Report from the
RISK POLICY WORKING GROUP

DRAFT

Risk Policy Road Map

NEW ENGLAND
FISHERY MANAGEMENT COUNCIL

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Contents

1.0   INTRODUCTION

The ***Risk Policy Working Group*** (RPWG) was originally formed by the New England Fishery Management Council as the *ABC Control Rule Working Grou*p, but the name change to *Risk Policy Working Group* more accurately reflects the working group's tasking, i.e., to assist the Council with developing a risk policy, which addresses risk and uncertainty across all levels of fisheries management, not just in the ABC Control Rule. The RPWG met several times during 2013, 2014, and 2015, to develop a Risk Policy (approved by the Council in November 2014) and discuss the steps necessary to implement/operationalize the Risk Policy in all Council-managed FMPs. This document serves as the RPWG's Road Map and includes the RPWG's recommendations for next steps to implement the Council's Risk Policy Statement.

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Acronyms

ABC	Acceptable Biological Catch
ACL	Annual Catch Limit
ACT	Annual Catch Target
AM	Accountability Measure
HCR	Harvest Control Rule
OY	Optimum Yield
RPWG	Risk Policy Working Group

2.0   RISK POLICY STATEMENT

The *Risk Policy Statement* is a high-level, broad articulation of the Council's general policy with respect to risk and uncertainty for setting ABCs, ACLs, and other management measures. It complements ABC control rules and ACL-setting by articulating the bounds of how risk tolerant or risk averse a Council's management approach is, given certain criteria. The Risk Policy is intended to inform and work in conjunction with a Council's application of an ABC control rule (CR) and a harvest control rule (HCR) in each FMP. Though informed by scientific advice from the SSC, the Council's risk tolerance is ultimately a policy decision, which is articulated in the Council's *Risk Policy Statement*. The elements of the Risk Policy Statement can be applied through the ABC CRs, HCRs, and management procedures for individual stocks in each FMP.

The three purposes identified in the Risk Policy Statement affirm the Council's intent to address risk and uncertainty across ***all aspects of fisheries management*** by articulating a risk policy not only just for those entities involved in specifying ABC and related harvest levels (i.e., the Council and its subordinate bodies), but also for NOAA Fisheries (NMFS) in cases when it may implement in-season management measures/adjustments (as authorized) or when conducting rule-making independently from the Council, and for the Northeast Fisheries Science Center when performing analyses for Council-managed stocks in the future. The four strategic approaches in the Risk Policy Statement articulate the policy to which the Council's harvest control rules and ABC control rules should adhere.

At its November 2014 meeting, the Council formally adopted the Risk Policy Statement provided below (shaded text).

NEFMC RISK POLICY

Recognizing that all fishery management is based on uncertain information and that all implementation is imperfect, it is the policy of the New England Fishery Management Council (Council) to weigh the risk of overfishing relative to the greatest expected overall net benefits to the Nation.

The purpose of the New England Fishery Management Council's risk policy is to:

1. Provide guidance to the Council and its subordinate bodies on taking account of risk and uncertainty in Fishery Management Plans and specification-setting;

2. Communicate the priorities and preferences of the Council regarding risk and uncertainty to NOAA Fisheries; and

3. Make fishery management more transparent, understandable, and predictable while better achieving FMP objectives in the face of uncertain information and imperfect implementation.

This risk policy will be supported by the following strategic approaches:

1. The Council's risk policy will take account of both the probability of an undesirable outcome and the negative impact of the outcome. The probability of outcomes that have a long-term negative impact on ecosystem function should be low.

2. The cumulative effects of addressing risk at all levels of the fishery management process (e.g., estimation of OFL, ABC, ACL, ACT, and setting accountability measures) will be taken into account.

3. Harvest control rules and management procedures will consider stability in the face of uncertain information and inherent variability in ecosystems.

4. Implementation of the policy will be analysis-based, using methods commensurate with the importance of tradeoffs between conservation, ecosystem roles, and fishery benefits, as well as the tradeoffs between short-term and long-term benefits. The goal should be harvest control rules and management procedures that are formally evaluated with a view towards extracting signal from noise so that management and fisheries are less sensitive to uncertainty. This goal should allow for a dynamic process of implementation and review, and modification when warranted.

Discussion

The Council's Risk Policy Statement provides a foundation for more explicit risk-based decision making by identifying social, economic, and ecological objectives that the Council should aim to achieve in all FMPs:

Evaluation of management decisions should consider the probability of an outcome as well as its severity. There may be flexibility to allow for short-term tradeoffs, but the risk of long-term or chronic overfishing should be low.

The risk of overfishing and impacting overall net benefits to the Nation are determined by the cumulative impacts of decisions that range from assessment modelling to estimating reference points, developing ABC control rules, specifying ACLs, ACTs, and all other elements of the management procedure. Focusing a risk-based decision for any one of these elements of the management procedure in isolation is inadequate to address the objectives of the Risk Policy. Net benefits to nation are further discussed with respect to the Risk Policy Statement in Section 2.1.

Stability – in both stocks and fisheries – is an important metric for evaluating the performance of the management system. Standards for performance measures for stability should be determined on a case-by-case basis. The concept of stability, as it applies to the Council's Risk Policy, is further discussed in Section 2.2.

Analysis of management procedures should account for the complex nature of the system and include both positive and negative feedbacks. This can be addressed through management strategy evaluation or other similar analytical approaches that allow for tradeoffs to be evaluated with respect to the risk of overfishing and net benefits to the Nation. Analytical models should include several performance measures with respect to conservation, and, to the extent possible, economic and social performance indicators. Evaluation of management procedures is further discussed in Section 2.3.

2.1 NET BENEFITS TO THE NATION

The Council (with technical support from the PDT and input from the Committee/Advisory Panel) should identify the factors that affect net benefits to the Nation for each stock/fishery, taking account of the impacts on benefits from other stocks and fisheries. Fishing activity frequently interacts with multiple stocks/fisheries. Decision making should consider the full extent of impacts on the fishery in question and other affected by that decision, in order to maximize the present value of the net benefits to the Nation. Risks to these factors should also be identified and measured to the extent possible. When making management decisions, the risk of overfishing the resource should be evaluated against the tradeoffs affecting the total net benefits to the Nation from all fisheries in the region.

Net benefits to the Nation should be interpreted broadly and inclusive of benefits not only to the target species/fishery in question, but also to bycatch species, habitat, the ecosystem, and other benefits that may accrue from managing fisheries. Fishery benefits are inclusive of the social, economic, and cultural benefits that rely on productive fish stocks. Furthermore, sustaining benefits to the Nation – including food, jobs, recreation, and intrinsic values – is dependent on productive marine ecosystems. This broad interpretation is consistent with the MSA discussion of *optimum yield and overall benefit to the Nation*:

Optimum yield is defined in the MSA as *the amount of fish which 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.* This implies that there is value associated not only with how much fish may be caught, but also how the fish are utilized and protection afforded to marine ecosystems. Therefore, if outcomes are evaluated by yield only, then the "greatest overall benefits" to the Nation may not have been fully considered.

The factors that need to be taken into account in determining the greatest benefit to the Nation are addressed in more detail in several of the MSA's ten National Standards. The guidelines to *National Standard 1* state that:

Determining the greatest benefit to the Nation. In determining the greatest benefit to the Nation, the values that should be weighed and receive serious attention when considering the economic, social, or ecological factors used in reducing MSY to obtain OY are:

(A) The benefits of food production are derived from providing seafood to consumers; maintaining an economically viable fishery together with its attendant contributions to the national, regional, and local economies; and utilizing the capacity of the Nation's fishery resources to meet nutritional needs.

(B) The benefits of recreational opportunities reflect the quality of both the recreational fishing experience and non-consumptive fishery uses such as ecotourism, fish watching, and recreational diving. Benefits also include the contribution of recreational fishing to the national, regional, and local economies and food supplies.

(C) The benefits of protection afforded to marine ecosystems are those resulting from maintaining viable populations (including those of unexploited species), maintaining adequate forage for all components of the ecosystem, maintaining evolutionary and ecological processes (e.g., disturbance regimes, hydrological processes, nutrient cycles),

maintaining the evolutionary potential of species and ecosystems, and accommodating human use.

Further guidance on net benefits to the Nation is provided in National Standards 8 and 9 and Executive Order 12866.

2.2   STABILITY

The concept of *stability* is important to understand as it relates to the Council's Risk Policy and addressing uncertainty/variability inherent in fisheries. Without explicitly identifying stability as an FMP objective in the Risk Policy Statement, the issue of stability cannot be decoupled from considerations of risk and uncertainty.   **The application of the term stability in the Risk Policy Statement refers explicitly to** *stability within the management system***, i.e., the ability to tailor the management system to respond to real change versus noise/variability.** Proposed changes to the National Standard Guidelines support the concept and use of stability in fisheries management (http://www.fisheries.noaa.gov/sfa/laws_policies/national_standards/index.html).

The strategic approach proposed in the Risk Policy Statement states that harvest control rules and management procedures will consider stability in the face of uncertain information and variability within fisheries systems. In other words, when developing rules to address risk and uncertainty, the rules should build from real signals and should not exacerbate variability in the system. The RPWG acknowledges that ecosystems are inherently dynamic and are never expected to be stable. While accepting this inherent variability, the Risk Policy Statement is intended to avoid abrupt shifts in fisheries management, which may ultimately provide for more stable stocks and more stable fisheries. The inherent variability in the system is likely due, in part, to measurement error. By avoiding abrupt shifts in fisheries management, damage caused by errors/variability can be reduced, as the system should be able to absorb a normal amount of random variability. As the Risk Policy is applied, stability should be achieved as management procedures (HCRs, ABC CRs, and other measures) can be structured to become less sensitive and less reactive to changes that may be due to natural variability and estimation error.

The concept of stability as it applies to the Risk Policy Statement (in the management system) is aimed at extracting signal from noise. However, stability may also be identified as a goal/objective for an individual FMP or fishery. *Stability within stocks* (ex. the ability to minimize major changes in stock biomass) and *stability within fisheries* (ex., the ability to reduce variability associated with annual catch/quota allocations for the fishery) can also serve as important metrics to evaluate the long-term performance of management procedures against the Risk Policy. Consideration of stability in stocks/fisheries may involve evaluating the trade-offs (if any) between stability and achieving the greatest overall net benefits to the Nation. These metrics can be identified, measured, and tracked over time on a stock/fishery basis. PDTs can provide guidance on an acceptable level of fluctuation for individual stocks/fisheries that would be expected for a well-managed fishery given the inherent variability (based on population dynamics for the stock and the fishery objectives). This could be used to evaluate performance of future actions. Metrics that monitor variability from year to year, e.g. in quotas, should be developed.

There are several local examples to illustrate how the management system can consider stability in the face of uncertain information.

The MAFMC SSC recently recommended specifications that considered stability in the summer flounder fishery. Quota reductions were spread over multiple years to mitigate impacts on industry and to allow time for more data to be collected/evaluated in year 2 to reduce potential for errors.

Georges Bank (GB) haddock designated to Eastern Georges Bank is jointly managed with Canada. Specifications for GB haddock are set annually through a cooperative two-step process. The Transboundary Resources Assessment Committee (TRAC) updates the assessment and the Transboundary Management Guidance Committee (TMGC) negotiates the quota based on TRAC guidance. The overall GB haddock specifications are reviewed by the SSC, ideally prior to the TMGC meeting. A retrospective pattern arose in the TRAC assessment in 2014. TRAC ran a sensitivity projection using the rho adjusted 2015 population numbers. Both the rho adjusted and non-rho adjusted projections were provided to TMGC for consideration. The stock has experienced large fluctuations primarily due to large recruitment events; the 2013 cohort has been estimated to be very large and was down-weighted by the SSC. In recommending catch advice, the SSC considered the size of year classes, stock status (GB haddock is well above B_{MSY}), and the impacts of overestimation.

2.3   EVALUATION OF MANAGEMENT PROCEDURES – MSE

An important element of the risk policy is that harvest control rules and management procedures be developed in a way that they can be formally evaluated in the context of uncertainty and designed to extract signal from noise. *Management strategy evaluation* (MSE) is a desirable method to formally evaluate HCRs and management procedures, if/when resources may allow. Generally, MSE is a formally-accepted procedure to provide management advice (ex., ABC) where the inputs and methods are pre-specified. All of the baseline work for MSE is done through collaboration with stakeholders, thereby increasing the potential for buy-in at the outcome. While the initial development may be lengthy, once constructed, MSE can essentially run on "autopilot," and flexibility can be incorporated into the process for future review/adjustments. MSE can be an important factor for evaluating the performance of a risk policy. In addition, other similar multi-criteria methods (ex., Optimal Control techniques) may be available in the future to evaluate the short-term and long-term trade-offs associated with various risk tolerance levels, the value of net benefits, and potentially other goals such as achieving greater stability in the fishery.

2.3.1   MSE Defined

Management strategy evaluation (MSE) is the evaluation of management strategies using simulation and a feedback loop (*simulation testing decision-making*). It is widely considered to be the most appropriate way to evaluate the trade-offs achieved by alternative management strategies and to assess the consequences of uncertainty for achieving management goals. MSE can examine outcomes of multiple parameters changing, perhaps even with cross-correlations. This allows for the examination of more complex uncertainties than the typically used method of projections, which can only handle single parameter changes. MSE can help to quantify the

impacts of uncertainty associated with management strategies adopted at present, and to identify the 'realizable' performance which can be achieved given the quality of the data available and the types of uncertainties which are inherent in the system being managed (Punt et. al, 2014). While decision-makers (i.e., the Council) identify the desirable outcomes that any management procedure should aim to achieve, the technical analyses (i.e., the MSE) can inform the decision-makers on the feasible ranges of trade-offs. This approach allows for explicit identification and consideration of multiple objectives, risks, and tradeoffs.

MSE allows for much more complex management frameworks to be evaluated. MSE simulates the assessment process and how that process plays out to future outcomes. MSE deals with multiple sources of uncertainty at once and allows for a wide range of different models to be considered. This approach allows for the evaluation of all outputs resulting in a decision that considers all of the possibilities within the range in multiple dimensions. The feedback loop between the management strategy and the operating model(s) is a fundamental aspect of MSE and is the particular feature that distinguishes MSE from simple risk assessment where the implications of unchanging management regulations (ex., constant quota) are evaluated by use of projections. Simple risk assessment can overestimate risk by failing to take into account management reactions to the information provided by future data (the feedback loop). Conducting a MSE is not the same as conducting projections from a stock assessment, although a stock assessment may form the basis for the operating model(s) which are central to the MSE. Specifically, MSE takes feedback control into account, that is it takes account of the collection and use of future data on the status of the managed system (Figure 1, from Punt et al, 2014).

The definition of MSE can be interpreted rather broadly, and the application of MSE should not be limited in any way by semantics. According to Smith (1994), the key elements of a MSE framework are:

- **Multiple Objectives**. This is almost always the case in fisheries management. The National Standards of the Magnuson-Stevens Act (MSA) inherently create a system with multiple objectives.

- **Uncertainty exists and can be characterized**. There are multiple levels of uncertainty and variability in fisheries management.

- **Stakeholder Involvement**. Stakeholders must be involved in the MSE process, from identifying the objectives to providing input to refine other scientific questions. One of the most challenging parts of the MSE process is obtaining stakeholder input in an objective manner.

- **Tradeoffs are Evaluated**. Performance indicators are refined and tested, but not for optimality in any single factor.

Figure 1 Conceptual Overview of Management Strategy Evaluation (MSE)
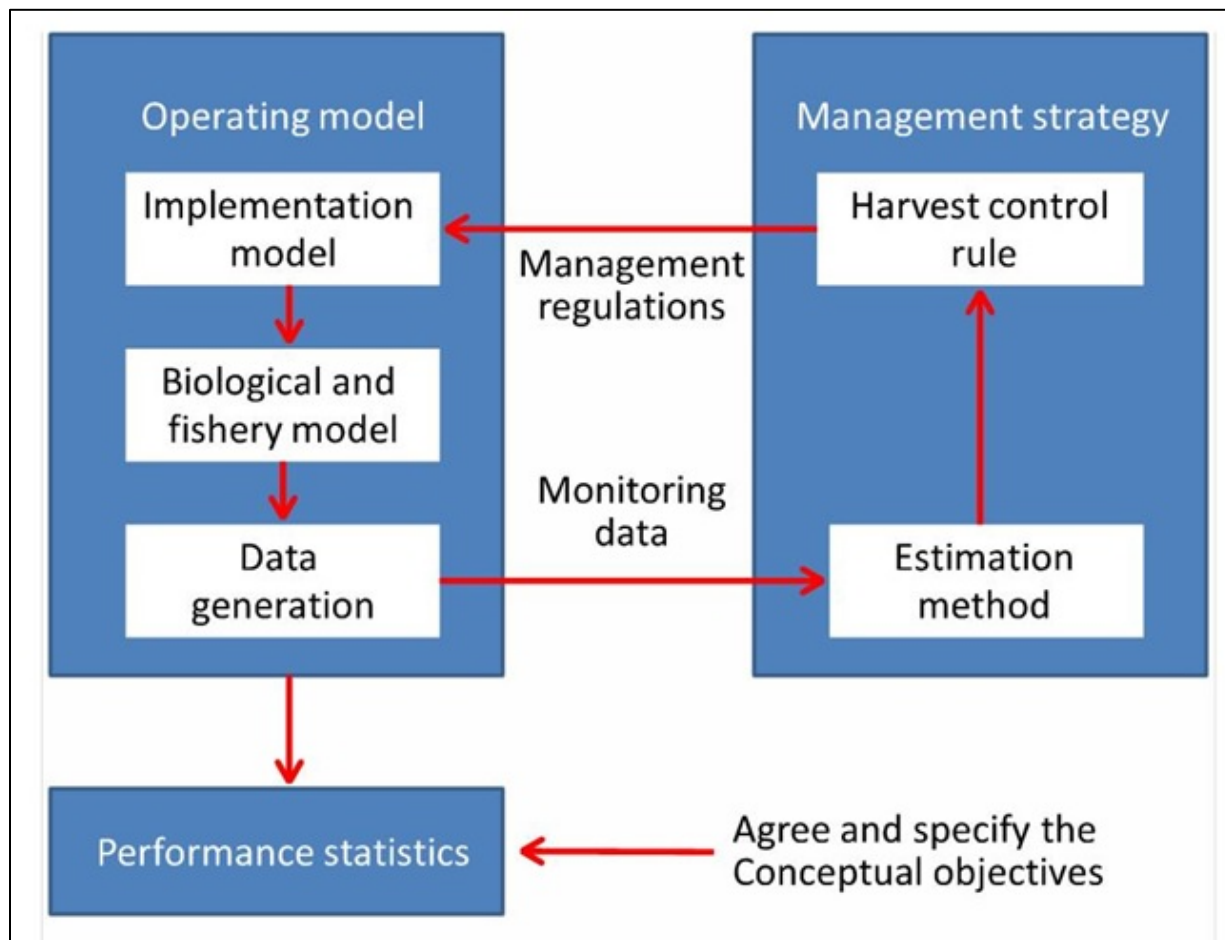
Source: Punt et al. 2014. Management strategy evaluation: best practices. Fish and Fisheries. DOI:10.1111/faf.12104.

Benefits of MSE

As described above, MSE allows for a thorough evaluation of risk with the added benefit of a feedback loop (Figure 1). MSE provides a clear framework that outlines the data to be used and the estimation method. This can help to streamline the overall process by reducing the number of meetings and timeframe required to complete a task, which can also increase the amount of time available for other research needs (Butterworth, 2007). MSE can identify which parameters a system is most sensitive to. The design of MSE allows all stakeholders to make informed decisions on the tradeoffs between longer term stability and interannual variability in a stock. MSE can be performed on various scales; if limited information is currently available, smaller evaluations could be conducted. It allows for multiple plausible perceptions about the state of nature to be considered.

Stakeholder Input

Stakeholders help ID and quantify objectives (desired outcomes) at the policy level. They also shape the scope of the operating model and how broadly the issue should be viewed. The MSE

structure is not based on one model but rather a number of models that encompass all of the possible alternatives and outcomes. The current system allows for stakeholder input at the policy level (i.e. scoping, AP, Committee, Council meetings) but limits their role in scientific uncertainty considerations. Stakeholder involvement increases buy-in and increases the range of plausible alternatives that may be considered.

2.3.2 MSE Best Practices

Punt et. al (2014) discuss the following best practices for MSE (see APPENDIX II) for a summary of all MSE best practices guidelines):

- **Establishing objectives and performance statistics.** When establishing objectives and performance statistics, any conceptual objectives should be translated into clear, operational objectives. These can then be used to construct an operating model, from which performance statistics can be calculated. The statistics used should be easily understood by all stakeholders. It is essential for all parties to understand the tradeoffs that typically arise between different components of a fishery (e.g. commercial versus recreational). A firm understanding would help each party select acceptable tradeoffs.

- **Selecting uncertainties to consider and selecting operating model parameters.** For every MSE, a range of uncertainties needs to be considered. These typically fall under the following categories: process uncertainty, parameter uncertainty, model uncertainty, errors when conducting assessments, and outcome uncertainty. However, individual factors will vary for every fishery. Each uncertainty should be explicitly addressed within the MSE. A suitable approach is to run scenarios of plausible hypotheses (i.e. 'reference trials') and scenarios or unlikely hypotheses ('robustness trials') then compare the outcomes. This acts as a performance evaluation on the management strategy. The incorporation of a standard set of factors could help ensure that a well-rounded MSE is being performed.

- **Identifying candidate management strategies which could realistically be considered for implementation.** The management strategy selected should be based on policies agreed to by decision-makers. However, alternative management strategies should be evaluated to better understand the strategies identified by decision makers. These strategies could be model-based or empirical, or a mixture of the two. Ideally all management strategies being tested would be fully run as if it was being applied.

- **Simulating the application of each management strategy for each operating model.** Care should be taken when running simulations to minimize the chance of errors from the coding itself. The strategy should only use data that is available and all assumptions should be outlined in advance.

- **Presenting results and selecting a management strategy.** Multiple strategies should be provided to help decision-makers address tradeoffs. This step highlights the importance of stakeholder involvement throughout the entire MSE development process. The basis of management strategy selection should be as simple as possible. The explanation of the

possible strategies should be as transparent as possible with the feasibilities of the various hypotheses adequately reported.

2.3.3   MSE Case Studies

There is a large body of available literature regarding MSE and case studies discussing the application of MSE to address fisheries management issues. A literature review of MSE case studies provides an overview of the broad application of MSE in fisheries management. (Follow-up with NEFSC still to be done). A few notable case studies are included in the reference list; a brief summary of the MSE for southern Bluefin tuna fishery is described below as one example that can be referenced for more information.

Management Strategy Evaluation for the Southern Bluefin Tuna Fishery (Hillary et al., 2015). The Southern Bluefin tuna stock has been at historically low levels in recent years. Even with a commercial moratorium predictions indicated an imminent collapse with minimal chance of recovery. To avoid such a moratorium an adaptive rebuilding strategy was adopted by the Commission. The Commission developed their management procedure by approving a set of monitoring data and a procedure for analyzing that data to be input to a harvest control rule which specifies the recommended level of catch or effort. This was a 10 year process. The countries involved were the stakeholders and provided input on objectives. The MSE was parameterized with respect to rebuilding target, the target year for completion, and the probability of reaching the target. The fishery is managed using a TAC and the committee constrained how much the TAC would be allowed to change. The assessment group designed an operating model based on stock dynamics and sources of uncertainty, which included strategies to address those uncertainties. Major sources of uncertainties included the shape and slope of the stock-recruit curve. The Commission subjected a range of management procedures to extensive simulation testing before selecting a procedure that 'combined elements of the two best performing candidates.' The simulation projection drew probabilistically from 1000 models, all of which were possible outcomes based on the parameters. A model was run to determine what the population would look like in the future, a stock assessment model was applied. A management strategy was applied followed by another modeling of the population and another stock assessment. This process resulted in an operating model and procedure to be followed. The TAC was then evaluated based on what parameters were observable. The chosen management procedure allows for the continued rebuilding while allowing continued harvest. Harvest levels are adjusted every three years to meet rebuilding targets.

3.0   IMPLEMENTING THE COUNCIL'S RISK POLICY – NEXT STEPS

As part of the 2015 management priorities, the Council identified the RPWG's work to review FMP risk policies for consistency with overall policy. In response to the direction from the Council, the RPWG considered various approaches to providing guidance to the Council regarding the risk policy. During RPWG discussions it became clear that most FMPs did not contain risk policies and rather than approaching this on an FMP by FMP basis a more appropriate approach was to prepare a guidance document that lays out the process for the technical work to be done in each FMP in compliance with the policy. The composition of the RPWG does not support FMP specific recommendations. The RPWG acknowledges that these

are recommendations for a longer term approach and there is not an expectation that the Council will universally adopt these guidelines within a certain timeframe.

Risk-based decision-making requires a somewhat different approach to the technical analysis of fisheries management programs. Many steps to operationalize the Council's Risk Policy over the long-term should be taken at the technical/analytical level. Ultimately, implementing analytical approaches like management strategy evaluation (MSE) must begin at the data collection/stock assessment level. In New England, this task largely falls on the NEFSC; their involvement in this process is essential for success.

Subject to approval by NEFSC reps on WG: The NEFSC has convened a MSE working group, which is currently developing its action plan for future work. The NEFMC is currently developing Amendment 8 to the Atlantic Herring FMP and is considering using MSE to evaluate ABC control rules. The Herring Committee is expected to receive a briefing on MSE before staff move forward with further development of the MSE.

As efforts by NMFS and the NEFSC continue to build the foundation to support MSE across all fisheries, additional steps can be taken in the short-term to operationalize the Risk Policy through the technical groups responsible for developing analysis to support the Council's decision-making (Plan Development Teams, PDTs). The RPWG recommendations for operationalizing the Risk Policy are focused on *process engineering*, i.e., how to design a process within the current system to generate the data and analyses needed to support risk-based decision-making. The RPWG recommends the following steps be taken over the next several years.

STEP 1. Document the Current Management Procedures.
(PDTs, with Committee and AP Input)

The first step that the technical teams should take is to document the current management procedures in order to clearly understand baseline conditions with respect to risks, uncertainty, and net benefits to the Nation for the stock/fishery in question. To this end, the RPWG has developed a *Risk Policy Matrix*.

The *Risk Policy Matrix* serves as a useful tool for cataloging existing information and data that are important to evaluate risks on a stock-by-stock basis. The intent is that the matrix will serve as a source document to characterize current conditions with the stock/fishery. This document can serve as a tool to help the PDTs identify risks and help the Council weigh them to communicate preferences to the SSC. Over time, providing information about risks, uncertainty, consequences, and net benefits to the Nation to the SSC in a standardized format for all stocks/fisheries will improve consistency and clarity in the ABC-setting process.

The Risk Policy Matrix template sheet is provided in Appendix I to this report. The Matrix should be a living document, maintained by Council staff and updated when a stock assessment is conducted, and/or when new specifications for a fishery are considered by the Council. The focus of the matrix is identifying baseline conditions for a stock/fishery; the matrix should not represent a "wish list" of the information or conditions that are desired if more/better information could be available.

When filling out the Risk Policy Matrix, specific consideration should be given to the risks associated with overfishing the stock in question. This is consistent with the first sentence of the Risk Policy – to weigh the risks of overfishing the resource relative to the greatest expected overall net benefits to the Nation. The impacts on the fishery, the ecosystem, and other impacts that can be measured with available data should be identified in the Risk Policy Matrix as the consequences of managing the risks of overfishing the resource. The consequences are important to identify in the matrix because they provide the Council a basis for evaluating net benefits to the Nation and comparing alternative management approaches based on the severity of consequences.

While there may continue to be refinements to the Risk Policy Matrix, the intent is to provide a relatively standardized format for communicating baseline conditions with respect to risk, uncertainty, and the management procedure to the SSC for ABC-setting and to the Council for risk-based decision-making. The Matrix will help the PDTs provide a standardized format to communicate risk and uncertainty. Depending on the relevant timeline for a PDT, this could be addressed over the next 1-3 years, and then the process could be revisited.

The RPWG expects that significant progress towards this step could be achieved across all Council-managed FMPs within 1-3 years.

STEP 2. **Evaluate How Well the Current Management Procedures Extract Signal from Noise.**

(PDTs, with Input from Committee)

Once the Risk Policy Matrix has been completed, the PDTs (with input from the Committee, as necessary) should use the information in the Matrix to identify management decisions that are made with uncertain information as well as the elements of the management procedure that have the most significant implications on net benefits to the Nation. Once these factors are identified, the PDTs can run some basic simulations to test the impacts of those factors on fishery performance.

Preliminary work on MSE-like approach could be applied to be provided as an appendix.

As part of the evaluation, the PDT could determine the feasibility of FMP goals/objectives quantitatively. The PDT should examine relevant factors and see how they perform. Objectives and constraints (e.g. ending overfishing) should be established and optimized during the evaluation. These are fed into the formulation of management alternatives. This would result in a more systematic process.

For each stock/fishery, the Council can prioritize the tradeoffs to consider with respect to net benefits to the Nation. The RPWG expects that significant progress towards this step could be achieved across all Council-managed FMPs within 1-3 years.

The RPWG expects that significant progress towards this step could be achieved across all Council-managed FMPs within 3 years.

STEP 3. Conduct a Generic MSE.

(NMFS/NEFSC)

Moving to MSE will require transition time because of the significant time and resources needed during its initial development. It is not expected that the management system can immediately support MSE across all fisheries. To further advance the movement towards risk-based analysis and decision-making, NMFS (the NEFSC) could conduct a generic MSE using a group of managers, stakeholders, and scientists, to address a management issue that affects multiple fisheries. This could be aided by the examination of common scenarios on which we often base management decisions across fisheries (ex., choke stocks, multispecies fisheries, predator/prey considerations). Information about generic MSEs would help guild the PDTs to develop analyses for more specific management alternatives. Ideally, a set of tools would be developed during this stage to help PDTs formulate management alternatives.

A literature review would document existing work. If resources are available to support additional work, the RPWG expects that the issue/approach for a generic MSE could be outlined and the MSE trial group formulated within one year; the work for the MSE could then be completed by the NEFSC, NMFS, or another scientific body in the second year.

STEP 4. Conduct a MSE for a Priority Fishery.

(NMFS/NEFSC, or other scientific person/entity, with Council and PDT)

While it will not be possible to transition to MSE for all stocks/fisheries, the RPWG considered what stocks currently managed by the Council may serve as a good candidate species to conduct a MSE as soon as possible, assuming that resources are available to do so. The RPWG recommended that the Council identify an appropriate fishery for an MSE, and with assistance from NEFSC, provide guidance on how this could be completed, i.e. under the annual priorities discussion, the Council could include a MSE task on either the Atlantic herring or Sea scallop FMPs as outlined below. This would be aided by funding, where possible, for contract work, which would augment the expertise available to complete the MSE. The species' Committee, PDT, and AP should be involved in design of MSE with respect to the performance measures to be modeled and sources of uncertainty.

A current possibility for MSE analysis within New England fisheries involves the impact of windowpane flounder ACLs, and associated AMs, on the scallop fishery. The windowpane flounder AM was recently triggered and is limiting effort by the scallop fishery. The scallop PDT could simulate the impacts on the fishery of the various alternatives for AMs for windowpane flounder in terms of the overall benefits to the scallop fishery, e.g. what is the most prudent form of AM given the uncertainty about fishing mortality on windowpane flounder. The PDT could examine how to design AMs that perform better in the face of uncertainty about stock status by evaluating foregone yield, etc.

Atlantic Herring	Sea Scallops
MSE – ABC Control Rule/Harvest Control Rule	MSE – Harvest Strategy (Area Rotation vs. Others)
Amendment 8 to the Atlantic Herring FMP recently initiated to develop ABC control rule, address herring's role in ecosystem, and address localized depletion	Scallop MSE could be explored independently of a management action
Low/medium value, relatively data rich but significant assessment uncertainty	High value, data rich – spend the limited resources on a high value fishery
Forage/ecosystem aspects of Atlantic herring management would be interesting to explore in MSE	Spatial aspects of scallop fishery management would be interesting to explore in MSE
Goals/objectives not clearly identified	Elements of operating model more clearly defined than herring
Foundation exists and groundwork has been laid – SSC recommended further development of Jon's preliminary MSE work on Am 8	
	Uncertainties are mostly with management (versus science)

Given the scale of the task, this would likely be a long-term priority. If resources are available to support this step, the RPWG expects that the NEFSC, with input and support from the Council, could move forward with conducting a priority MSE for this species within the next few years.

STEP 5.   Revisit/Re-evaluate the Risk Policy in 3-5 Years.

(Council, PDTs, Risk Policy Working Group)

Operationalizing the Risk Policy will take the support of the Council, Council staff, NMFS, and the Science Centers.

Once the Council reviews the Risk Policy Roadmap, the PDTs and technical groups can begin taking the first steps to operationalize the Risk Policy and better ensuring that all Council-managed FMPs are consistent with the Risk Policy. The RPWG understands that this transition will take time and does not expect that any steps outlined in this Roadmap would become strict Council policies or rules by which the PDTs and other technical groups must adhere. Rather, the RPWG recommends annual check-in with the working group to see how things are going. Updates about developments at the Science Center and challenges that the PDTs are facing.

- There should be some oversight of the roadmap over time. (Exec. Committee once/year? Council staff support for Risk Policy Matrix – touch base with PDT chairs as they work through it)
- Council Staff - Managing PDT work and challenges that the PDT faces as they work through Steps 1 and 2.

- Discuss how to get Council buy in – education and communication about risk-based decision making and MSE. Recommendation for a regional workshop (RPWG – to be discussed by the RPWG)
- Council and NMFS should consider funding (where possible) for contract work to support MSE

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