National SSC Meeting IV Steering Committee
Meeting 1 Summary Notes

The first meeting of the National SSC Meeting IV Steering Committee was held via conference call on Tuesday March 2, 2011. SSC Chairs in attendance included John Boreman (MAFMC), Steve Cadrin (NEFMC), Pat Livingston (NPFMC) and Martin Dorn (PFMC). Others on the call included Rick Methot (NMFS), Rich Seagraves (MAFMC), Paul Dalzell (WPFMC), Mike Burner (PFMC), Don McIsaac (PFMC), and Harry Blanchett (GFMC).

J. Boreman opened the meeting with a description of the meeting time and location. The meeting will be held at the Kingsmill Resort in Willamsburg,VA on 4-6, 2011 (travel days are Oct 3 and 7). The first issue discussed was the scope of topics to be addressed including social/economic and ecosystem considerations. The consensus of the group was that both topics were considered at the last SSC workshop in Charleston for inclusion on the agenda of the next National SSC meeting. The decision at the CCC meeting was to provide funding for another SSC Workshop and to include both social/economic and ecosystem considerations at the 2011 meeting.

It was noted that given the disparate nature of these two topic areas, broader representation from each Council SSC was necessary. In the past, funding for four participants from each Council was provided (3 SSC and 1 staff member). For this workshop, funding will be provided for five participants from each Council (4 SSC and 1 staff member). The first action item is to send out a call for nominations from each Council for participation at the conference (to be handled by Boreman and Seagraves). Each Council will be asked to nominate 2 social/economic and 2 biological/ecosystem scientists form the ranks of their SSCs.

The group then discussed the program structure (see attached agenda for strawman). The idea was to start out in plenary the first morning and then work in break-out groups until the last session Thursday morning when everyone could come back together in plenary. M. Dorn was concerned that there might be too much competition between breakout sessions. The group agreed that the plenary on day one would be extended into the afternoon to include other topics of mutual interest. Breakouts would occur on day 2 and the last day would be a wrap-up discussion in plenary.

The issue of planning actual program for the meeting was discussed. One thought was to have two separate planning groups for each topic. It was agreed that the SSC Steering Committee would perform the overall planning function and that two subgroups would be formed comprised of economic and ecosystem types to plan out each respective program. There were no economists on the call so it was decided to wait and see who gets nominated by the Councils and recruit the planning subcommittees from the attendee list.

One of the things everyone needs to think about are trigger questions to be presented at the initial plenary to stimulate discussion during the breakout sessions. In addition, key

note speakers need to be identified fairly soon so that invitations can be sent out (especially for any international participants).

D. McIsaac asked for clarification on the number of participants allowed for each Council in cases where SSC members are also NMFS employees (i.e., their travel costs are covered by NMFS). [*Post meeting discussion with C. Moore indicated that we are limited by overall space and that it would be best to limit attendance from each Council to 5 each but there would some reasonable allowance for additional participation on a case by case basis*]. He also asked for clarification of how social/economic and ecosystem considerations in the specification of ABC are permitted under the NS1 guidelines. The NS1 are flexible in this regard and one of the key topics for discussion could be how social and economic factors might be considered in ABC determinations, especially in data poor situations. As the Councils transition into an ecosystem based fishery management paradigm, ecosystem considerations will certainly become a significant component of scientific uncertainty within the ABC specification process.

National SSC Workshop IV Steering Committee
Conference Call
March 1, 2011 (5:00 p.m. EST)
Agenda

Purpose of the call is to begin planning for:

National SSC Workshop IV
October 4-7, 2011
Kingsmill Resort
Willamsburg, VA

Agenda Item 1: Topics to be discussed
-Social/ economic and ecosystem considerations during ABC determinations under MSRA

Agenda Item 2: Format
-tentative format would be as follows:

Day 1 morning:	plenary session
Day 2 afternoon:	breakout sessions
Day 2 morning:	breakout sessions
Day 2 afternoon:	breakout sessions
Day 3 morning:	plenary session

Agenda Item 3: attendance
-4 members from each SSC (2 soc/econ and 2 biologists) and 1 Council staffer
- 3 NMFS S&T
-invited speakers

Agenda Item 4: Develop separate planning subgroups for each theme?

Agenda Item 4: Dinners/receptions

Agenda Item 5: Other issues

National SSC Meeting IV Steering Committee
Meeting 2 Summary Notes

The second meeting of the National SSC Meeting IV Steering Committee was held via conference call on May 5, 2011. SSC Chairs in attendance included John Boreman (MAFMC), Pat Livingston (NPFMC), Carolyn Belcher (SAFMC), and Martin Dorn (PFMC). Others on the call included Rick Methot (NMFS), Rich Seagraves (MAFMC), Paul Dalzell (WPFMC), Mike Burner (PFMC), Dave Witherell (NPFMC), Chris Kellogg (NEFMC), Dan Georgianna (NEFMC SSC), Matt McPherson (NMFS NEFSC), Churchill Grimes (SAFMC SSC), David Tomberlin (MAFMC SSC), and Sherry Larkin (SAFMC SSC).

R. Seagraves opened the call by giving a background for the purpose of the call (develop a charge to the Ecosystems and Socioeconomics Program Subcommittees), and listed the people currently nominated to serve on the subcommittees. P. Dalzell offered the names of two SSC members from his council to serve on the subcommittees (Craig Severance/Socioeconomics and Bob Skillman/Ecosystems) and names will also be forthcoming from the PFMC (after the call M. Burner submitted the following names: Cindy Thompson and Todd Lee/Socioeconomics and Martin Dorn/Ecosystems). R. Seagraves emphasized the importance in having the subcommittees identify potential guest speakers for their sessions at the national workshop ASAP so invitations and travel arrangements can be initiated. He also provided the call participants with the powerpoint presentation that Chris Moore, MAFMC Executive Director, is delivering this week to the Council Coordinating Committee that provides information on the past and planned National SSC Workshops.

J. Boreman then discussed the proposed charge to the program subcommittees (Attachment 1), which was sent out to the call participants earlier in the week. Call participants were in general agreement with the potential topics listed for the ecosystems and socioeconomics programs.

P. Livingston offered several other topics based on her discussions with members of the NPFMC SSC. These included 1) setting overfishing thresholds in an ecosystem context (how are other Councils dealing with this?) 2) dealing with non-endangered marine mammals, seabirds and other species which must be taken into consideration during ABC specification for Magnuson managed species, 3) general concern about lack of social and economic data from industry and community impacts (how are other Councils dealing with this?), 4) non-market valuation concept relative to ecosystem services.

R. Methot also noted that NOAA has been developing the Integrated Ecosystem Assessment concept, something many within the Council process may not be aware of- this would be a good opportunity to brief the Councils on work in this area. He also noted that Fishery Ecosystem Plans (FEPs) were not on the list and it might be useful to discuss the relationship between FEPs and existing FMPs.

D. Georgianna noted his general dissatisfaction with the way in which social and economic impacts have been addressed in the establishment of the Council's risk policy. More analyses of the social and economic impacts of ABC setting process should be completed -the current interplay between the SSC and the Councils in terms of establishing risk policies appears to be circular. R. Methot noted that the SSCs and Councils should take into account social and economic considerations during the creation of the ABC control rules rather than during their application.

M. McPherson noted that it is important to take into account social and economic factors when establishing EBFM policy. J. Boreman suggested that the overlap between EBFM and social and economic considerations should be a topic of one of the plenary sessions. D. Tomberlin expressed disappointment with the fact that the two topics appear to be treated separately in the proposed workshop program - there needs to be more integration of the social and economic analyses during development of the EBFM paradigm. He suggested that we take advantage of this opportunity to integrate both topics. R. Methot suggested there be some separation of the two topic areas and then we could bring them together under the topic heading of OY.

M. Dorn was concerned that some of the topics on the list are regional in nature and may not have broad application at a national level. He also thought the SSC reports from each Council at previous National SSC Meetings were very informative and favored keeping that sort of report out in the next meeting. He was also concerned that the SSCs should not be leading the agenda in terms of EBFM, which is a policy prerogative of the Council. The Council should establish their EBFM goals first and then the SSC should provide the scientific support to achieve those goals. J. Boreman noted that the MAFMC is enlisting its SSC to help develop its EBFM approach through formation of an Ecosystems Subcommittee of the SSC. R. Methot agreed that science needs to lead the way to determine what are the consequences /trade-offs of choosing different p* levels as a consequence of ecosystem considerations.

P. Dalzell noted that the WPFMC is conducting an IEA for the Kona Coast and that a symposium report will be available shortly and should be informative for the group. They also held three symposiums looking at biology, social and economic factors and policy to develop an EBP which they would happy to report on at the meeting.

In general, the call participants made the following observations and suggestions regarding the proposed charge:

1. The program subcommittees should develop the final list of topics that should be addressed at the workshop. Subcommittee chairs can either be elected by the subcommittee members at their first meeting, or be named by the workshop chair; the call participants had no preference.

2. There should be more overlap between the two programs (ecosystems and socioeconomics) during the workshop, perhaps having only a half-day breakout session to prepare for a joint session to discuss topics of mutual interest. Rick Methot suggested

that using a theme centered on OY might be the thread that ties ecosystems and socioeconomics together. It was agreed that the two program subcommittee chairs will coordinate on the structure of the breakout and joint sessions.

3. The general plenary should include a round robin of the SSC chairs, but the round robin should focus on what's been accomplished since the last national workshop, and perhaps address the question: What is your SSC doing to engage social scientists and economists, and incorporate ecosystem considerations into your ABC control rules and specification-setting process?

4. Other topics for plenary might include those identified at last year's workshop: species groupings and complexes, and SSC workload management.

R. Methot also noted that NOAA has been developing the Integrated Ecosystem Assessment concept, something many within the Council process may not be aware of- this would be a good opportunity to brief the Councils on work in this area. He also noted that Fishery Ecosystem Plans (FEPs) were not on the list and it might be useful to discuss the relationship between FEPs and existing FMPs.

R. Seagraves will try to get the program subcommittees scheduled for conference calls within the next few weeks to keep the momentum moving forward.

Note: Following the meeting, the rosters for the two program planning subcommittees were completed (see Attachment 2)

Attachment 1

Proposed Charge to Ecosystems and Socioeconomics Program Subcommittees (Draft)

1) Elect chairs for program subcommittees
2) Plan on a full day of separate sessions (AM and PM)
3) Topics of presentations and discussions should relate to setting ABCs/ACLs.
4) Consider inviting keynote speakers of national or international renown.
5) Nominate someone to report out to plenary on morning of Day 3.

Topics for Ecosystems Program Subcommittee to consider addressing:

1. Accounting for forage species in setting ABCs/ACLs, including technical definition of "forage species"
2. Quantifying scientific uncertainty relative to ecosystem considerations in context of specifying ABC control rules (i.e., buffering ABC from OFL based on ecosystem considerations)
3. Reviewing case studies (US and/or worldwide) of ecosystem-based fishery management systems/approaches
4. Determining the state of EBFM in US federally-managed fisheries
5. Providing best available science to establish EBFM goals and objectives (including best practices to transition from single-species approach to EBFM)

Topics for Socioeconomics Program Subcommittee to consider addressing:

1. Incorporating industry observations of fishery performance in setting ABCs/ACLs.
2. Considering social/economic consequences of *ad hoc* ABC control rules in data poor situations
3. Is it appropriate to consider social/economic impacts when SSCs establish ABC/OFL specifications?
4. Incorporating social and economic information in the SSC process
5. Incorporating economic evaluations as part of MSE studies of ABC control rules
6. Economic valuation of ecosystem components and ecosystem services they provide to support EBFM

Attachment 2
National SSC IV
Planning Subcommittees

Social/Economic		
Name	email	Affiliation
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Ecosystems		
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Martin Dorn	martin.dorn@noaa.gov	PFMC
Bob Skillman	raskil@mac.com	WPFMC

Charge to Ecosystems and Social and Economic Program Subcommittees (Draft 6/2/11)

1. Elect chairs for program subcommittees [*done*]
2. Plan on a full day of separate sessions (AM and PM) [*revised: could include only one half day breakout]*
3. Topics of presentations and discussions should relate to setting ABCs/ACLs [*revised to include OY considerations*].
4. Consider inviting keynote speakers of national or international renown.
5. Nominate someone to report out to plenary on morning of Day 3 (could be done day of meeting).

Topics for Ecosystems Program Subcommittee to consider addressing: *[Revised by R. Seagraves based on Steering Committee discussion*]

1. Accounting for forage species in setting ABCs/ACLs, including technical definition of "forage species"
2. Quantifying scientific uncertainty relative to ecosystem considerations in context of specifying ABC control rules (i.e., buffering ABC from OFL based on ecosystem considerations)
3. What is your SSC doing to incorporate ecosystem considerations into your ABC control rules and specification-setting process?
4. Reviewing case studies (US and/or worldwide) of ecosystem-based fishery management systems/approaches
5. Determining the state of EBFM in US federally-managed fisheries
6. Providing best available science to establish EBFM goals and objectives (including best practices to transition from single-species approach to EBFM)

Topics for Socioeconomics Program Subcommittee to consider addressing *[Revised by R. Seagraves based on Steering Committee discussion*]

1. Incorporating industry observations of fishery performance in setting ABCs/ACLs
2. General concern about lack of social and economic data from industry and community impacts (how are other Councils dealing with this?)
3. Considering social/economic consequences of *ad hoc* ABC control rules in data poor situations
4. Is it appropriate to consider social/economic impacts when SSCs establish ABC/OFL specifications?
5. Incorporating social and economic information in the SSC process
6. Incorporating economic evaluations as part of MSE studies of ABC control rules
7. Economic valuation of ecosystem components and ecosystem services they provide to support EBFM

Evaluation of Acceptable Biological Catch (ABC) Control Rules for a Mid-Atlantic Stock

Fifth Quarterly Progress Report to

Mid-Atlantic Fishery Management Council

April 29th, 2011

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Introduction

In the revised National Standard 1 under the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (MSFCMRA), the Statistical and Scientific Committee (SSC) of each of the eight regional management Councils has been tasked with recommending Acceptable Biological Catch (ABC) levels. National Standard 1 requires that scientific uncertainty be used to guide the selection of an ABC by achieving a specific, acceptable risk of overfishing. Importantly, the ABCs will constrain the annual catch limit that must be set by the Council as the Councils cannot set a catch level above the ABC recommended by its SSC. Many control rules to manage fisheries have been developed and tested (reviewed in Deroba and Bence 2008), yet few of these satisfy the requirements of the revised MSFCMRA. In particular, achieving a specified level of risk of exceeding a fishing mortality threshold has generally not been an explicit criterion for control rules.

The objective of this project is to determine feasibility of implementation and likely effects on short-term ABC levels to guide control rule development. We will apply proposed control rules to a data-rich mid-Atlantic stock to determine feasibility of implementation, likely effects on short-term ABC levels, and to guide control rule development. In this analysis, we will apply each of the proposed ABC control rules (or one of a family of control rules) to data from a mid-Atlantic stock. There are only a limited number of stocks that have sufficient data for our needs, including scup, Atlantic mackerel, and summer flounder. Each method for determining ABC will be applied with data from the selected stock. For some control rules, the stock selected will be treated as if it only has the minimum data necessary to apply the control rule. Estimation of uncertainty varies greatly across assessments for mid-Atlantic stocks. We will explore how alternative uncertainty estimation methods affect the precision of estimates. This may involve conducting additional stock assessments on a given stock to provide the appropriate estimates for calculation of the control rule. We will work closely with scientists at the Northeast Fisheries Science Center and Council staff for this portion of the project.

One criterion that has been suggested for candidate control rules to meet the new National Standard 1 is that the ABCs should be relatively easy to estimate from the results of the assessment. Thus, the first task of this objective will be to determine how easily the estimates necessary to calculate ABC can be obtained for each control rule. This will include determining whether necessary estimates are currently available or can be readily calculated with modifications to the stock assessment.

In addition to avoiding overfishing, another goal of the MSFCMA is to provide opportunities for sustainable harvest. Thus, ABC control rules must balance the risk overfishing against the desire to continue harvest on stocks when fishing is considered sustainable. We will evaluate the extent to which ABC control rules provide opportunities to continue fishing under these circumstances.

The final consideration under this objective is to use the case study stock to guide in control rule development. The goal of this analysis is to determine whether the different methods have the desired property of including more precaution when less is known

about the stock. For example, if only catch data are available for a stock, the ABC control rule should determine a lower ABC than if a full statistically based stock assessment has been conducted. This analysis will provide specific levels of precaution (i.e., buffer size) for each reference point to ensure that situations with less information are treated in a more precautionary manner.

Summary of Progress Since Last Progress Report

We are currently developing the management strategy evaluation (MSE) model. In early March we held a full day meeting with members of the project steering committee to help prioritize model inputs and the questions we will explore with the model. We are tailoring the model to address the key issues determined by the steering committee (see attached summary of the meeting below).

Detailed progress since the last report:

A detailed summary of the project steering committee meeting can be found at the end of this report. While all the details for the project were not ironed-out at the meeting, many issues were decided, and we are now in the process of incorporating these ideas into the model as we develop it.

We are currently developing the foundation for our full MSE model. The full model will be very complex, so it is essential that we develop the model with care, adding complexity in steps to make sure that the model is working properly. The model consists of three components: 1) the operating model, 2) the assessment model(s), and 3) the projection model used to calculate the ABC from the control rules of interest. We are currently developing 1 and 2 in AD Model Builder (Fournier, 2011). The same model framework will be used to measure the performance of both data-rich (Tiers 1-3) and –poor (Tier 4) control rules, but the key difference between these model runs is that no assessment will be done when evaluating the data-poor control rules.

Operating Model

The operating model describes the population dynamics of the stock being modeled. We have developed an age-structured population model, parameterized for a species with an "average" life history, similar to summer flounder. Annual abundance at age in the model, or $N(a,t)$, follows

$$(1) \qquad N(a,t)=\begin{cases} R(t) & a = a_R \\ N(a-1,t-1)e^{-(M+s_F(a-1)F(t-1))} & a_R < a < a_{\max} \\ N(a-1,t-1)e^{-(M+s_F(a-1)F(t-1))}+N(a,t-1)e^{-(M+s_F(a)F(t-1))} & a = a_{\max} \end{cases}$$

where R is recruitment (to the population at age a_R), M is natural mortality, F is fishing mortality, and $s_F(a)$ is the age-specific selectivity to the fishery. Currently, age-specific stock characteristics (i.e. length (L), weight (W), maturity (m), and selectivity (s_F)) are fixed in the operating model (i.e. they vary by age but not across years), as is natural mortality. Selectivity to the fishery is a logistic (saturating) function

(2) $$s_F(a) = \frac{1}{1 + e^{-(\frac{a - s_{F,50\%}}{\gamma_F})}}$$

with $s_{F,50\%}$ the age where 50% of the age class is susceptible to the fishery, and γ_F determines how rapidly the function saturates. Variability is introduced into the population via log-normal stochasticity in the stock-recruit (S-R) function (currently assumed to follow the Beverton-Holt relationship)

(3) $$R(t) = \frac{S(t - a_R)}{\alpha + \beta S(t - a_R)} e^{\theta_R - 0.5\sigma_R^2}$$

where $S(t)$ is the total spawning biomass in year t ($\sum_{a=a_R}^{a_{max}} m(a)W(a)N(a,t)$), α and β are parameters, and $e^{\theta_R - 0.5\sigma_R^2}$ represents the lognormal stochasticity.

In the operating model there is an initial period where the population is fished under a constant harvest pressure without management actions. At the start of this period, the population is in an unfished (virgin) state. At the end of the period the population is assessed and the ABC is estimated for a particular control rule. The current model contains a single fishery, although the full MSE model will contain multiple fisheries (both recreational and commercial). Total catch (in weight) in year t, $C(t)$ is calculated with

(4) $$C(t) = \sum_a \frac{s(a)F(t)}{s(a)F(t) + M} N(a,t)(1 - e^{-(M + s(a)F(t))})$$

Assessment Model

To conduct an assessment in the model requires a time-series of catch estimates and at least one abundance index. We simulate these data from the true values calculated in the operating model. While we could easily generate these data for the entire 50 year period, data for most fisheries do not span the entire history of the fishery, such that some populations are already heavily depleted by the time data collection starts. We therefore generate our data starting at year 20 in the operating model, resulting in 30 years of data to conduct the first assessment. Our simulated (observed) data consists of annual estimate of total catch in the fishery, and an index of abundance (in weight) from a single fishery-independent survey. Both data sets are generated from the true catch- and abundance-at-age in the model.

$$\hat{C}(t) = C(t)e^{\theta_f - 0.5\sigma_f^2}$$

$$\hat{I}(t) = \left[q \sum_a s_I(a)N(a,t)W(a) \right] e^{\theta_I - 0.5\sigma_I^2}$$

where q is the catchability in the survey, $s_I(a)$ is the selectivity in the survey a(also a saturating function with age as in Eqn 2, but with different parameter values), and the exponentiated terms represent the lognormal error in estimating the catch and in sampling the population with the survey. We also generate observed proportions at age in both the catch and survey. These proportions are currently set to the true values, but we could also allow for some error when generating these values.

With annual estimates of total catch and survey abundance, as well as the proportions at age in both the catch and survey, we then conduct a stock assessment to estimate trends in biomass, important parameters, and the biological reference points (BRPs) of S_{MSY}, F_{MSY}, and MSY. Currently, we estimate the vector of annual recruitments (R), the survey catchability q, and the parameters from the fishery and survey selectivities (Eqn 2). Parameters are estimated using a log-likelihood approach, assuming lognormal distributions for the annual catch and survey estimates, and multinomial distributions for the proportions at age in the catch and survey. The full log-likelihood function is the sum of the individual log-likelihood components, and parameters are estimated in AD Model Builder by optimizing the full log-likelihood function.

The operating and simple assessment model are working, and our next step will be to use the quantities derived from the assessment to calculate the BRPs for this stock. We will then begin extending the model to calculate the ABCs given the estimated status of the stock.

References

Deroba, J. J., and J. R. Bence. 2008. A review of harvest policies: understanding relative performance of control rules. Fisheries Research 94:210-223.

Fournier, D. 2011. An Introduction to AD Model Builder for Use in Nonlinear Modeling and Statistics. Version 10. http://admb-project.org/documentation/manuals/admb-user-manuals (accessed 4/14/2011).

Shertzer, K.W., M.H. Prager and E.H. Williams. 2008. A probability-based approach to setting annual catch levels. Fishery Bulletin, 106: 225-232.

Summary of the Steering Committee Meeting

On March 7th members of ABC control rule steering committee met for a full day at the Chesapeake Biological Laboratory in Solomons Maryland to help prioritize key questions and conditions to model. Attendees of the meeting were: Rick Robins, Lee Anderson, John Boreman, Jessica Coakley, Liz Brooks, Jason Link, Tom Miller, John Wiedenmann, and Mike Wilberg. The areas discussed can be broadly placed into the following categories:

1) ABC control rules to test
2) States of nature
3) Model inputs and uncertainties
4) Performance measures

ABC Control Rules

The Steering Committee agreed that we should explore control rules used in both data poor (Tier 4) and data rich (Tiers 2-4) situations.

For the data-poor control rules, the steering committee agreed that the most important control rule to explore is some summary of the catch history, such as the mean or the median. However, in calculating the mean or median catch, we may want to only use a portion of the entire catch history. For example, we may omit catches from years deemed unsustainable, either by simply removing the top x% of the catch history, or by looking at an index of abundance in conjunction with the catch history and only use catches from years where the index was stable or increasing to calculate the mean or median. We may also account for high catches by simply reducing the mean or median catch by some amount (e.g. use a catch that is 75% of the median). Other data-poor control rules that were discussed are depletion-based, stock-reduction analysis (DB-SRA), depletion corrected average catch (DCAC), and the status quo catch + or - a standard deviation, but the steering committee determined these control rules to be a lesser priority.

For data-rich control rules, the steering committee agreed that the focus be on control rules currently used by the different fisheries management councils to prevent overfishing. Most councils have adopted some variation of the P* approach of Shertzer et al. (2008), although the catch at 75% of F_{lim} is also being used. For the P* approach, it will be important look at different assumed levels of uncertainty, both in the estimate of F_{lim} and in the current biomass to determine how risk-prone or –averse a particular P* approach may be.

States of Nature

The steering committee agreed that if time permits, we should run the MSE model for a species with "slow," "medium," and "fast" life-history. A species with a "slow" life-history would have a low productivity (slow growing, low steepness in the stock-recruit relationship), whereas a "fast" life history would have a high productivity (fast growing and high steepness). A "medium" life-history would have a productivity somewhere in

between the "slow" and "fast" life-histories. Example species from the Mid-Atlantic are butterfish "fast", summer flounder "medium", and dogfish "slow". While we may use these species as guides in parameterizing the model, it was agreed that tailoring the model for these particular species might result in a loss of the generality of the results.. The steering committee determined that the MSE should be initially run for the "medium" life history, and that it be run for the other life-histories if time permits. Also discussed was whether or not to have *M* fixed or vary for a particular species.

In addition to the underlying stock dynamics, the steering committee discussed the historical dynamics to include in the model. The operating model will be run for a number of years under a fixed exploitation history before the population is assessed and the various control rules are applied to stock. The overall model results will likely depend on the stock status at the time when the population is assessed and the control rule applied, and for some control rules the catch history will also have an impact on the results. The steering committee felt that running the model with low, medium and high current biomass (i.e., biomass prior to the initial ABC determination) would be sufficient to capture the effects of population status on control rule performance. Although not specified, low biomass will likely be below the overfished threshold, high biomass will be above the biomass target, and medium biomass somewhere in between. The specific catch history used will vary depending in part on the current status (i.e. the low starting biomass run will have experienced heavy exploitation during at least part of its history). However, multiple catch-histories can produce the same starting biomass. For example, a species with high current biomass could have barely been fished, or it could have been overfished at some point and subsequently rebuilt. In such situations the steering committee felt that catch histories that included at least some periods with intense harvest are preferred .

The committee also discussed the length of population dynamics forecasts that should be used in the evaluation. It was decided that short term transient behavior and long term expected behavior are both important aspects of performance. Thus the forecasts should be at least several generations for the modeled life history.

Stock Assessment Model and Uncertainties

Within each run of the MSE model, multiple stock assessments will be conducted to determine stock status and the biological reference points (BRPs). For data-rich examples the model will conduct a statistical catch-at-age assessment. We may also want to conduct a production model in some situations. Information from the assessment will then be used to calculate the ABC for a given control rule until for the period between assessments. The steering committee felt that having the stock assessment interval tied into the age at recruitment of the stock would be ideal, with a longer assessment interval for stocks with a higher age at recruitment. Thus, the number of assessments done during some fixed period would vary depending upon the life history of the stock being modeled. If possible for a given control rule, the ABC should be calculated based on projections over the period of interest. Thus, for a fixed *F* if the stock is predicted to

increase then the associated ABC should also increase. If possible, projections will be done using a S-R function, or else they will be drawn from past recruitment estimates.

The ability within the model to estimate a reasonable S-R relationship will depend in part on the temporal coverage of the data. For most stocks along the eastern U.S., data collection began well after the fishery developed and biomass was reduced, making inference into the shape of the S-R difficult. Therefore, the steering committee agreed that the simulated data should be collected in the model at some point after the fishery has developed. If a reasonable S-R relationship cannot be determined, we may rely on the $F\%$ approach from SPR models to generate reference BRPs.

For the simulated data within the model, the steering committee discussed potential biases we may wish to include in the generation of our data. Some surveys have incomplete spatial and/or temporal (seasonal) coverage for a particular stock, such that indices of abundance from such surveys may be heavily biased. One possible way to explore survey bias is allow q (the catchability parameter) to vary temporally, and see how this affects model results if it is assumed fixed across all years vs. estimated annually.

Performance Measures

The full MSE model will require extensive computing power. Saving all of the information from each model run is computationally prohibitive, so it is essential that we determine the output from the model to be saved to evaluate the ABC control rule performance ahead of time. The steering committee concluded that the following performance measures would effectively summarize the performance of the ABC control rules:

- Time series of B/B_{MSY} and F/F_{MSY}
- Average catch and the variation in that catch
- Proportion of years when overfishing is estimated to be occurring
- Proportion of years when the population is estimated to be overfished
- Foregone yield

While there was a consensus on including these performance measures, there was some debate over the time-period in the model over which these measures will be calculated. The length of this time-horizon should be long enough to allow for multiple assessments and application of the ABC control rules, although depending on the life-history of the species we are modeling that may mean time horizons of different length. It may beneficial to have a variable time-horizon for the different species life-histories to ensure that the same number of assessment cycles takes place for each species.

There was also some discussion by the steering committee about how to deal with the retrospective bias across assessments when measuring the performance of the ABC control rules. For example, an assessment in the middle of the time horizon may indicate

that a particular control rule resulted in overfishing in 40% of the years, whereas a later assessment may indicate a much different rate of overfishing. It was not decided how to best deal with summarizing the performance of a control given strong retrospective bias.

2nd Meeting of the MAFMC ABC Control Rule Project Steering Committee

Thursday, May 26th, 2011, 1 PM.

Agenda

1:00 – 1:30:	Presentation by John Wiedenmann of work since last meeting
1:30 – 2:00	Questions about current work
2:00 - 3:00	Discussion of issues in current work/unresolved issues from last time
3:00 - 3:15	Break
3:15 – 4:30	Discussion of future steps
4:30 – 5:00	Wrap-up / Select next meeting date

Summary of the First Steering Committee Meeting

On March 7th members of ABC control rule steering committee met for a full day at the Chesapeake Biological Laboratory to help prioritize key questions and conditions to model. The areas discussed can be broadly placed into the following categories:

1) ABC control rules to test
2) States of nature
3) Model inputs and uncertainties
4) Performance measures

ABC Control Rules

The Steering Committee agreed that we should explore control rules used in both data poor (Tier 4) and data rich (Tiers 2-4) situations.

For the data poor control rules, the steering committee agreed that the most important control rule to explore is some summary of the catch history, such as the mean or the median. However, in calculating the mean or median catch, we may want to only use a portion of the entire catch history. For example, we may omit catches from years deemed unsustainable, either by simply removing the top x% of the catch history, or by looking at an index of abundance in conjunction with the catch history and only use catches from years where the index was stable or increasing to calculate the mean or median. We may also account for high catches by simply reducing the mean or median catch by some amount (e.g. use a catch that is 75% of the median). Other data-poor control rules that were discussed are depletion-based, stock-reduction analysis (DB-SRA), depletion corrected average catch (DCAC), and the status quo catch + or - a standard deviation, but the steering committee determined these control rules to be a lesser priority.

For data-rich control rules, the steering committee agreed that the focus be on control rules currently used by the different fisheries management councils to prevent overfishing. Most councils have adopted some variation of the P* approach of Shertzer et al. (2008), although the catch at 75% of F_{lim} is also being used. For the P* approach, it will be important look at different assumed levels of uncertainty, both in the estimate of F_{lim} and in the current biomass to determine how risk-prone or –averse a particular P* approach may be.

States of Nature

The steering committee agreed that if time permits, we should run the MSE model for a species with "slow," "medium," and "fast" life-history. A species with a "slow" life-history would have a low productivity (slow growing, low steepness in the stock-recruit relationship), whereas a "fast" life history would have a high productivity (fast growing and high steepness). A "medium" life-history would have a productivity somewhere in between the "slow" and "fast" life-histories. Example species from the Mid-Atlantic are butterfish, summer flounder, and dogfish, for the "slow", "medium" and "fast" life-histories, respectively. While we may use these species as guides in parameterizing the

model, it was agreed that tailoring the model for these particular species might result in a loss of the generality of the results. The steering committee determined that the MSE should be initially run for the "medium" life history, and that it be run for the other life-histories if time permits. Also discussed was whether or not to have *M* fixed or vary for a particular species.

In addition to the underlying stock dynamics, the steering committee discussed the historical dynamics to include in the model. The operating model will be run for a number of years under a fixed exploitation history before the population is assessed and the various control rules are applied to stock. The overall model results will likely depend on the stock status at the time when the population is assessed and the control rule applied, and for some control rules the catch history will also have an impact on the results. The steering committee felt that running the model with low, medium and high current biomass would be sufficient to capture the effects of population status on control rule performance. Although not specified, low biomass will likely be below the overfished threshold, high biomass will be above the overfished threshold, and medium biomass somewhere in between. The specific catch history used will vary depending in part on the current status (i.e. the low starting biomass run will have experienced heavy exploitation during at least part of its history). However, multiple catch-histories can produce the same starting biomass. For example, a species with high current biomass could have barely been fished, or it could have been overfished at some point and subsequently rebuilt. In such situations the steering committee felt that catch histories that included at least some periods with intense harvest are preferred .

Stock Assessment Model and Uncertainties

Within each run of the MSE model, multiple stock assessments will be conducted to determine stock status and the biological reference points (BRPs). For data-rich examples the model will conduct a statistical catch-at-age assessment. We may also want to conduct a production model in some situations. Information from the assessment will then be used to calculate the ABC for a given control rule until for the period between assessments. The steering committee felt that having the stock assessment interval tied into the age at recruitment of the stock would be ideal, with a longer assessment interval for stocks with a higher age at recruitment. Thus, the number of assessments done during some fixed period would vary depending upon the life history of the stock being modeled. If possible for a given control, the ABC should be calculated based on projections over the period of interest. Thus, for a fixed *F* if the stock is predicted to increase then the associated ABC should also increase. If possible, projections will be done using a S-R function, or else they will be drawn from past recruitment estimates.

The ability within the model to estimate a reasonable S-R relationship will depend in part on the temporal coverage of the data. For most stocks along the eastern U.S., data collection began well after the fishery developed and biomass reduced, making inference into the shape of the S-R difficult. Therefore, the steering committee agreed that the simulated data should be collected in the model at some point after the fishery has

developed. If a reasonable S-R relationship cannot be determined, we may rely on the $F\%$ approach from SPR models to generate reference BRPs.

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There was also some discussion by the steering committee about how to deal with the retrospective bias across assessments when measuring the performance of the ABC control rules. For example, an assessment in the middle of the time horizon may indicate that a particular control rule resulted in overfishing in 40% of the years, whereas a later assessment may indicate a much different rate of overfishing. It was not decided how to best deal with summarizing the performance of a control given strong retrospective bias.