge to a higher level of data-richness.

2. What is the shape of the MSY control rule? (Section 2.1.1)

The MSY control rule is used to define limits to exploitation. It can be thought of as a strategy in which the fishing mortality is controlled so as to achieve maximum longterm yield. The MSY control rule constitutes the Maximum Fishing Mortality Threshold, MFMT, and is used to determine the Minimum Stock Size Threshold, MSST (Section 2.1.2), and its shape can be an important consideration (e.g., Sections 2.1.2 and 2.1.3 explain how the value of the MSST may depend on the shape of the MSY control rule).

3. Parameterize the MSY-control rule

Once the shape of the MSY control rule is chosen, the values of the parameters that define the control rule need to be specified. As a simple example, consider an MSY control rule in which F is to be set constant, independently of the stock size. The only parameter that needs to be defined in this case is F_{MSY}, the single value of F that maximizes longterm yield. In other cases, when the MSY control rule is specified as an F that varies with stock size, the parameters of that relationship which maximize longterm yield need to be determined (Section 2.1.2). Note that, with the exception of constant F strategies, it is very unlikely that such parameterizations can be found in the literature, and Councils should work together with assessment scientists to carry out the necessary computations. Inasmuch as possible, such computations should take into account the relevant characteristics of the stock and fishery: selectivity, availability, stock-recruitment relationship, reproduction, growth, natural mortality, and natural variability. Optionally, Councils may adopt the default MSY control rule recommended in Section 2.1.4.

4. Specify MFMT

The maximum fishing mortality threshold, MFMT, is simply the value(s) of fishing mortality in the MSY control rule. The MFMT will be a single value (F_{MSY}) only in the case of a constant-F MSY control rule. Otherwise, the MFMT should be expressed as a function of stock size.

5. Estimate B_{MSY}

According to the NSGs, the value of B_{MSY} is to be computed with a constant-F strategy. That is, even if the shape of the MSY control rule chosen by the Council is not a constant-F one, computations should be made with a constant-F control rule for the purpose of defining B_{MSY}. In some instances, it is possible that values of B_{MSY} for the stock in question are available from the literature, or that reasonable proxies may be defined (Section 2.2.1). Inasmuch as possible, computations of B_{MSY} should take into account the relevant characteristics of the stock and fishery: selectivity, availability,

stock-recruitment relationship, reproduction, growth, natural mortality, and natural variability.

6. Specify MSST

The minimum stock size threshold, MSST, will be the greater of (a) one-half B_{MSY}, or (b) the minimum stock size at which rebuilding to the B_{MSY} level would be expected to occur within 10 years if the stock were consistently exploited according to the MFMT. Again, the necessary computations should be made according to the MSY control rule chosen by the Council and taking into account the relevant characteristics of the stock and fishery. Optionally, Councils may use the recommended default MSY control rule and MSST of Section 2.1.4.

(2) Optimum Yield

1. What is the shape of the target control rule that defines OY?

The MSY control rule in (1), above, is used to define limits to exploitation (the Status Determination Criteria). The OY is a target for the management of the fishery, constrained to keep the fishing mortality at or below MFMT. In many cases, the shape of the target control rule that defines OY will be the same as the shape of the MSY control rule. However, the NSGs do not require that this be the case necessarily, and Councils may wish to select another shape based on additional considerations. For instance, a Council may choose a constant-*F* MSY control rule to define the MSST and MFMT, but may wish to harvest the stock instead following a constant catch strategy. Thus, OY should not be equated with MSY.

2. Parameterize the target control rule

The target control rule that defines OY should be parameterized taking into account the objectives of management (e.g., longterm magnitude of yield, interannual yield variability, socioeconomic considerations). The approaches outlined in Sections 3.1 and 3.2 can be used to carry out the necessary computations. It is not a good idea to avoid making computations by setting the target control equal to the MFMT because, due to variability alone, overfishing (F>MFMT) could take place 50% of the time, or more. The recommended default to be used in the absence of detailed analyses sets the target F to be 25% below the recommended default MFMT (Section 3.3).

3. Is the target control rule precautionary?

The NSGs recommend that the target control rule defining OY be precautionary. Once

the target is defined, it could be deemed to be precautionary if it adheres to the following characteristics:

(a) Is F(target) < MFMT?
(b) If stock size were reduced below B_{MSY}, would F(target) also be reduced?
(c) Is the target risk-averse in the sense that increased uncertainty leads to more conservatism?

Note, however, that a precautionary target does not necessarily have to meet all three conditions. For example, if F(target) is substantially lower than F_{MSY}, attribute (b) may not be an essential condition to protect the stock from overfishing.

(3) Rebuilding Plans

A carefully chosen target control rule should incorporate rebuilding elements that prevent the stock size from falling below the MSST. For example, implementing a target that conforms to the three precautionary attributes in item 3, above, should prevent a healthy stock from becoming overfished. Nevertheless, it is certain that many stocks are already overfished, i.e. below the MSST. A special rebuilding plan may be required for these stocks in order to bring them up to or above the B_{MSY} level.

Rebuilding plans must be designed to achieve the desired result within a specified time period. For this reason, and because different stocks have different population dynamics characteristics, defining rebuilding plans will almost certainly necessitate computations that are not readily available in the literature. Councils should work together with assessment scientists to carry out the necessary computations. Inasmuch as possible, such computations should take into account the relevant characteristics of the stock and fishery: current stock size and its uncertainty, selectivity, availability, stock-recruitment relationship, growth, natural mortality, and natural variability.

The following items should be addressed in designing a rebuilding plan (Section 3.4):

1. What is the minimum possible time to rebuilding, T_{min}?

According to the NSGs, T_{min} is computed by setting F equal to zero and projecting the stock forward in time. Accounting for uncertainty in current stock size as well as uncertainty in future productivity (e.g., in the stock-recruitment relationship), T_{min} would be the time elapsed until the B_{MSY} level is achieved with 50% probability.

2. What is the maximum allowable time to rebuilding, T_{max}?

If T_{min} is less than 10 years, then T_{max} is 10 years. Otherwise, the maximum allowable time is T_{min} plus 1 generation time (see Section 3.4 for the definition of generation time).

3. What is the target rebuilding time period, T_{target}?

In general, T_{target} should be as short as possible and shorter than T_{max}. Under the very special circumstances detailed in §600.310(e)(4) of the NSGs, Councils could set the target rebuilding time period to be equal to T_{max}. The recommended default in Section 3.4 of the technical guidance document is to set T_{target} below the midpoint between T_{min} and T_{max}.

4. What is the target rebuilding trajectory?

The rebuilding plan would best be specified as a target control rule, designed to achieve rebuilding in T_{target} years with 50% probability, or higher. The rebuilding trajectory should clearly identify milestones to be met during rebuilding. The technical guidance document does not recommend a default rebuilding trajectory because the rebuilding plans must, by necessity, be stock-specific. They must take into account not only the stock's productivity, but also its current status relative to B_{MSY}.

Rebuilding overfished stocks will almost certainly require temporary sacrifices in yield relative to current catch levels. A target rebuilding trajectory that delays such sacrifices until the final years in the plan would not be precautionary and may have a low probability of success.

5. What mechanisms will be used to monitor progress with respect to the target rebuilding trajectory?

A rebuilding plan is an agreed set of decisions that should be implemented effectively. Stocks under rebuilding plans must be monitored closely so that adjustments can be made to the trajectory when the rebuilding milestones are not being met due to any reason. For example, if the plan's target *F*s are exceeded due to quota over-runs, subsequent target *F*s should be adjusted downwards in order to put the stock back on the plan's recovery trajectory. A sound rebuilding plan should identify how the monitoring will be carried out (e.g., through annual assessments and tracking of milestones) and ensure that the stock will be maintained at the target trajectory.

Annex 1 — Hypothetical Example

(1) Status Determination Criteria

1. What is the level of available knowledge for the stock?

The hypothetical example stock is classified as being at the lower end of the "data-moderate" scale. Natural mortality is assumed to be 0.2 based on life history considerations, and growth and maturity are known fairly well. This has not been a high-priority stock historically, so stock assessments have been infrequent and rudimentary. The last assessment made three years ago used a "separable VPA" which resulted in estimates of selectivity at age, fishing mortality and stock sizes for a 6-year series of catch data. The series is too short to infer anything about a stock-recruitment relationship. No indices of relative abundance are available, although one could be developed by standardizing CPUE data. No efforts have been made to evaluate the sensitivity of the results to different assumptions and models. Figure A1 depicts the growth, maturity and selectivity information, as well as the relationship between spawning biomass per recruit and fully-selected fishing mortality.

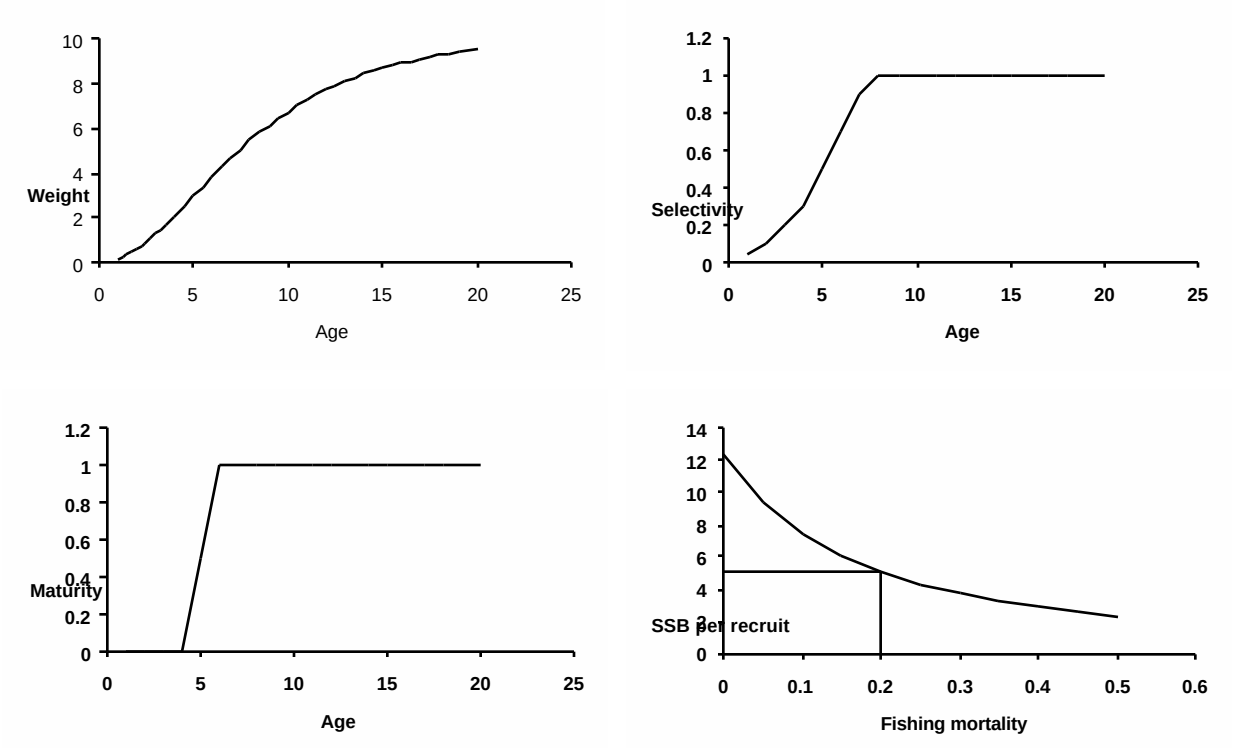

Figure A1. Growth, maturity and selectivity information for the hypothetical stock. The panel in the lower right shows the relationship between SSB per recruit and fishing mortality.

2. What is the shape of the MSY control rule?

Given the timetable for the FMP amendment, the Council chooses to use the default recommended in Section 2.1.4:

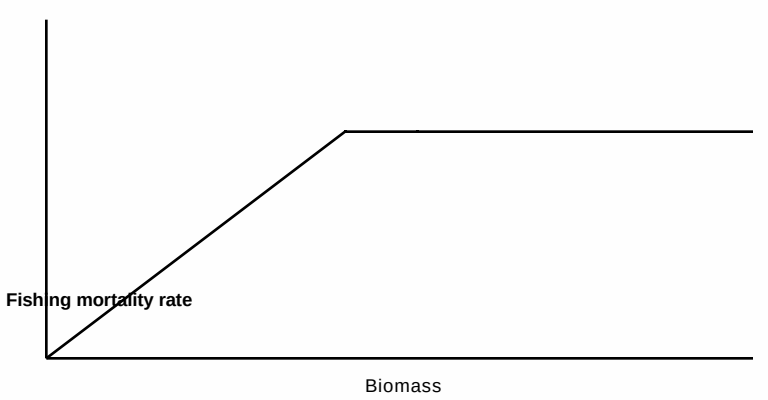

Figure A2. Shape of the MSY control rule selected.

3. Parameterize the MSY-control rule

The Council chooses to parameterize the MSY control rule as recommended in Section 2.1.4. Use of proxies is necessary because estimates of F_{MSY} and B_{MSY} are not available. The Council's Stock Assessment panel recommends using a proxy of the type $F_{x\%SPR}$ for F_{MSY}. Based on discussions about the likely resilience of the species to fishing, thought to be "low to moderate", the Panel decides on using $F_{40\%}$ according to the recommendations in Section 2.2.1. Given the available information (see Figure A1), 40%SPR is obtained with a fully-selected F of 0.2 per year. Thus far, the Y-axis in the MSY control rule is given by:

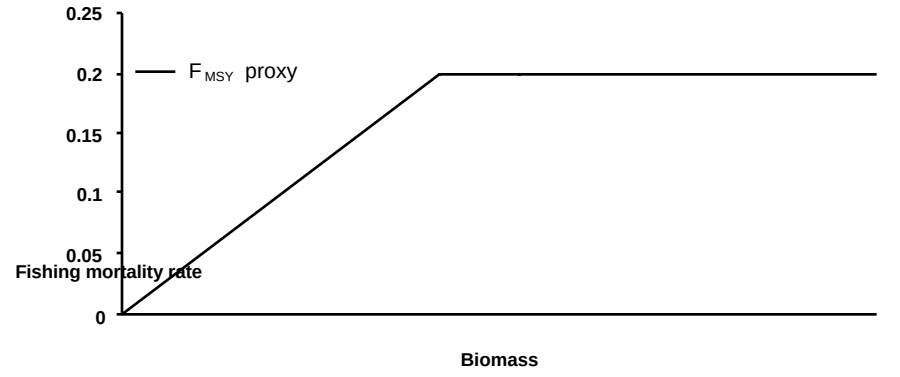

Figure A3. Parameterization of the Y-axis in the MSY control rule.

4. Specify MFMT

The MFMT is given by the function in Figure A3. The X-axis in the figure needs to be parameterized before determining at what level of biomass the MFMT drops from $F_{40\%}$ to the origin.

5. Estimate B_{MSY}

The Stock Assessment Panel uses a default recommended in section 2.2.1: "B_{MSY} can also be approximated by the mean recruitment (R_{mean}) multiplied by either (a) the level of spawning per recruit at F_{MSY} ..." The SPR at $F_{40\%}$ is 5.0852 Kg/recruit. The mean recruitment estimated from the assessment is 620,000 fish. Therefore, the current estimate of B_{MSY} is (5.0852)(620)=3152.8 tons of spawning biomass (SSB). Note, however, that a new assessment (based on a new model or a longer time series) may result in a different estimate of B_{MSY}; FMPs must be sufficiently flexible to accommodate such changes.

6. Specify MSST

The Stock Assessment Panel did not have time to carry out simulation analyses to determine the lowest biomass for which rebuilding to 3152.8 tons would take 10 years if fishing at the MFMT depicted in Figure A3. Therefore, the Panel decided to use the recommended default of Section 2.1.4: MSST = max(0.5,1-M)*BMSY = (1-0.2)(3152.8) = 2522.24 tons of SSB. The fully-parameterized MSY control rule is shown in Figure A4.

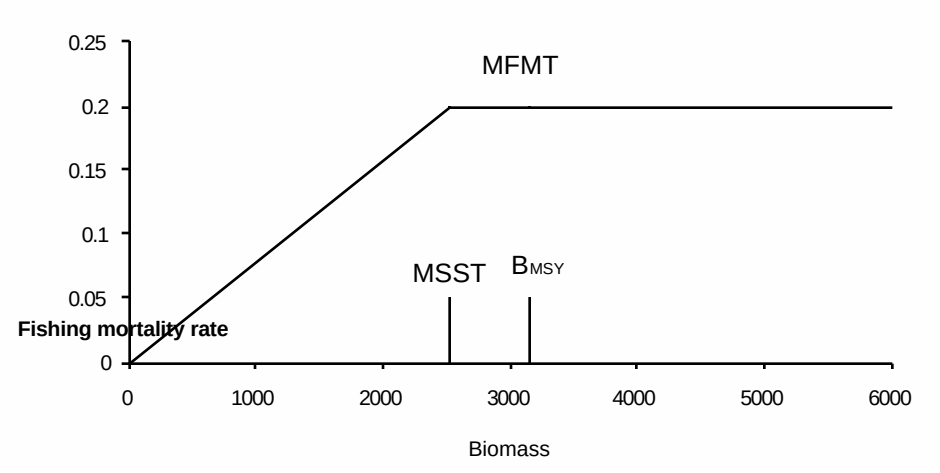

Figure A4. The MSY control rule and status determination criteria (MSST and MFMT).

(2) Optimum Yield

1. What is the shape of the target control rule that defines OY?

The Council chooses a control rule with the same shape as the MSY control rule.

2. Parameterize the target control rule

The Council chooses the default recommended in Section 3.3 of setting the target 25% below the limit (Figure A5):

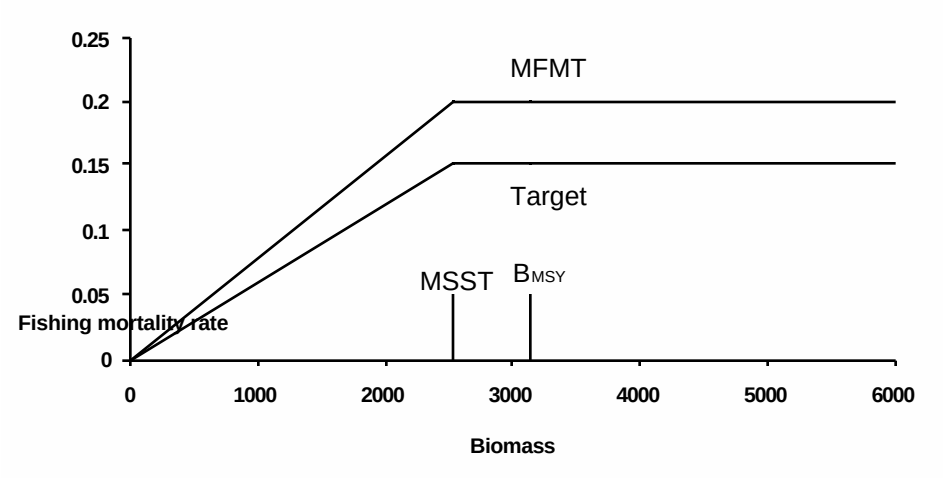

Figure A5. Target control rule and Status Determination Criteria.

3. Is the target control rule precautionary?

Question: Is *F*(target) < MFMT? Answer: Yes, it is 25% lower.

Question: If stock size were reduced below B_{MSY}, would *F*(target) also be reduced? Answer: Yes, but not until stock size falls below $0.8B_{MSY}$.

Question: Is the target risk-averse in the sense that increased uncertainty leads to more conservatism? Answer: Not really. The target is 25% below the limit, independent of the level of uncertainty.

Overall, the target control rule appears to be precautionary. However, its performance depends on the reliability of the various inputs used to develop MSY-related proxies and parameterize the control rules.