Memorandum

Date:	August 2, 2021
To:	Council and the ASMFC ISFMP Policy Board
From:	Recreational Harvest Control Rule FMAT and PDT
Subject:	Update on development of the Recreational Harvest Control Rule Framework/Addendum

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1. Introduction and Background

The Mid-Atlantic Fishery Management Council (Council) and the Atlantic States Marine Fisheries Commission's (Commission's) Interstate Fishery Management Program Policy Board (Policy Board) are considering several changes to management of the recreational fisheries for summer flounder, scup, black sea bass, and bluefish through the Recreational Reform Initiative (Initiative). The goals of the Initiative are to provide stability in the recreational bag, size, and season limits (henceforth referred to as recreational management measures), develop strategies to

increase management flexibility, and achieve accessibility aligned with availability/stock status for all four species. This initiative aims to address a range of challenges in recreational fisheries management including widespread angler dissatisfaction with some recreational management measures, stakeholder perception that measures are not reflective of stock status, and concerns about how Marine Recreational Information Program (MRIP) data are used to manage these fisheries.

In October 2020, the Council and Policy Board prioritized several topics for further development through the Initiative, all of which are described in more detail in a January 2021 staff memo. Given workload constraints and other ongoing actions for these species, in February 2021, the Council and Policy Board agreed to prioritize development of a proposal referred to as a Harvest Control Rule prior to further development of the other Initiative topics.

This memo summarizes a preliminary set of Harvest Control Rule alternatives developed by a joint Fishery Management Action Team (FMAT)/Plan Development Team (PDT) to be considered through a fishery management plan (FMP) framework/addendum. During their August 9, 2021 meeting, the Council and the Policy Board should provide feedback and guidance to the FMAT/PDT on this set of alternatives. The FMAT/PDT will continue to develop the alternatives approved by the Council and Policy Board for further development. As described in more detail below, certain aspects of these alternatives require further development before a final range of alternatives can be approved and taken out to public hearings.

Statement of the Problem

The overarching goal of the Harvest Control Rule is to rely less on expected fishery performance compared to a catch or harvest limit (see alternative 1 below), and instead to use a more holistic approach that places greater emphasis on traditional and non-traditional stock status indicators and trends. The alternatives will have predetermined management responses based on a suite of metrics. The type of response and the metrics used to guide the response vary by alternative.

Under the current process for setting recreational management measures, the Council and relevant Commission species Management Board adopt a combination of bag, size, and season limits that are intended to prevent overages of the coastwide RHL. This process relies on the assumption that if these measures remain unchanged, next year's harvest will be similar to harvest in the current year or a recent year's average. If unchanged measures are expected to result in harvest notably above or below the RHL, then the measures are adjusted to achieve a desired percent liberalization or reduction in harvest based on an analysis using the previous years' MRIP data. However, it is challenging to accurately predict recreational harvest under any combination of measures. Harvest is impacted by many factors, including regulations, weather, availability of multiple species, economic trends, and other factors. MRIP data often show considerable variations in harvest across years when the measures remain unchanged.

2. Initial Draft Range of Alternatives

Under all alternatives, changes are only considered to how the recreational bag, size, and season limits are set, and potential changes to recreational accountability measures (AMs). No changes are considered to how the recreational annual catch limits (ACLs) are set or the allocations between the commercial and recreational sectors. The alternatives do not consider any changes to commercial fisheries management. Under all alternatives MRIP data will continue to be the primary source of information on recreational catch, harvest, discards, fishing effort, and fishing

mortality. However, MRIP data may not be the main driver in setting management measures, depending on the alternative. Methods to account for variability and uncertainty in the MRIP data (e.g., smoothing of outliers when appropriate) can be used under any of the alternatives below, including the no action alternative.

Alternatives 2-5 include restrictions on how liberal the recreational management measures could be, either as a maximum percentage liberalization or pre-defined set of the most liberal measures. In addition, alternatives 2-5 could require restrictions in the recreational fisheries (e.g., based on stock status considerations) when a strict MRIP to RHL comparison (see alternative 1) may not require restrictions. As such, there could be situations where the commercial fishery is allowed to increase but the recreational fishery is not. The commercial fishery will continue to be managed based on their quota, but the recreational fishery would be managed based on a number of metrics other than the RHL under alternatives 2-5. The FMAT/PDT agreed that these differences in approaches between the commercial and recreational sectors are appropriate given differences in how the fisheries are managed and monitored.

It should be noted that current management measures may not be the appropriate starting point for some alternatives for a variety of reasons (e.g., widespread angler dissatisfaction with some measures, potential for notable ACL overages for some species under current allocations). The FMAT/PDT is considering ways to define the appropriate starting point for each species under each alternative by using statistical models and other methods. Additional time is needed to further develop these ideas, and updates will be provided at a future Council and Policy Board meeting.

Some alternatives outline potential changes to recreational AMs. The Magnuson-Stevens Fishery Conservation and Management Act requires that Council FMPs contain provisions for ACLs and "measures to ensure accountability." The National Standards Guidelines state that AMs "are management controls to prevent ACLs, including sector-ACLs, from being exceeded, and to correct or mitigate overages of the ACL if they occur. AMs should address and minimize both the frequency and magnitude of overages and correct the problems that caused the overage in as short a time as possible" (50 CFR 600.310 (g)).

For all four species, states currently have the option to modify their management measures as long as their measures are deemed to be conservationally equivalent to the measures which would otherwise be implemented. The relevant species Management Board may determine that this process is not appropriate in some circumstances. Further consideration is needed regarding the Commission's conservation equivalency process under several alternatives. Many of the alternatives below rely on use of predetermined management measures. These alternatives may not achieve their desired outcomes if states have considerable flexibility to deviate from those measures.

2.1. Alternative 1: No Action (current process for setting recreational measures)

Under the current process, methods used to adjust measures can vary but generally use MRIP harvest data from one or more recent years to predict the impacts of changes in bag, size, and/or season limits. Although there are some differences in how measures are set for state and federal waters, the same general process and the same general assumptions are used to set measures in both federal and state waters. This process does not vary based on stock status and generally does not account for expected differences in availability or other factors in the upcoming year

compared to previous years beyond assumptions accounted for when setting the RHL (e.g., assumptions about future recruitment are made when calculating the ABC from which the RHL is derived).

By aiming to prevent RHL overages, this method also aims to prevent ACL overages, and therefore overages of the acceptable biological catch limit (ABC). The RHL accounts for harvest only and is equal to the ACL minus expected dead discards. If expected dead discards are accurately predicted, then preventing RHL overages should also prevent ACL overages. However, as previously noted, it is challenging to accurately predict recreational harvest and discards under any combination of measures. Harvest and discards are impacted by many factors, including regulations, weather, availability of multiple species, economic trends, and other factors. MRIP data often show considerable variations in harvest across years when the measures remain unchanged.

The regulations and FMPs allow the federal waters recreational bag, size, and season limits for summer flounder and black sea bass to be waived in favor of the measures in the state where anglers land their catch. This is not allowed for scup or bluefish. This process, known as conservation equivalency (though different from the Commission's state conservation equivalency process described below), has been used for summer flounder since 2002. It has been allowed for black sea bass since 2020, though it has not been used to date. This process relies on the same assumptions as those described above. Specifically, in order for the federal waters measures to be waived, it must be demonstrated that state waters measures are collectively expected to prevent harvest from exceeding the RHL. This analysis is based on recent MRIP data.[1]

For all Commission-managed species, states have the option to modify their management measures as long as their measures are deemed to be conservationally equivalent to the measures which would otherwise be implemented. The methods for determining if measures are conservationally equivalent can vary;[2] however, in practice for summer flounder, scup, black sea bass, and bluefish, these methods usually aim to demonstrate that the modified management measures will result in the same level of harvest as the measures which would otherwise be implemented and this analysis relies on recent MRIP data.

Accountability Measures Under Alternative 1

The current recreational AMs for these four species were implemented through an omnibus amendment in 2013. Proactive AMs include adjustments to the management measures for the upcoming fishing year, if necessary, to prevent RHL and ACL overages. Due to the timing of availability of current-year MRIP data, in-season closures are not used as a proactive AM for these fisheries. Therefore, measures must be set in a manner that is reasonably expected to constrain harvest to the RHL.

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[1] The federal conservation equivalency process is described in more detail in the regulations at §648.102(d) and in Frameworks 2 and 6 for summer flounder and framework 14 for black sea bass (available at: https://www.mafmc.org/sf-s-bsb.)

[2] For example, see the guidelines available here: http://www.asmfc.org/files/pub/ConservationEquivalencyGuidance_2016.pdf.

Reactive recreational AMs include a set of possible responses to exceeding the ACL, depending on stock status and whether the ABC was also exceeded. To determine if a reactive AM has been triggered, the most recent 3-year average recreational ACL is compared against the most recent 3-year average recreational dead catch estimate. If average catch exceeds the average ACL, then the appropriate AM is determined based on stock status. Pound-for-pound ACL overage paybacks are only required when the stock is overfished, under a rebuilding plan, or stock status is unknown. If biomass is below the target level, but the stock is not overfished, then a payback is only required if the ABC was also exceeded. In this circumstance, the payback amount is less than the full overage and varies such that a greater payback is required under lower biomass levels than under higher biomass levels. In all other circumstances (i.e., biomass exceeds the target or biomass is below the target but above the threshold and the ABC was not exceeded), recreational ACL overages do not require paybacks but require consideration of changes to the bag, size, and season limits in future years to prevent further overages.

A more detailed summary of the AMs for summer flounder, scup, and black sea bass is available here. The bluefish AMs are very similar, but include additional considerations related to transfers between the commercial and recreational sectors.

2.2. Alternative 2: Percent Change Alternative

This alternative proposes a mechanism for recreational measures setting that continues to use a comparison of MRIP estimates to the RHL. It aims to provide more stability and predictability of measures while better incorporating stock status into the measures setting process. Recreational measures would be considered every other year to align with the anticipated schedule of stock assessment updates.

This alternative differs from the no action alternative (alternative 1) in that it includes an explicit consideration of biomass compared to the target level (B/B_{MSY}) when determining if the recreational management measures should be liberalized, reduced, or remain unchanged from one year to the next. The amount of change varies based on the magnitude of the difference between MRIP estimates and the RHL, as well as considerations related to B/B_{MSY}.

This alternative considers the upcoming RHL relative to the confidence interval (CI) of the most recent MRIP time-series estimate. If the RHL for the upcoming management period is within the CI of the most recent MRIP time series estimate, then measures would remain unchanged or result in a pre-defined percentage liberalization or reduction based on the B/B_{MSY} ratio. If the RHL is outside the CI of the most recent MRIP time series estimate, then one of the tables below would be used to determine the appropriate pre-defined scale of liberalization or reduction.

Further FMAT/PDT discussion is needed regarding the appropriate percentage values for the difference between the RHL and the MRIP estimate and the "a," "b," "c", "d", and "e" percentage change values in the tables below. The appropriate value may vary by species. It is, however, intended that this be mirrored up and down to provide similar consideration of the need for reductions and opportunities for liberalization.

The two tables below differ in their approach to enacting liberalizations/reductions. In Table 1, the response is based on a binned approach where percentage liberalizations and reductions are pre-defined. In Table 2 the percent difference between the future RHL and the current MRIP time-series average estimate is multiplied by a coefficient ("d" or "e") to determine the percentage liberalization or reduction. The Table 1 provides stability and predictability in the

percent liberalization or reduction. In contrast, Table 2 allows for a more proportional response to RHL underages or overages because the liberalizations and reductions are not predetermined but instead are a ratio of the RHL overage/underage.

This alternative considers changes from a starting point. The current management measures may not be the appropriate starting point for a variety of reasons (e.g., widespread angler dissatisfaction with some measures, potential for notable ACL overages for some species under current allocations). The FMAT/PDT is considering ways to define the appropriate starting point for each species under each alternative by using statistical models and other methods. Additional time is needed to further develop these ideas, and updates will be provided at a future Council and Policy Board meeting.

Accountability Measures Under Alternative 2

Under this alternative, when there is a potential for an RHL overage, the greater the potential overage, the lesser the chance to liberalize measures and the greater the likelihood of restrictions. This can be considered a proactive AM to prevent future RHL overages.

Further FMAT/PDT discussion is needed to determine if other changes to the AMs should be considered under this alternative.

Table 1: Binned approach to enacting changes in measures under alternative 2.[3]

Future RHL vs MRIP Estimate	B/B_{MSY}	Change in Measures
Future RHL more than X% higher than MRIP estimate (and outside CI)	> 1.5	c% Liberalization
	1 - 1.5	b% Liberalization
	< 1	0% (Status quo)
Future RHL up to X% higher than MRIP estimate (and outside CI)	> 1.5	b% Liberalization
	1-1.5	a% Liberalization
	< 1	0% (Status quo)
Future RHL within CI of MRIP estimate	> 1.5	a% Liberalization
	1-1.5	0% (Status quo)
	< 1	a% Reduction
Future RHL up to X% lower than MRIP estimate (and outside CI)	> 1.5	0% (Status quo)
	1-1.5	a% Reduction
	< 1	b% Reduction
Future RHL more than X% lower than MRIP estimate (and outside CI)	> 1.5	0% (Status quo)
	1-1.5	b% Reduction
	< 1	c% Reduction

[3] The proposed B/B_{MSY} inflection points are based on the Council's Risk Policy. Future changes to the Council risk policy may warrant reconsideration of this proposed process.

Table 2: Coefficient approach to enacting changes in measures under alternative 2. [4]

Future RHL vs MRIP Estimate	B/B_{MSY}	Change in Measures
RHL X% higher than MRIP estimate (and outside CI)	> 1.5	d% Liberalization
	1 - 1.5	e% Liberalization
	< 1	0% (Status Quo)
RHL within CI of MRIP estimate	> 1.5	e% Liberalization
	1-1.5	0% (Status Quo)
	< 1	e% Reduction
RHL X% lower than MRIP estimate (and outside CI)	> 1.5	0% (Status Quo)
	1-1.5	e% Reduction
	< 1	d% Reduction

2.3. Alternative 3: Fishery Score Alternative

This alternative would combine multiple metrics into one "fishery score" which would be used to determine the recreational management measures. The fishery score would be calculated each time updated stock assessment information is available (anticipated to be every other year); therefore, it may be appropriate to leave the recreational management measures unchanged in the interim years, even if other components of the fishery score (e.g., recent harvest) change. This would provide some level of stability in the fishery while also ensuring a management response to the best available information on stock status.

The FMAT/PDT proposes the following four metrics for calculating the fishery score: fishing mortality (F) relative to the threshold level (F_{MSY}) and biomass (B) relative to the target (B_{MSY}) or threshold level (½ B_{MSY}) from the terminal year of the stock assessment, as well as recruitment (R) trends, and a comparison of average harvest to the RHL. Each metric would have a weighting component such that metrics with a stronger relationship to harvest (e.g., F and biomass) would have more weight in the fishery score while still accounting for metrics that play a role but may not drive harvest as strongly. Other metrics can be added and weighting schemes adjusted. The overall goal of the fishery score is to have a single metric that is easily interpreted by stakeholders, provides early indication of stock declines, provides stability in recreational measures, and accommodates multiple metrics contributing to recreational harvest.

The fishery score would be calculated using the following formula:

$$F/F_{MSY}(W_F) + B/B_{MSY}(W_B) + R\ Trend(W_R) + Fishery\ performance\ (W_{FP}) = Fishery\ Score$$

Where W refers to the weight of each factor. As an example to help explain the methodology, the fishery score will range from 0 to 5; however, final values could vary based on further development of this alternative. Different fishery score values would be binned and assigned to different sets of recreational management measures. Example bins for consideration are defined in Table 3.

[4] See previous footnote.

The calculation of a fishery score can accommodate additional metrics that may be added in the future, such as socioeconomic information. An example of how the fishery score could be calculated based on the recent information for each species is provided in Appendix A.

Weights will have a minimum and maximum range (e.g., a minimum of 0.1 and a maximum of 0.5) to prevent any one metric from being weighed too heavily in relation to the others. The intent is to allow the Monitoring Committee to recommend changes to the weights through the specifications process based on their expert judgement and empirical methods when possible. Changes should be limited to provide stability in comparisons over time.

A declining fishery score over time could indicate negative trends in stock status. An examination of the individual fishery score metrics can provide insight into why the overall score is declining. This can also serve as an early warning of the need to use more restrictive measures in the future if the trend continues.

Accountability Measures Under Alternative 3

Further FMAT/PDT discussion is needed regarding AMs under the fishery score alternative. Movement from one bin to another could be considered a proactive AM.

If recreational catch or harvest exceeds the ACL or RHL for more than one stock assessment cycle, then this could trigger a revision to the management measures associated with each of the fishery score bins.

Table 3: Fishery Score bins related to level of concern, stock status and fishery performance outlook, and measures.

Fishery Score	Level of Concern	Stock Status and Fishery Performance Outlook	Measures
0-1.99	Highest Risk	Very Poor	Most Restrictive
2-2.99	High Risk	Poor	Restrictive
3-3.99	Medium Risk	Moderate	Liberal
4-5	Low Risk	Good	Most Liberal

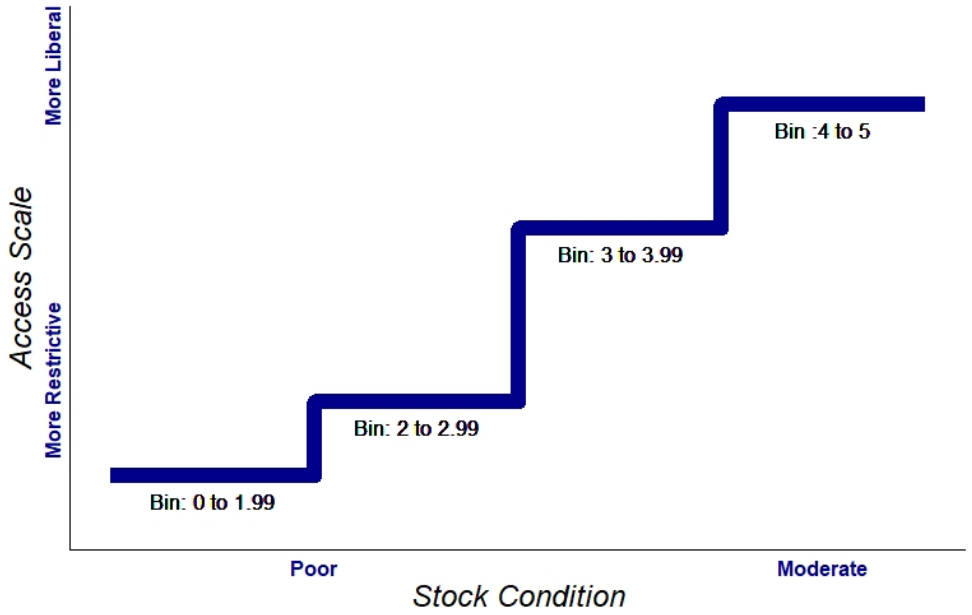

Figure 1: Illustration of fishery score bins relative to stock condition and level of recreational fishing access.

2.4. Alternative 4: Biological Reference Point Alternative

Under this alternative, the primary metrics of terminal year B/B_{MSY} and F/F_{MSY} from the most recent stock assessment would be used to guide selection of management measures. Management measures would be binned into seven potential "boxes," as illustrated in Figure 2. Each box would have a set of default measures which would be implemented the first time the stock is placed in that box.

To define the boxes under this alternative, F would be considered in two states (i.e., above or below the target) while B/B_{MSY} would be further divided to provide managers and anglers with more responsive levels of access. The following bins of B/B_{MSY} are proposed.

- Biomass is greater than or equal to 1.5x the target.
- Biomass is greater than or equal to the target but less than 1.5x the target.
- Biomass is less than the target, but greater than or equal to the threshold (the threshold is ½ the target).
- Biomass is less than the threshold (the stock is overfished).

Trends in biomass (see Appendix B) and recruitment are secondary metrics under this alternative which are used to fine tune default measures only when stock conditions (F/F_{MSY} and B/B_{MSY}) relative to the categories above have not changed between the prior and most recent assessments. In this case, biomass and recruitment trends can be used to further relax, restrict, or re-evaluate measures. As such, trends in biomass and recruitment would impact the management measures, but to a lesser extent than F/F_{MSY} and B/B_{MSY}.

Changes to the measures would be considered based on the following process when updated stock assessment information is available (anticipated to be every other year). The first time a stock is in a new box, the fishery would be subject to the default measures. If the box remains unchanged after a subsequent stock assessment update, then trends in recruitment and biomass

would be considered to determine if measures remain unchanged or if limited liberalizations or reductions can be permitted. As described below, liberalizations within a box are only allowed in boxes 1 and 2, which are associated with a healthy stock status. Restrictions and/or re-evaluation within a box can be required based on secondary metrics for boxes 3-6. This allows for relative stability if stock status is unchanged, but also room for tuning of measures if biomass and/or recruitment trends warrant it. It is intended that the changes within a box would be based on predetermined guidelines.

Liberalizations within a box are not permitted when biomass is below the target level or when F exceeds F_{MSY}. For example, if a stock in box 2 (F below F_{MSY} and biomass above B_{MSY}, but below 150% of B_{MSY}) remains in box 2 based on an updated stock assessment, then measures may be liberalized to preset measures if recruitment and/or biomass are trending upwards. If either of those trends are down, then measures would stay status quo. If the updated stock assessment information indicates biomass exceeds 150% of B_{MSY}, then the stock would move into box 1, triggering a new set of default measures more relaxed than those from box 2. Alternatively, if biomass is below the target, then the stock would move to a more restrictive box (boxes 3-6).

Stocks in box 3 are not subject to overfishing and are not overfished, but are below their target biomass level. Stocks in boxes 4-6 are experiencing overfishing. The goal of the management measures in boxes 3-6 is to improve stock status by ending overfishing and/or increasing biomass. If the initial default measures do not accomplish this, but the primary metrics of F/F_{MSY} and B/B_{MSY} do not change, then secondary measures can inform how to better adjust regulations to reach the target through additional restrictions. This differs from stocks in boxes 1-2, where measures would not be adjusted in this circumstance. Additionally, when a stock is in boxes 3-6 (F exceeds F_{MSY}) and the current measures produce catch or harvest that exceed the ACL or RHL (e.g., based on a multi-year average), then the default measures should be re-evaluated.

Any overfished stock (biomass below ½ B/B_{MSY}) would fall into box 7 and would no longer be able to utilize the Harvest Control Rule. This stock would default back to a rebuilding plan as outlined in the FMP. The use of FMP rebuilding strategies allow the Council and Board the flexibility to draft a rebuilding plan, and it is not appropriate to have pre-defined measures when a stock is rebuilding.

While conditions that drive the box definitions would be consistent across all species, the specific combination of management measures, such as bag, season, and size limits, appropriate for each step would be species specific.

Appendix C provides examples of which box summer flounder, scup, and black sea bass would be placed in based on the most recent stock assessment information.

Accountability Measures Under Alternative 4

The main AM built into this alternative is the movement between boxes based on changes in stock status. The incorporation of an additional secondary metric of fishery performance when overfishing is occurring ensures there is accountability to an ACL or RHL by triggering a management response (i.e., restrict and re-evaluate measures) when the recreational fishery contributes to overfishing by exceeding their limits.

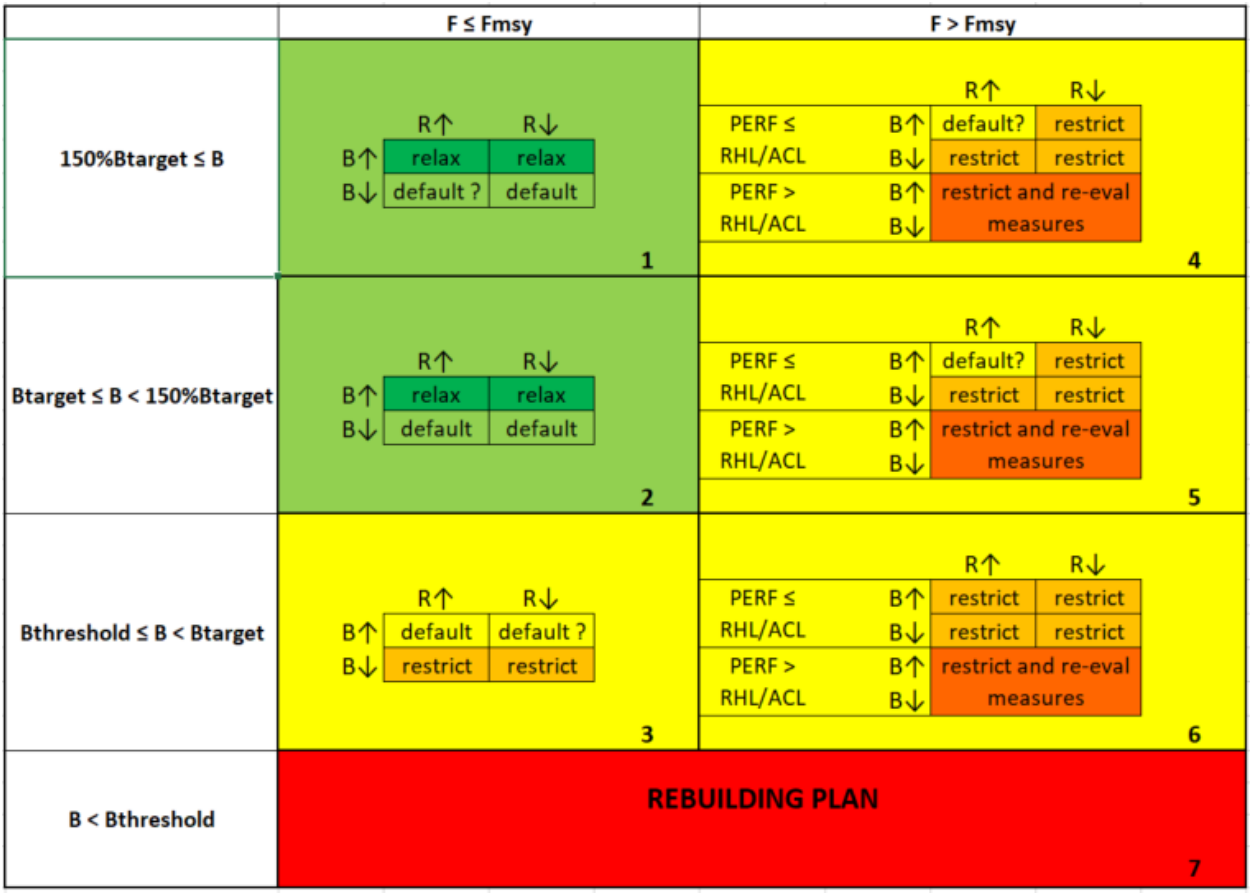

Figure 2: Illustration of example biological reference point "boxes" under alternative 4.

2.5. Alternative 5: Biomass Based Matrix Alternative

This alternative uses a matrix to set recreational measures based on two factors: B/B_{MSY} and the most recent trend in biomass (increasing, stable, or decreasing). Using these two factors and four parameters for each, as described below, provides a three-by-four matrix to determine the appropriate management measure "step." Step A represents the optimal conditions, while Step F represents the worst conditions. Certain pairs of conditions (e.g., a healthy stock that is increasing or an abundant stock with any biomass trend) are treated as equivalent to reduce the number of steps to six.

The specific combination of management measures (bag, season, and size limits) that are appropriate for each step will be species specific. However, the conditions that drive the steps can be the same across all species.

The use of this methodology will have a hard ceiling beyond which measures will not liberalize, even if the stock continues to improve, unless a revision is conducted. Additional FMAT/PDT discussion is needed to determine the criteria and circumstances that would trigger a revision and the process to make the revision. Additionally, even under increasing catch limits, if the fishing mortality comparison does not indicate overages, but the stock status metrics suggest downward trends, then the recreational fishery may have more conservative measures than if those measures were set based on an RHL comparison alone (e.g., alternative 1).

Definitions:

- Abundant = Stock is at least 150% of the target level (B_{MSY})
- Healthy = Stock is above the target, but less than 150% of the target
- Below Target = Stock is below the target, but above the threshold (½ B_{MSY})
- Overfished = The stock is below the threshold

When biomass exceeds 150% of the target level, regardless of the biomass trend, step A measures are selected. This special condition is aimed at providing an opportunity to keep recreational management measures aligned with stock status, which in this case, is significantly above the target. When a stock is fished at F_{MSY} it is expected that stock size will decrease towards the biomass target unless above average recruitment events occur. Thus, it is not necessarily a negative sign if the stock at such high biomass levels experiences a declining trend.

Evaluating biomass trends can be accomplished using a variety of statistical methods. The FMAT/PDT is working on a number of potential options (see Appendix B). The application of this alternative to summer flounder, scup, black sea bass and bluefish is provided in Appendix D.

Accountability Measures Under Alternative 5

Movement from one step to another could be considered a proactive AM under this alternative. The FMAT/PDT has discussed the possibility of using fishing mortality to evaluate fishery performance as a reactive AM, either as a stand alone metric or in conjunction with a comparison of catch to the ACL. Further FMAT/PDT discussion is needed regarding AMs under this alternative.

Table 4: Recreational management measure matrix under alternative 5.

		Biomass Trend		
		Increasing	**Stable**	**Decreasing**
Stock Status	**Abundant**	Step A		
	Healthy	Step A	Step B	
	Below Target	Step C	Step D	
	Overfished	Step E	Step F	

3. Next steps

This section lists the major next steps needed to complete this framework/addendum. The Council and Policy Board should provide guidance to the FMAT/PDT on their desired implementation date, considering the time needed to complete the tasks listed below alongside other priority actions for these species. For example, the FMAT/PDT noted that although final action in early 2022 (to inform 2022 measures) may be feasible, this would be very ambitious and may not allow sufficient time to thoroughly analyze the alternatives, refine analytical methods to develop example management measures, and incorporate revisions based on Monitoring Committee and public input.

This framework/addendum would define a process for setting recreational management measures; it would not prescribe specific management measures. However, development of example management measures will help facilitate comparison of potential impacts across alternatives and to allow for informed stakeholder input. Additional work is needed to develop example measures under each alternative. As described above, several alternatives require development of many different sets of measures associated with different stock status conditions. The FMAT/PDT recommends use of an analytical, model-based approach as the basis for setting the management measures, in combination with public input. Quantitative models can be used to estimate predicted catch or harvest under any combination of bag, size, and season limits. These measures can be further refined based on stakeholder input.

The FMAT/PDT has discussed the potential use of two models that are currently in development (i.e., an economic model developed for the summer flounder management strategy evaluation and the recreational fleet dynamics model originally developed in 2018 and 2019 through a contract funded by the Council). A sub-group of the SSC will review both models in late September 2021. These models may be revised based on SSC input. It should be noted that one model has so far only been developed for summer flounder (the management strategy evaluation model) and the other model has been developed for summer flounder and black sea bass (the recreational fleet dynamics model). Both models could be updated in the future for all four species; however, this will require additional time and likely cannot be done until at least mid to late 2022, depending on availability of the scientists who developed the models.

Major milestones in completion of this framework/addendum are listed below. Example completion dates for each milestone are provided; however, these dates are subject to change based on any delays during the process.

- Council and Policy Board approve draft alternatives for continued development (August 2021).
- Further development and refinement of the alternatives by the FMAT/PDT based on Board and Council feedback; development of draft addendum (August - October 2021).
- SSC sub-group peer review of two models (September 20, 2021).
- Revisions to the models, if needed based on SSC feedback (September - October 2021).
- Workgroups to solicit stakeholder input and ideas on different management scenarios (September and October 2021).
- FMAT/PDT begin using models to develop example management measures under each alternative (October 2021).
- Monitoring Committee and Advisory Panel meetings to provide input on draft alternatives and example management measures (November 2021).
- Council and Policy Board review refined draft alternatives and consider approval of a final range of alternatives for the framework/addendum and draft addendum document for public hearings (October 2021).
- Public hearings (November - December 2021).
- FMAT/PDT and Advisory Panel meetings to consider input received during public hearings and develop recommendations for final action (January 2021 or February 2022).
- Council and Policy Board meeting to consider final action (February 2022).
- Development of NEPA document for Council framework and federal rulemaking (February to mid to late 2022).

- Monitoring Committee, Council, and Board consideration of use in setting 2022 recreational management measures (Spring 2022).

4. Appendices

4.1. Appendix A: Fishery score example

This appendix provides an example of how the fishery score (see alternative 3) could be calculated for black sea bass. As described in Section 2.3, the fishery score would be calculated based on the following formula:

$$F/F_{MSY}(W_F) + B/B_{MSY}(W_B) + R\ Trend(W_R) + Fishery\ performance\ (W_{FP}) = Fishery\ Score$$

Where W refers to the weight of each factor. For the purposes of this example, the fishery score ranges from 0-5 and each factor in the score is assigned a value of 0-5.

Under this example, the B/B_{MSY} score would be assigned based on the following range of B/B_{MSY} ratios from the most recent stock assessment.

- 5: $B/B_{MSY} >= 2.0$
- 4: $2.0 < B/B_{MSY} >= 1.25$
- 3: $1.25 < B/B_{MSY} >= .75$
- 2: $0.75< B/B_{MSY} >=0.25$
- 1: $0.25=< B/B_{MSY}$

Under this example, the F/F_{MSY} score would be assigned based on the following range of F/F_{MSY} ratios from the most recent stock assessment.

- 5: $F/F_{MSY} < 1$
- 3: $F/F_{MSY} = 1$
- 1: $F/F_{MSY} > 1$

Under this example, recruitment trend is calculated by comparing the terminal year estimate from the stock assessment to the most recent three year average.

- 5: terminal year R greater than 20% above 3 year average
- 4: terminal year R less than 20% but more than 10% above 3 year average
- 3: terminal year R within 10% above and below 3 year average
- 2: terminal year R less than 20% but more than 10% above 3 year average
- 1: terminal year 1 greater than 20% below 3 year average

The following comparisons provide an example of how to evaluate recreational harvest compared to the RHL.

- 5: most recent 3 year average harvest at least 20% below upcoming RHL
- 4: most recent 3 year average harvest 5-20% below upcoming RHL
- 3: most recent 3 year average harvest 0-5% below upcoming RHL
- 2: most recent 3 year average harvest exceeds the upcoming RHL by 25% or less
- 1: most recent 3 year average harvest exceeds the upcoming RHL by more than 25%

According to the most recent black sea bass stock assessment B/B_{MSY} was 2.1 and F/F_{MSY} was 0.85 in 2019. This results in a value of 5 for both the $B/B_{MSY\ and}$ F/F_{MSY} fishery score metrics.

Recruitment in 2019 was 21% greater than the 2017-2019 average, resulting in a fishery score metric of 5.

According to currently available MRIP data, the average black sea bass harvest from Maine through Cape Hatteras, NC was 8.53 million pounds in 2018-2020. The 2021 RHL (provided for example purposes only as RHLs beyond 2022 will be determined at a later date) is 6.34 million pounds. This results in a fishery score metric of 1.

The appropriate weighting of each factor in the fishery score requires further consideration. If it is assumed that each factor is assigned an equal weight, then the examples above would result in the following overall fishery score:

$$5(0.25) + 5(0.25) + 5(0.25) + 1\ (0.25) = 4$$

$$F/F_{MSY}(W_F) + B/B_{MSY}(W_B) + R\ Trend(W_R) + Fishery\ performance\ (W_{FP}) = Fishery\ Score$$

Based on the method outlined in Section 2.3, black sea bass would be considered healthy and the corresponding management measures would be the most liberal based on an overall fishery score of 4.0.

Based on this same methodology, summer flounder would be assigned an F score of 5, a B/B_{MSY} score of 3, a recruitment score of 4, and a fishery performance score of 2. This would result in an overall fishery score of 3.5.

Scup would be assigned an F score of 5, a B/B_{MSY} score of 5, a recruitment score of 1, and a fishery performance score of 1. This would result in an overall fishery score of 3.0.

4.2. Appendix B: Methods for Evaluating Biomass Trend

Alternatives 4 & 5 require evaluating trends in biomass. The FMAT/PDT is working on a number of potential options to evaluate trends. One possible approach would take the average percent change in spawning stock biomass from the three most recent years in the assessment and compare the average to pre-defined breakpoints. Figure 3 illustrates three potential breakpoints: 3%, 4%, and 4%. Increasing, decreasing, or stable would be defined as follows, based on a 3% example.

- Increasing: percent change ≥ 3%
- Decreasing: percent change ≤ -3%
- Stable: -3% < percent change < 3%

The FMAT/PDT also considered a method to evaluate biomass trend by examining slopes in spawning stock biomass. This is similar to methods that have been considered in multiple stock assessment contexts. The FMAT/PDT developed examples of both the averaging and slope methods. Both methods produced very similar results; therefore, the FMAT/PDT recommends further consideration of the averaging method given that it is computationally much simpler than the slope method.

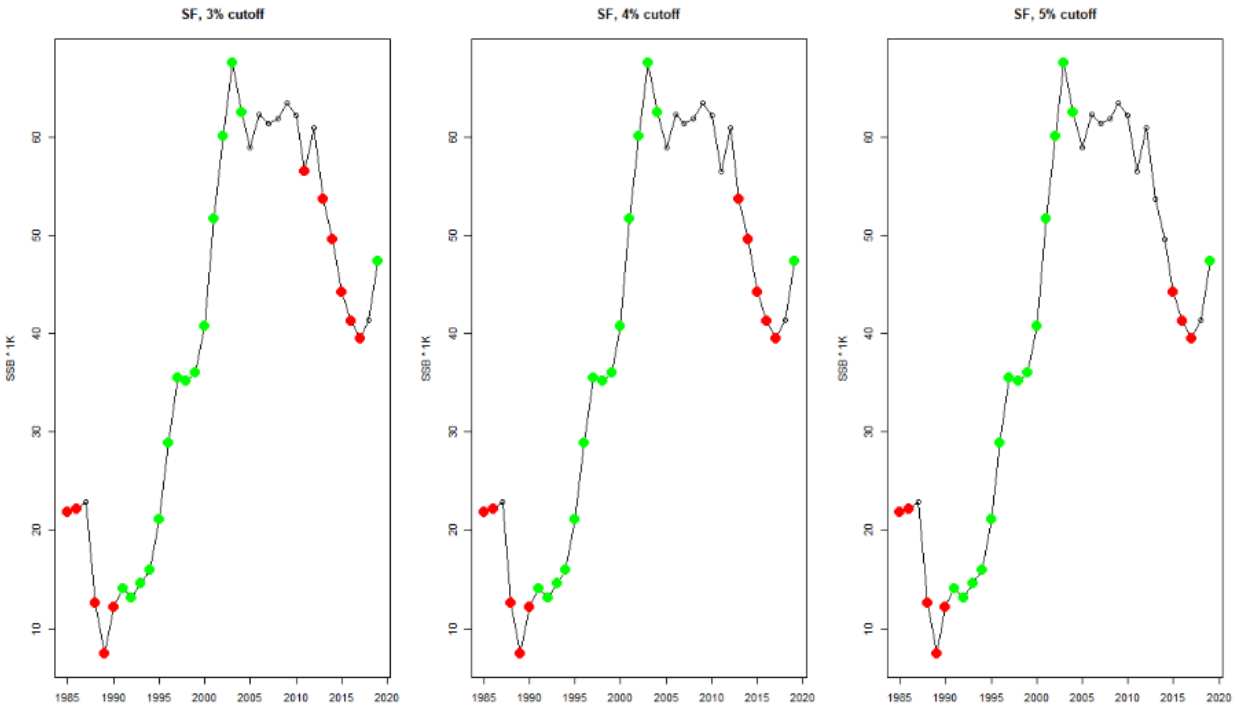

Figure 3: Trend sensitivity analysis for summer flounder. Green indicates years with an increasing biomass trend, as defined above. Red indicates years with a decreasing biomass trend. Black indicates stable biomass trend.

4.3. Appendix C: Biological Reference Point Alternative Examples

This appendix provides example of which "box" under the Biological Reference Point Alternative (alternative 4) each stock would be placed in based on recent information.

According to the 2021 management track assessment, black sea bass biomass in 2019 was about 210% of the target level. Fishing mortality in 2019 was 85% of F_{MSY}. This places black sea in box 1.

According to the 2021 management track assessment, summer flounder biomass in 2019 was about 85% of the target level. Fishing mortality was 81% of F_{MSY}. Based on these values, summer flounder would be placed in box 3.

According to the 2021 management track assessment, scup biomass in 2019 was about double the target level. Fishing mortality was 68% of F_{MSY}. Based on these values, scup would be placed in box 1.

According to the 2021 management track assessment, bluefish biomass in 2019 was about 5% below the threshold level, indicating that the stock was overfished. This places bluefish in box 7, which means the harvest control rule cannot be used and the rebuilding plan will be used to determine the recreational management measures.

4.1. Appendix D: Placement of Each Stock Within the Biomass Based Matrix (Alternative 5)

According to the 2021 management track assessment, black sea bass biomass in 2019 was about 210% of the target level and has been declining towards the target since a peak in 2014. This puts black sea bass in Step A under this alternative.

According to the 2021 management track assessment, scup biomass in 2019 was about double the target level and has been declining towards the target since 2017. This puts scup in Step A under this alternative.

According to the 2021 management track assessment, summer flounder biomass in 2019 was about 85% of the target level but has been increasing since 2017. This puts summer flounder in Step C under this alternative.

According to the 2021 management track assessment, bluefish biomass in 2019 was about 5% below the threshold level. The biomass trend has been generally stable over the past 6 years. This puts bluefish in Step F under this alternative.

Table 5: Recreational management measure matrix under alternative 5.

		Biomass Trend		
		Increasing	**Stable**	**Decreasing**
Stock Status	**Abundant**	Step A		
	Healthy	Step A	Step B	
	Below Target	Step C	Step D	
	Overfished	Step E	Step F	