Gulf of Mexico Fishery Management Council
Scientific and Statistical Committees
Review of Status Determination Criteria Discussions
August 2014 to Present

August 2014

Review of Options Paper to Define Status Determination Criteria and Optimum Yield for All Finfish Stocks

Mr. Atran reviewed the proposed actions and alternatives in the options paper. He explained that he had presented the options paper at the last Council meeting, but many Council members found it confusing. He was therefore attempting to revise the options paper to be more understandable, and was seeking SSC's guidance on how to proceed. Due to time constraints, the Chairman suggested that SSC members read the options paper on their own and provide any suggestions to Mr. Atran via e-mail. An SSC member noted that the October SSC meeting was going to be a very full meeting, and both the SSC and Council staff would have a heavy workload. Given that this options paper was not a high priority, he asked that it not be brought back to the SSC until after the October meeting.

September 2015

Integrated Ecosystem Assessment – Management Strategy Evaluation – Single Species

Bill Harford presented a demonstration of how Management Strategy Evaluation (MSE) could be applied to an ecosystem model to evaluate the impacts of various management strategies on single-species management. This process can incorporate simulations of a random episodic event such as a red tide event. By varying not only whether such an event occurs, but also when it occurs, MSE can provide a dynamic evaluation of possible management outcomes (Figure 6).

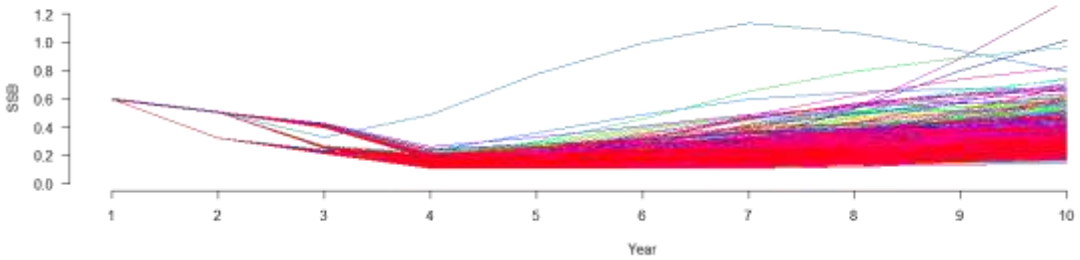

Figure 1. An example of applying multiple simulations to determine the likelihood that a specific management objective will be achieved. Each line in this spaghetti plot is an iteration of the simulation run (n = 1,000)

MSE can be used to evaluate the effect of different harvest control rules on multiple objectives by plotting the results relative to each objective on a radar graph (Figure 7).

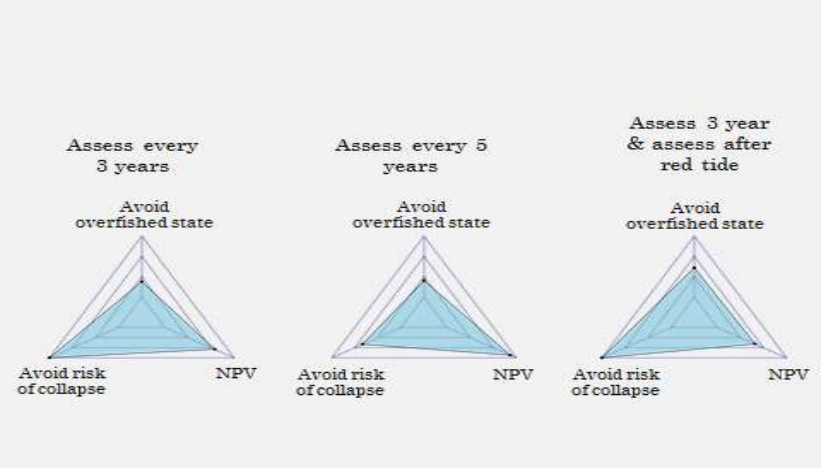

Figure 2. Example of evaluating various harvest control rules on multiple objectives. This example shows radar graphs with three objectives (net present value, avoid overfished state, avoid collapse), but the process is not limited to that number.

Examples of additional dimensions that could be incorporated into the evaluation include:

- Red tide magnitude & frequency
- Stock assessment uncertainty (imprecision)
- Frequency of assessment
- Alternative HCRs and scalar levels
- Relevant performance measures
- Implementation uncertainty (i.e. ACLs)

The presentation was not intended to be a comprehensive evaluation of the MSE process, but rather an introduction for which Dr. Harford was seeking feedback.

SSC members suggested that, in terms of determining relevant objectives to include, input from user groups and stakeholders should be a part of the process, and that more of the human element should be considered. Other factors were also noted for inclusion including the time lag between an ecological event and the ability of an assessment to capture the impact of the event on the stock. One suggestion was made to collaborate with the Reef Fish AP to determine relevant performance factors. However, it was noted that there will be tradeoffs between management needs and stakeholder needs.

One SSC member requested that the Ecosystem team provide the SSC with progress report presentations once or twice per year. A suggestion was made to form a working group. Dr. Cass-Calay noted that each of the regional Science Centers will be hiring an MSE expert. Dr. Cass-Calay added that the SEFSC was forming an MSE Advisory Committee, and suggested that perhaps there could be a Council representative on that committee.

Dr. Harford indicated that he would use the feedback that he received from the SSC to help further the development of the MSE process.

January 2016

Management Strategy Evaluation Using the Individual-Based Multi-Species Model OSMOSE-WFS

Dr. Arnaud Grüss demonstrated the application of management strategy evaluation (MSE) red tide implications on red grouper using the individual-based multi-species model OSMOSE-WFS. MSE is a framework that can be used to simulate alternative management strategies. It can be used to identify strategies robust to uncertainties and natural variation, and that balance conservation and socio-economic objectives (Figure 5). In its simplest form, MSE provides feedback between an operating model that simulates dynamics in the real world and a management model that prescribes management actions based on decision rules.

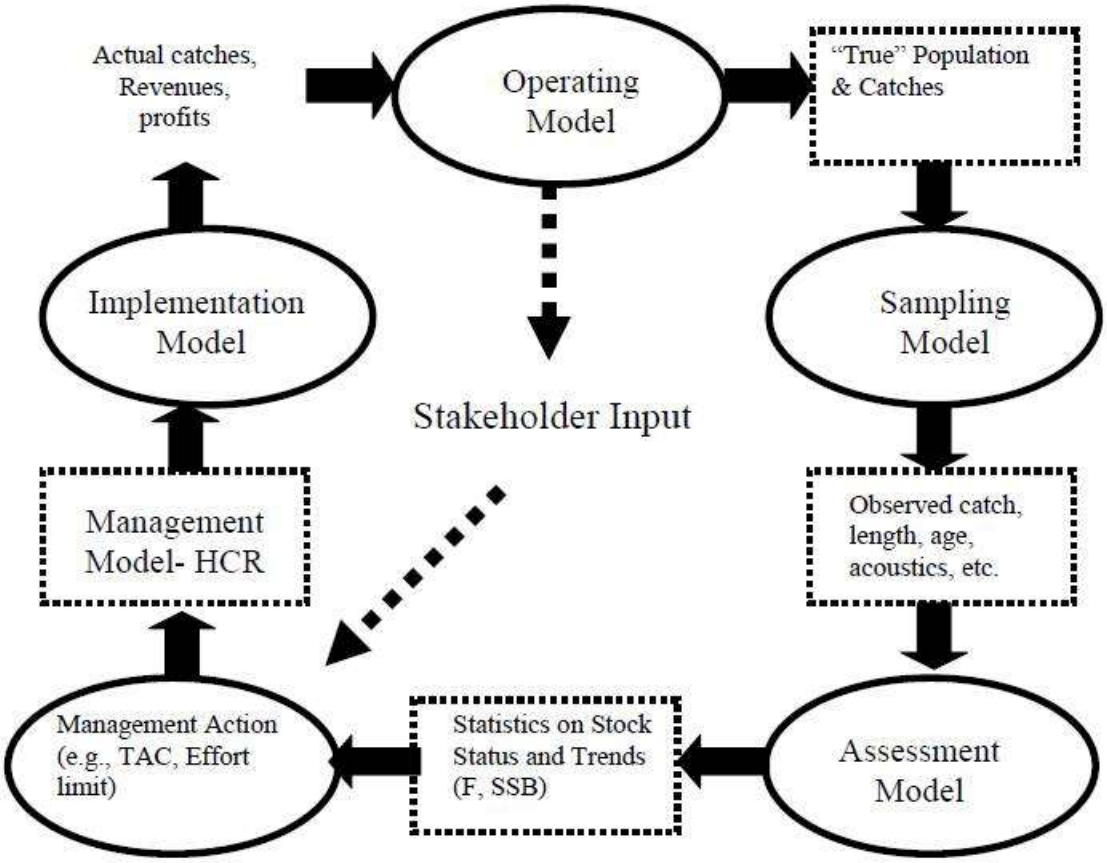

Figure 3. Conceptual management strategy evaluation framework. (Holland 2010[1])

MSE models can be tactical (provide practical management advice and focus on short-term impacts), or strategic (explore a diversity of what-if models to inform management and evaluate long-term impacts). The presentation presented a simplified demonstration of a strategic MSE applied to red grouper that included as metrics the probability of avoiding overfishing, the

[1] Holland, D. S. (2010), "Management Strategy Evaluation and Management Procedures: Tools for Rebuilding and Sustaining Fisheries", OECD Food, Agriculture and Fisheries Working Papers, No. 25, OECD Publishing. doi: 10.1787/5kmd77jhvkjf-en http://www.oecd.org/greengrowth/fisheries/45497984.pdf

probability of a stock collapse, stability of the catch, net present value of the catch, plus four other metrics.

The model found that, in the absence of episodic events of natural mortality, all ABC strategies resulted in significant initial decrease in catch, but allowed the red grouper catch to exceed its initial level in medium term (i.e., after 10 to 20 years of simulations). In general, higher P* values resulted in higher catch-related metrics, while smaller P* values resulted in higher biomass-related metrics. When episodic events of natural mortality occurred in the model, higher P* values eventually resulted in lower catches. The frequency of ABC updates did not have a significant impact on performance of ABC strategies.

SSC members noted that net present value of revenue vs. profits often move in different directions, and suggested that the economic metrics in the model should include measures other than net present value of revenue if the data is available. Metrics should also address the different user groups, which may behave differently from each other.

Dr. Grüss noted that this presentation was a simple implementation of MSE. It will eventually be developed into a more comprehensive model that will be more useful to management.

One SSC member suggested that the trade-offs be evaluated between applying the MSE approach to single species management vs. an ecosystem based management approach.

Dr. Cass-Calay noted that the SSC had previously discussed the possibility of creating a committee to review the MSE evaluations. The SEFSC will eventually have a position for someone to conduct MSE evaluations within the SEFSC. That person will be informed by a committee of persons within the SEFSC with stock assessment expertise, but expanding that to include Council, stakeholder, and SSC members might be useful.

Dr. Barbieri noted that Dr. Kai Lorenzen had previously expressed an interest in participating in such a process, and suggested that Dr. Lorenzen take the lead in the process of determining the SSC's role. Dr. Lorenzen agreed, and Dr. Barbieri states that a sub-committee of volunteers would be formed by e-mail to develop the parameters that the SSC would use to work with the SEFSC. This sub-committee would report its findings to the SSC at its next meeting.

June 2016

OY Exceeding MSY in Some Scenarios

Staff noted that under the Magnuson-Stevens Act definition of optimum yield, OY is a reduction from MSY, but in some circumstances the SEFSC calculation of OY can exceed MSY, most recently with the red grouper assessment in January 2016. Staff suggested that OY be redefined to some other method where OY can never exceed MSY, such as OY=ACL or OY=75% of MSY rather than the yield at 75% of F_{MSY}. Dr. Clay Porch noted that one of the biggest issues when calculating OY is the assumption that near-term recruitment levels exist forever. The SSC made no recommendations on this topic.

September 2016

Discussion on Limit and Target Reference Points and MSY Proxies for Reef Fish

Luiz Barbieri gave s presentation on risk and uncertainty with respect to target and limit reference points and MSY proxies. He noted that there are two types of uncertainty, knowledge uncertainty which is easier to control, and natural variability, which is hard to control. He defined risk as equal to probability × consequence. With respect to MSY proxies, we often do not know the true spawner-recruit relationship and therefore cannot calculate a credible MSY. Therefore, MSY proxies are used, and are generally expressed on the basis of SPR. Simulation analyses indicates that F_{MSY} is often in the range of $F_{20\%SPR}$ and $F_{40\%SPR}$. The choice of proxy depends upon the life history schedules for that species or stock. Dr. Barbieri asked if it would be advisable to form an ad hoc working group to assist with this tasks and to assist the Council in developing a more explicit risk policy for managed stocks.

Some SSC members noted that in addition to the biological risk of overfishing, there are socioeconomic risks from overregulation of foregone economic and social costs. It was suggested that the socioeconomic scientists on the SSC (Ben Blount, Lee Anderson, Ken Roberts, Walter Keithly, and others) work together to develop a white paper on this aspect for the next SSC meeting. Other SSC members could work on developing a list of other items to be discussed when developing MSY proxies.

May 2017

Status Determination Criteria Options Paper

Staff reviewed an early draft of an options paper for a generic amendment to define status determination criteria (SDC) and optimum yield (OY). The options paper includes actions to define MSY proxies, MSST for stocks not included in Amendment 44 (which addresses possible MSST revisions for stocks that currently have MSST defined), MFMT, and OY. The options paper currently includes all finfish managed solely by the Gulf Council (reef fish plus red drum), but does not include coastal migratory pelagics (which would require a joint amendment with the South Atlantic Council) or invertebrate species (shrimp, spiny lobster). SDC has been addressed for shrimp (Shrimp Amendment 15and 17B) and for spiny lobster (Spiny Lobster Amendment 10).

The SSC's discussion primarily concerned OY. Some SSC members noted that OFL, ABC, ACL, and ACT are currently utilized reference points. They questioned whether it was necessary to address OY since it does not seem to be part of current management. Staff responded that OY was part of the Magnuson-Stevens Act, and therefore its role in management needed to be addressed. However, there are two types of OY: 1) a long-term average catch, analogous to MSY; or 2) an annual OY, analogous to OFL. When used as an annual OY, the NS1 guidelines state that the annual OY cannot exceed the ACL. SSC members noted that the Magnuson-Stevens Act definition of OY includes a socio-economic component. The formula frequently used for OY for management consideration (yield at $0.75*F_{MSY}$), while simple for

assessment purposes, does not address social or economic considerations. Furthermore, in some situations, this definition of OY could exceed the ACL in some years.

It was suggested that the inclusion of socioeconomic considerations in OY be discussed at the Council level and by Advisory Panels in order to determine objectives and policy. Those objectives could then be converted to numbers by the SSC. It might be necessary to consider what factors apply to setting of OY on a stock-by-stock basis. For example, with shrimp, MSY was reduced to take into consideration minimizing sea turtle mortality. An SSC member suggested that OY is often regarded in the context of achieving the greatest economic return rather than in the context of some yield below MSY, inferring that economic considerations should be more a part of the management process than they appear. Addressing OY from this perspective may require a different management style than what is currently in place.

One SSC member noted that he had attended a workshop a few years ago on National Standard 1 and OY[2]. He suggested that the speakers at that workshop (Rick Methot, NOAA Fisheries, and Galen Tromble, NOAA Fisheries) be invited to attend an SSC meeting where OY is discussed.

January 2018

Review of Draft Status Determination Criteria/Optimum Yield Options Paper

Staff reviewed an options paper for an amendment to set or revise MSY proxies, MSST, MFMT, and OY for reef fish and red drum stocks. For MSY proxies (Action 1), staff noted that the alternatives included a range from the yield at F20% SPR to F30% SPR. However, a paper from the SEFSC currently undergoing in-house review[3] suggests that, when there is uncertainty about the stock-recruitment relationship, proxies that provide the strongest probabilities of achieving SPR are 40% SPR for gonochoristic species and 50% SPR for hermaphroditic species. As a result, the range of proxy alternatives will be increased in the next draft. An SSC member suggested that the MSY proxy decision should focus on growth overfishing rather than recruitment overfishing. Staff asked if it was possible to determine relative risk associated with various MSY proxies. Will Harford suggested that it might be possible to determine risk from the analysis, but it would require making assumptions about the stock-recruitment steepness.

For MSST (Action 2), one of the concerns stated by an SSC member was how long it would take to rebuild a stock from 50% of B_{MSY}. Staff noted that the SEFSC had done an analysis for Amendment 44 for a range of stocks with different life histories, and in all cases the stocks were projected to rebuild to B_{MSY} in 10 years or less if there was no fishing mortality.

For MFMT (Action 3), the SSC agreed that it made sense for the overfishing threshold of a rebuilding stock to be $F_{REBUILD}$ rather than F_{MSY}. Staff noted that this was consistent with the National Standard 1 guidelines.

[2] Fisheries Leadership & Sustainability Forum: Optimum Yield & National Standard 1 (September 4-7, 2012) http://www.fisheriesforum.org/our-work/fisheries-forums/wcf-2012

[3] Harford, W.J., S.R. Sagarese, and M. Karnauskas. In progress. Selecting proxy fishing mortality reference points for grouper-snapper fisheries under uncertainty about stock-recruitment steepness.

For OY (Action 4), the SSC discussed using maximum economic yield (MEY) as the OY. However, this makes sense primarily for large-scale commercial fisheries. The use of a fixed buffer, e.g., yield at 75% of F_{MSY}, does not explicitly account for social and economic considerations, and could be an uncertain buffer given uncertainties about the stock. OY can be set as either an annual catch that changes from year-to-year, or a long-term OY. SSC members felt that an annual OY was unnecessary, but there was no economic basis for setting a long-term OY.

May 2018

Draft Reef Fish Amendment 48/Red Drum Amendment 5

Dr. Dan Goethel (SEFSC) reviewed a recently published paper he co-authored titled, *Establishing Stock Status Determination Criteria for Fisheries with High Discards and Uncertain Recruitment*[4]. This paper described several alternative methods for calculating MSY using red snapper as an example. The methods differed in their assumption of the steepness value used in the spawner-recruit relationship (values of 1.0, 0.85. and 0.7 were examined), and in the way discards were treated and distributed among various fleets in the model. A "global MSY" in which red snapper were all harvested at an optimal age (age 10, 11, or 13 depending upon steepness value) with no discards was achieved at SPR levels of 24%, 29%, or 38% depending upon steepness value. The remaining analysis examined various "conditional MSYs" in which the selectivity and fleet distribution of dead discards were varied. These produced MSY at SPRs ranging from 12% to 42%.

Under a global MSY, the MSY yield cannot be achieved in real life since the optimal selectivity cannot be achieved. However, the authors felt that the global MSY approach produced the most inherently sustainable spawning stock biomass, which suggested that the appropriate MSY proxy for red snapper was in the range of 24% to 38% SPR.

The SSC next reviewed a reference sheet prepared by staff to assist the Council in understanding the concepts in Reef Fish Amendment 48/Red Drum 5. Several suggestions were made to improve the "stock status" graphic. However, Committee members had several concerns about the graphic showing the relationship between MSY proxy, MSST, MFMT, and OY. Several members felt that the relationships were unclear as presented, and Science Center staff disagreed with the premise that the overfishing threshold (MFMT) could be set below F_{MSY} under certain conditions.

The Committee began to review the actions and alternatives in Reef Fish Amendment 48/Red Drum Amendment 5. However, the Committee did not get further than Action 1 – MSY proxies. Many Committee members objected to having the MSY proxy set by the Council. They felt it is a biological decision and should be up to the SSC. They also felt that the SSC should have the

[4] Goethel, D.R., M.W. Smith, S.L. Cass-Calay, and C.E. Porch. 2018. Establishing Stock Status Determination Criteria for Fisheries with High Discards and Uncertain Recruitment. North American Journal of Fisheries Management 38:120-139.

ability to change the MSY proxy whenever such change seems appropriate based on the most recent assessment or biological information, without the need to go through a plan amendment. One suggestion was made to, rather than explicitly define specific MSY proxies in the FMP, have the FMP state that the MSY proxy for each stock is the proxy recommended by the SSC. Another suggestion was made to have the FMP define a range of MSY proxies within which the SSC would make its selection or change when new information or stock assessment becomes available. Some Committee members objected to using the term MSY or MSY proxy with data-limited stocks where the proxy would be set based on some average catch level over time. In the Caribbean region the term, Sustainable Yield Level (SYL) is used instead of MSY because the reference yield, while considered to be sustainable, is not necessarily the maximum sustainable.

August 2018

Draft Reef Fish Amendment 48/Red Drum Amendment 5

Staff presented a revised infographic reference sheet to accompany the draft amendment during reviews, which was intended to help explain the technical terms used in the amendment. The graphics in the top of the sheet, representing stock status and MSST, have been improved based on input from the SSC and others, and now do a good job of representing these concepts. However, the lower half, which previously contained a flow chart to illustrate the relationships between MSY, MSST, MFMT, and other reference points that was confusing to many, has been replaced by a pictorial graphic that attempts to integrate stock size, fishing morality, MSY, OY, and MFMT, and MSST into a single representation. In internal staff reviews, this pictorial has received mixed reviews and observations that it incorrectly portrays some of the linkages. Staff asked SSC members to contact her if they had any suggestions for improving the graphic.

For the draft amendment, staff reviewed revisions to Action 1 (MSY proxies) that were made following the previous SSC review in June. Council, SERO, and SEFSC staff had formed an *ad hoc* MSY Proxies Working Group to hold a conference call following the June SSC meeting in order to address the SSC's concerns with Action 1 and to develop revised alternatives. A summary of that conference call was included in the SSC meeting materials. As a result of that conference call and the SSC's comments, an alternative was added to Sub-Action 1.1 (MSY proxies for assessed stocks) to provide a method similar to that included in the South Atlantic Council's Snapper-Grouper Amendment 24, whereby the SSC would recommend an MSY proxy, and the Council would then adopt it by a notation in a plan amendment. A range of alternatives would be unnecessary because any MSY proxy other than the SSC's recommendation would not be based on the best scientific information available, and would not comply with National Standard 2. For the same reason, alternatives were removed that would have allowed the Council to set MSY proxies at the yield at $F_{40\% \text{ SPR}}$ or $F_{50\% \text{ SPR}}$ regardless of SSC recommendations.

Staff reviewed further changes to sub-action 1.2 (MSY proxies for stock complexes) and Sub-action 1.3 (MSY proxies for unassessed stocks), and noted that new sub-actions had been added as Sub-action 1.4 (MSY proxy for goliath grouper) and Sub-action 1.5 (MSY proxy for red drum). With respect to Sub-action 1.2 (MSY proxies for stock complexes), an SSC member

asked what would happen if the Council chose to use an indicator stock for a stock complex status, but there was more than 1 stock that could be used an as indicator species. Another SSC member noted that the Caribbean Council uses stock complexes with multiple indicator species, and they average the stock status of those species for a stock complex result.

With respect to sub-action 1.3 (MSY proxies for unassessed stocks) a question came up during the MSY Proxies Working Group conference call as to how accurate the ABC control rule Tier 3 methods were in determining values that could be used as MSY proxies. To evaluate this question, Dr. John Froeschke and Dr. John Walter conducted a comparison of the ABCs from recently assessed stocks with the OFL values that would have resulted from a Tier 3 method. The results suggested that the Tier 3 method produced results that were reasonably close to the assessment values. One SSC member noted that, when using the Tier 3 method, the selection of years to use as a base was critical to the results.

A new sub-action 1.4 was added for goliath grouper that contained an alternative to set the MSY proxy at 800 fish based on analysis conducted by Clay Porch and Luiz Barbieri (2007) and presented to the Council that suggested that this might be an appropriate take of goliath grouper at $F_{50\% \text{ SPR}}$. An additional alternative was added to set the goliath grouper MSY proxy at the yield at $F_{50\% \text{ SPR}}$, but this proxy would not be measurable without a stock assessment.

A new sub-action 1.5 was added for red drum that contained an alternative to set the MSY proxy at the yield corresponding to a 30% escapement of juvenile red drum to the spawning stock biomass. This proxy is measurable, but each state has a different way of measuring escapement, so escapement estimates are not consistent across the Gulf. An additional alternative was added to set the red drum MSY proxy at the yield at $F_{30\% \text{ SPR}}$, but because federal waters, if opened, would have a different selectivity that state waters, this proxy would not be measurable without a Gulf-wide stock assessment.

Due to time constraints, staff skipped reviews of Action 2 (MSST) and Action 3 (MFMT) other than a brief overview. Staff reviewed the alternatives in Action 4 (Optimum Yield). Alternative 2 would set OY as the yield at a fixed percentage of $F_{\text{MSY proxy}}$, which infers that economic, ecological, and social factors are implicitly accounted for. Alternative 3 would explicitly account for such factors by the use of a decision tool that ranks several economic, ecological, and social factors to determine a buffer between MSY and OY. The decision tool being constructed by staff is based on the stock prioritization tool developed by the Science Center, which included such factors, but is still under development. One SSC member suggested that, given the complexity of trying to account for factors that are not all scientific, OY should be set at 75% of FMSY unless there are other considerations. OY doesn't have a single definition, and that rather than talk about OY, we should talk about a target, which is a quota to stay away from OFL. Staff noted that the revised amendment would not be coming back to the Council for review until the October 2018 Council meeting.