# Joint MAFMC/ASMFC Webinar

**Thursday, October 21, 2021**

*12:45 p.m. – 2:45 p.m.*

The Mid-Atlantic Fishery Management Council (MAFMC) will meet jointly by webinar with the Atlantic States Marine Fisheries Commission's (ASMFC) ISFMP Policy Board on Thursday, October 21, 2021. This meeting will be hosted by the ASMFC. Register for the webinar here.

MAFMC materials for the joint portion of the meeting are available on the MAFMC meeting page at https://www.mafmc.org/briefing/oct-21-2021-joint-meeting.

# Agenda

## Thursday, October 21

**12:45 p.m. – 2:45 p.m.** **Update on Draft Addendum/Framework on Harvest Control Rule for Bluefish, Summer Flounder, Scup, and Black Sea Bass**

- Review progress on the Draft Amendment/Framework
- Provide feedback to the FMAT/PDT regarding recommendations outlined in the memo to the Board and Council

The above agenda items may not be taken in the order in which they appear and are subject to change as necessary. Other items may be added, but the Council cannot take action on such items even if the item requires emergency action without additional public notice. Non-emergency matters not contained in this agenda may come before the Council and / or its Committees for discussion, but these matters may not be the subject of formal Council or Committee action during this meeting. Council and Committee actions will be restricted to the issues specifically listed in this agenda. Any issues requiring emergency action under section 305(c) of the Magnuson-Stevens Act that arise after publication of the Federal Register Notice for this meeting may be acted upon provided that the public has been notified of the Council's intent to take final action to address the emergency. The meeting may be closed to discuss employment or other internal administrative matters.

# MEETING OVERVIEW

**ISFMP Policy Board**
**Thursday October 21, 2021**
**12:45 – 4:35 p.m.**
**Webinar**

A portion of this meeting will be held with the Mid-Atlantic Fishery Management Council (MAFMC).

| Chair: Pat Keliher (ME)<br>Assumed Chairmanship: 10/19 | Vice Chair: Spud Woodward (GA) | Previous Board Meetings:<br>August 5, 2021 |
|---|---|---|
| Voting Members: ME, NH, MA, RI, CT, NY, NJ, PA, DE, MD, DC, PRFC, VA, NC, SC, GA, FL, NMFS, USFWS (19 votes) | | |

**2. Board Consent**

- Approval of Agenda
- Approval of Proceedings from August 6, 2021

**3. Public Comment –** At the beginning of the meeting public comment will be taken on items not on the agenda. Individuals that wish to speak at this time must sign-in at the beginning of the meeting. For agenda items that have already gone out for public hearing and/or have had a public comment period that has closed, the Board Chair may determine that additional public comment will not provide additional information. In this circumstance the Chair will not allow additional public comment on an issue. For agenda items that the public has not had a chance to provide input, the Board Chair may allow limited opportunity for comment. The Board Chair has the discretion to limit the number of speakers and/or the length of each comment.

**The below agenda item (4) will be considered with the MAFMC.**

| **4. Update on Draft Addendum/Framework on Harvest Control Rule for Bluefish, Summer Flounder, Scup, and Black Sea Bass (1:00- 3:00 p.m.)** |
|---|
| **Background**<br>• After reviewing nine topics that were either recommended by the Recreational Management Reform Initiative Steering Committee or by stakeholders through scoping for two separate ongoing amendments, the Council and Board agreed to initiate a joint framework/addendum and a joint amendment to address several recreational issues. During the February 2021 meeting, the Council and Policy Board prioritized development of the harvest control Rule as the first step in addressing recreational reform.<br>• A joint Plan Development Team (PDT) and Fishery Management Action Team (FMAT) has been developing the Recreational Harvest Control Rule Framework/Addendum as part of the Recreational Reform Initiative. The PDT/FMAT recommendations for the management options have been incorporated into the Draft Addendum document |

| |
|---|
| (**Briefing Materials)** but have identified additional recommendations for the Board and Council's review in a memo to the Board and Council (**Briefing Materials**). Lastly, the PDT/FMAT requests additional time to fully develop the options and to further develop two statistical models which can be used to inform the recreational measure setting process for the framework/addendum (**Briefing Materials**). |
| **Presentations**<br>• Staff will present progress on the Draft Amendment/Framework |
| **Board/Council discussion at this meeting**<br>• Provide feedback to the PDT regarding recommendations outline in the memo to the Board and Council |

| **5. Executive Committee Report (3:00-3:15 p.m.)** |
|---|
| **Background**<br>• The Executive Committee will meet on October 20, 2021 |
| **Presentations**<br>• P. Keliher will provide an update of the Executive Committee's work |
| **Board action for consideration at this meeting**<br>• none |

| **6. Review Management and Science Committee Tasks to address Conservation Equivalency Concerns (3:15-3:45 p.m.)** |
|---|
| **Background**<br>• The Executive Committee raised questions and concerns regarding the use of conservation equivalency in Commission FMPs. The Committee tasked a subgroup to create a list of tasks for the Management and Science Committee to address general concerns that have been raised either through the Executive Committee or species management boards, e.g. Atlantic striped bass. The subgroup develop a list of tasks for the MSC to consider (**Supplemental Materials**). |
| **Presentations**<br>• T. Kerns will present the list of tasks for the MSC |
| **Board discussion at this meeting**<br>• Provide feedback on MSC tasks |

| **7. Presentation of NOAA Fisheries Efforts and Next Steps to Reduce Sea Turtle Bycatch in Several Trawl Fisheries in the Greater Atlantic Region, including Summer Flounder, Atlantic Croakers and Longfin Squid (3:45-4:15 p.m.)** |
|---|
| **Background**<br>• NOAA Fisheries has been considering ways to reduce sea turtle bycatch in several trawl fisheries in the Greater Atlantic Region, including summer flounder, longfin squid, and Atlantic croaker. Research with the industry on various gear modifications that could reduce turtle mortality has been ongoing for several years. |

**Presentations**

- M. Pentony will present NOAA Fisheries efforts and next steps to reduce sea turtle bycatch in the Greater Atlantic Region

**Board action for consideration at this meeting**

- None

**8. Update on East Coast Climate Change Scenario Planning Initiative (4:15-4:20 p.m.)**

**Background**

- In November 2020, the Northeast Region Coordinating Council (NRCC) initiated a region-wide scenario planning initiative. Through this East Coast Climate Change Scenario Planning Initiative, fishery managers and scientists are working collaboratively to explore jurisdictional and governance issues related to climate change and shifting fishery stocks.
- The specific focus of this scenario project is (i) to assess how climate change might affect stock distribution, availability and other aspects of east coast marine fisheries over the next 20 years, and (ii) to identify what this means for effective future governance and fisheries management.
- The Core Team conducted a series of webinars that introduced the East Coast Fisheries Climate Change Scenario Planning Initiative.

**Presentations**

- T. Kerns will provide an update of the initiative

**Board action for consideration at this meeting**

- None

**9. Review Non-Compliance Findings, if Necessary Action**

**10. Other Business**

**11. Adjourn**

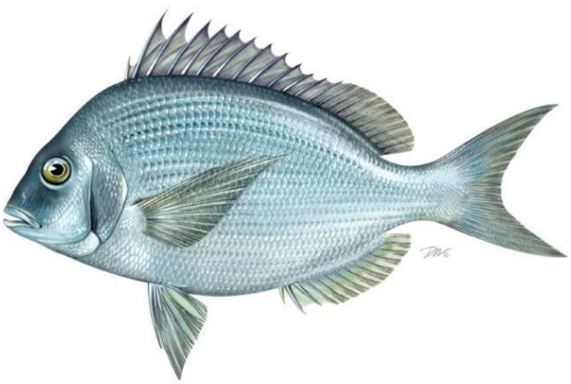
**Draft Addendum for Public Comment**

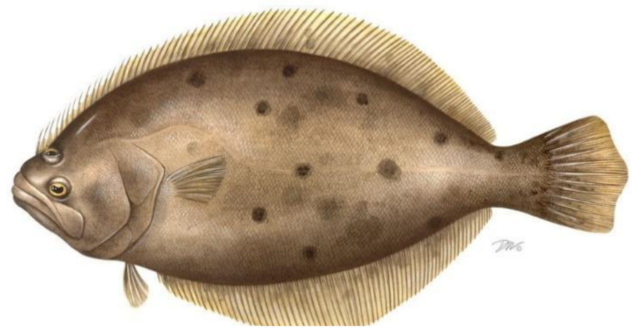
# *Atlantic States Marine Fisheries Commission*

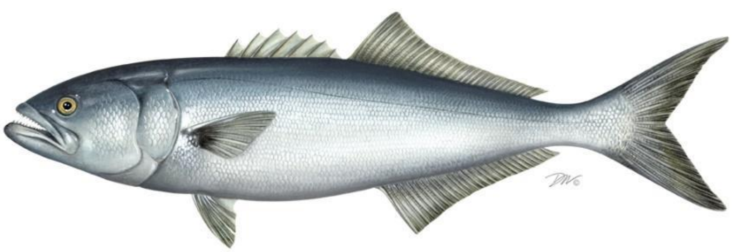
## DRAFT OMNIBUS ADDENDUM TO THE FISHERY MANAGEMENT PLANS FOR SUMMER FLOUNDER, SCUP, AND BLACK SEA BASS, AND BLUEFISH FOR PUBLIC COMMENT

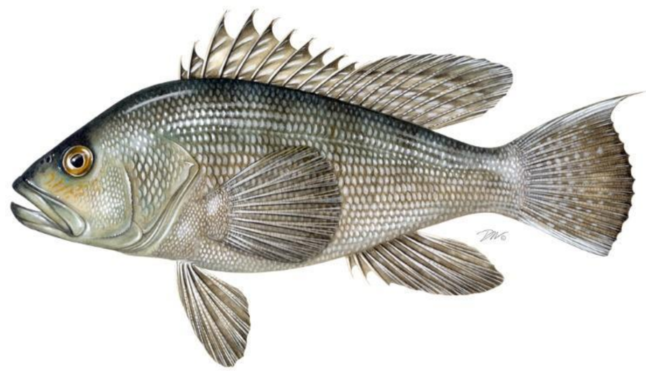
***Harvest Control Rule for Recreational Management***

***This action is being developed with the Mid-Atlantic Fishery Management Council.***









**This draft document was developed for Policy Board review and discussion. This document is not intended to solicit public comments. Comments on this draft document may be given at the appropriate time on the agenda during the scheduled Policy Board and Council meeting. If approved, a public comment period will be established to solicit input on the issues contained in the document.**

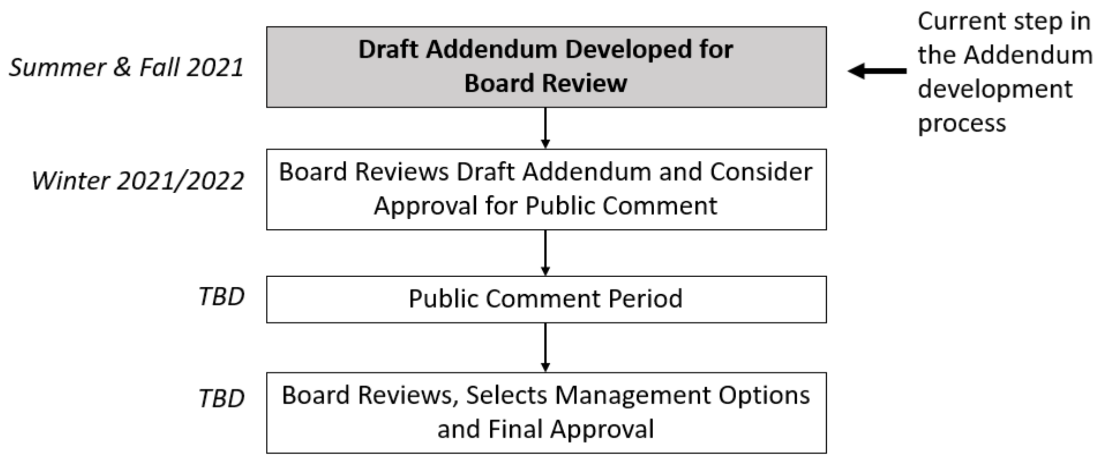
**October 2021**

ATLANTIC STATES MARINE FISHERIES COMMISSION

**Sustainable and Cooperative Management of Atlantic Coastal Fisheries**

**Public Comment Process and Proposed Timeline**

In October 2020, the Atlantic States Marine Fisheries Commission's (Commission's) Summer Flounder, Scup, and Black Sea Bass Management Board (Board) and the Mid-Atlantic Fishery Management Council (Council) initiated a draft addendum (for the Commission) and framework action (for the Council) to address management of the recreational summer flounder, scup, black sea bass, and bluefish fisheries. This Draft Addendum and the Council's framework considers modifications to the process for setting recreational bag, size, and season limits (i.e., "recreational measures") for all four species. The Draft Addendum and the Council's framework action will consider an identical set of options. This document presents background on recreational management for these species and a range of options to set recreational measures for public consideration and comment. The addendum process and expected timeline are below.




The public is encouraged to submit comments regarding this document at any time during the public comment period. The final date comments will be accepted is DATE TBD at 11:59 p.m. Comments may be submitted at state public hearings or by mail, email, or fax. If you have any questions or would like to submit a comment, please use the contact information below. **All comments will be made available to both the Commission and Council for consideration; duplicate comments do not need to be submitted to both bodies.**

Mail: Dustin Colson Leaning, FMP Coordinator
Atlantic States Marine Fisheries Commission
1050 North Highland Street, Suite 200 A-N
Arlington, VA 22201

Email: comments@asmfc.org
(Subject: Draft Addendum XXXIV)
Phone: 703.842.0740
FAX: 703.842.0741

**Tips for Providing Public Comment**

We value your input, and to be most effective we request that your comment include specific details as to why you support or oppose a particular proposed management option. Specifically, address the following:

- Which proposed options/sub-options do you support, and which options/sub-options do you oppose?
- Why do you support or oppose the option(s)?
- Is there any additional information you think should be considered?

**Table of Contents**

## 1.0 Introduction

Summer flounder, scup, black sea bass, and bluefish fisheries are managed cooperatively by the Commission in state waters (0-3 miles), and by the Council and NOAA Fisheries in Federal waters (3-200 miles). The management unit for summer flounder in US waters is the western Atlantic Ocean from the southern border of North Carolina northward to the US-Canadian border. The management unit for scup and black sea bass in US waters is the western Atlantic Ocean from Cape Hatteras, North Carolina north to the Canadian border. Bluefish are managed in US waters along the entire eastern US coast, from Maine to Florida.

The Council and Commission jointly agree to recreational annual catch limits (ACLs) and recreational harvest limits (RHLs) for all four species. They also jointly agreed to the overall approach to setting recreational bag, size, and season limits (i.e., recreational measures). Recreational measures in state waters are determined through the Commission process. The current process for setting recreational measures in state waters for summer flounder and black sea bass was established in 2018 through Addendum XXXII to the Summer Flounder, Scup, and Black Sea Bass FMP. Amendment 1 to the Bluefish FMP established a process for setting recreational measures for bluefish.

In October 2020, the Commission's Policy Board and the Mid-Atlantic Fishery Management Council approved the following motion:

> *Move to initiate a joint framework/addendum to address the following topics for summer flounder, scup, black sea bass, and bluefish, as discussed today:*
>
> - *Better incorporate MRIP uncertainty into management*
> - *Develop guidelines for maintaining status quo measures*
> - *Develop a process for setting multi-year measures*
> - *Consider changes to the timing of federal waters measures recommendations*
> - *Harvest control rule*
>
> *and to also initiate an amendment to address recreational sector separation and recreational catch accounting such that scoping for the amendment would be conducted during the development of the framework/addendum.*

During their February 2021 meeting, the Council and Policy Board prioritized development of the harvest control Rule referenced in the motion above prior to further development of the other topics. This Draft Addendum and the Council's framework address only the harvest control Rule; however, as described in more detail in later sections of this document, considerations related to uncertainty in the MRIP data, guidelines for status quo measures, and multi-year measures are incorporated into many of the options.

The Draft Addendum and the Council's framework propose different options for setting recreational measures for summer flounder, scup, black sea bass, and bluefish.

> **The goal of this Draft Addendum and the Council's framework is to establish a process for setting recreational bag, size, and season limits for summer flounder, scup, black**

**sea bass, and bluefish such that measures aim to prevent overfishing, are reflective of stock status, appropriately account for uncertainty in the recreational data, take into consideration angler preferences, and provide an appropriate level of stability and predictability in changes from year to year.**

## 2.0 Overview

### 2.1 Statement of Problem

The Commission and Council face a number of challenges with regard to setting recreational management measures for summer flounder, scup, black sea bass, and bluefish. As described in more detail in section 2.2, recent challenges have included concerns related to uncertainty and variability in the recreational fishery data and the need to change measures, sometimes annually, based on those data, as well as the perception that measures are not reflective of current stock status. In addition, management measures have not always had their intended effect on overall harvest.

The purpose of this document is to consider a management approach called a harvest control rule to establish a process for setting recreational bag, size, and season limits for summer flounder, scup, black sea bass, and bluefish such that measures aim to prevent overfishing, are reflective of stock status, appropriately account for uncertainty in the recreational data, take into consideration angler preferences, and provide an appropriate level of stability and predictability in changes from year to year. A harvest control rule relies less on expected fishery performance and instead uses a more holistic approach with greater emphasis on traditional and non-traditional stock status indicators and trends.

Addendum XXXII established an interim management approach that addressed several key management objectives and served as a foundation for broad-based, long-term management reform. The Policy Board and Council are addressing ongoing management challenges and objectives via comprehensive, long-term management reforms over the next several years starting with this document. Those actions will draw upon improved recreational fishery data[1], new stock assessments, and innovative management tools.

### 2.2 Background

For all four species, recreational ACLs are set under the joint management program with the Council. The ACL accounts for landings and dead discards. An RHL for each species is set equal to the ACL minus expected dead discards. Recreational measures (i.e., bag, size, and season limits) are set with the goal of preventing RHL overages. In preventing RHL overages, these measures also aim to prevent ACL overages.

[1] MRIP is an evolving program with ongoing improvements to its methods. Several recent advancements including the transition from a telephone survey to a mail survey to estimate fishing effort have resulted in the need to calibrate estimates of recreational catch and effort for 1981–2017 for comparison to newer estimates. In addition, the MRIP harvest estimates for 2018 need to be “back-calibrated” for comparison to the 2018 and interim 2019 RHLs, because these RHLs were based on stock assessment using the pre-calibrated MRIP harvest estimates.

The ACLs and RHLs are revised each time new stock assessment information becomes available and are based on stock assessment projections, considerations related to scientific uncertainty, and commercial/recreational allocations. The RHLs also account for management uncertainty and assumptions about dead discards. Assumptions about discards also impact the ACLs for summer flounder and black sea bass due to the landings-based commercial/recreational allocations for those species, as opposed to the catch-based allocations for scup and bluefish.

The methods used to determine which measures will prevent RHL overages are not specified in the FMPs and can be modified based on annual recommendations from the Council's Monitoring Committees and the Commission's Technical Committees. Marine Recreational Information Program (MRIP) harvest data from one or more recent years are typically used to predict the impacts of changes in bag, size, or season limits on harvest. For summer flounder, scup, and black sea bass, this analysis has typically relied heavily on preliminary, incomplete current year data and assumptions based on trends in MRIP data from one or more previous years. For bluefish, this analysis typically considered multi-year averages of final, full-year MRIP data. The bluefish measures remained unchanged for many years and RHL overages through 2019 were rare. Measures for summer flounder, scup, and black sea bass changed much more frequently. In addition, summer flounder and black sea bass harvest approached or exceeded the RHL more frequently than for the other species. For these reasons, the Monitoring and Technical Committees felt it was appropriate to rely on the most recent MRIP data, including preliminary current-year data for summer flounder, scup, and black sea bass and to use a multi-year average of final, full-year data for bluefish.

The analysis for all four species typically relied on the assumption that if the recreational measures remained unchanged, then next year's harvest would be similar to harvest in the current year or a recent year average. If unchanged measures were expected to result in harvest notably above or below the RHL, then the measures were adjusted to achieve a desired percent liberalization or reduction in harvest based on an analysis of trends shown in previous years' MRIP data.

Because the bluefish specification process typically did not use preliminary current year data, and because measures remained unchanged for several years, decisions on bluefish recreational measures were typically made in August, when the Board and Council usually jointly approve the recreational ACL and RHL for the upcoming year. However, in recent years, the bluefish RHL has been more constraining and recreational measure setting has begun to follow the approach taken for summer flounder, scup, and black sea bass.

The summer flounder, scup, and black sea bass ACLs and RHLs for the upcoming year are also typically approved in August; however, the approach for setting recreational measures is usually not recommended until December to allow for consideration of preliminary current year data though August. In December, the Council and Board typically agree to the overall approach for recreational measures for summer flounder, scup, and black sea bass (e.g., status quo or an overall percentage liberalization or reduction), as well as the federal waters measures. State waters measures are typically approved by the Board in February of the following year.

This process has resulted in management challenges for several reasons. As previously stated, for all four species, the RHLs changed each time new stock assessment information became available. For recreational fisheries that tend to harvest close to, and sometimes more than, their RHL (primarily summer flounder and black sea bass), this resulted in a frequent need to change the recreational bag, size, and season limits to prevent future RHL overages. This was sometimes exacerbated by the reliance on a single year of MRIP data in the analysis of management measures as MRIP data can show variable harvest from one year to the next, even under the same management measures. The required changes in management measures sometimes felt more like a response to variability and uncertainty in the MRIP data than a clear conservation need. This challenge has been referred to as "chasing the RHL." In addition, many recreational stakeholders expressed frustration that the black sea bass measures did not seem reflective of stock status as they have generally been more restrictive in recent years than when the stock was under a rebuilding plan, despite the stock currently being more than double the target level and highly available to anglers.

Although the scup and bluefish recreational measures were able to remain largely unchanged for many years (prior to 2020 for bluefish), the Policy Board and Council agreed that solutions to these challenges should be developed in such a way that they could apply to all four jointly managed species to allow for consistency in management approaches.

The bluefish stock was declared overfished in 2019, triggering the development of a rebuilding plan and a need for more restrictive management measures than had previously been in place. The options in this document include special considerations for stocks in a rebuilding plan. The options in this document are not meant to replace the bluefish rebuilding measures. Any measures implemented for bluefish must comply with the rebuilding plan.

## 2.3 Status of the Stocks

### 2.3.1 Summer Flounder

The most recent summer flounder management track stock assessment was completed in June 2021, using data through 2019 (NEFSC 2021a). The assessment approach is a complex statistical catch-at-age model incorporating a broad array of fishery and survey data. Results from the 2021 assessment indicate that the summer flounder stock was not overfished, but was 14% below the biomass target, and overfishing was not occurring, in 2019 (**Figure 1**). Fishing mortality was 20% below the threshold level defining overfishing. More detail on the assessment can be found in the draft report provided to the SSC.

The 2021 management track stock assessment provided the basis for setting fishery specifications for 2022–2023.

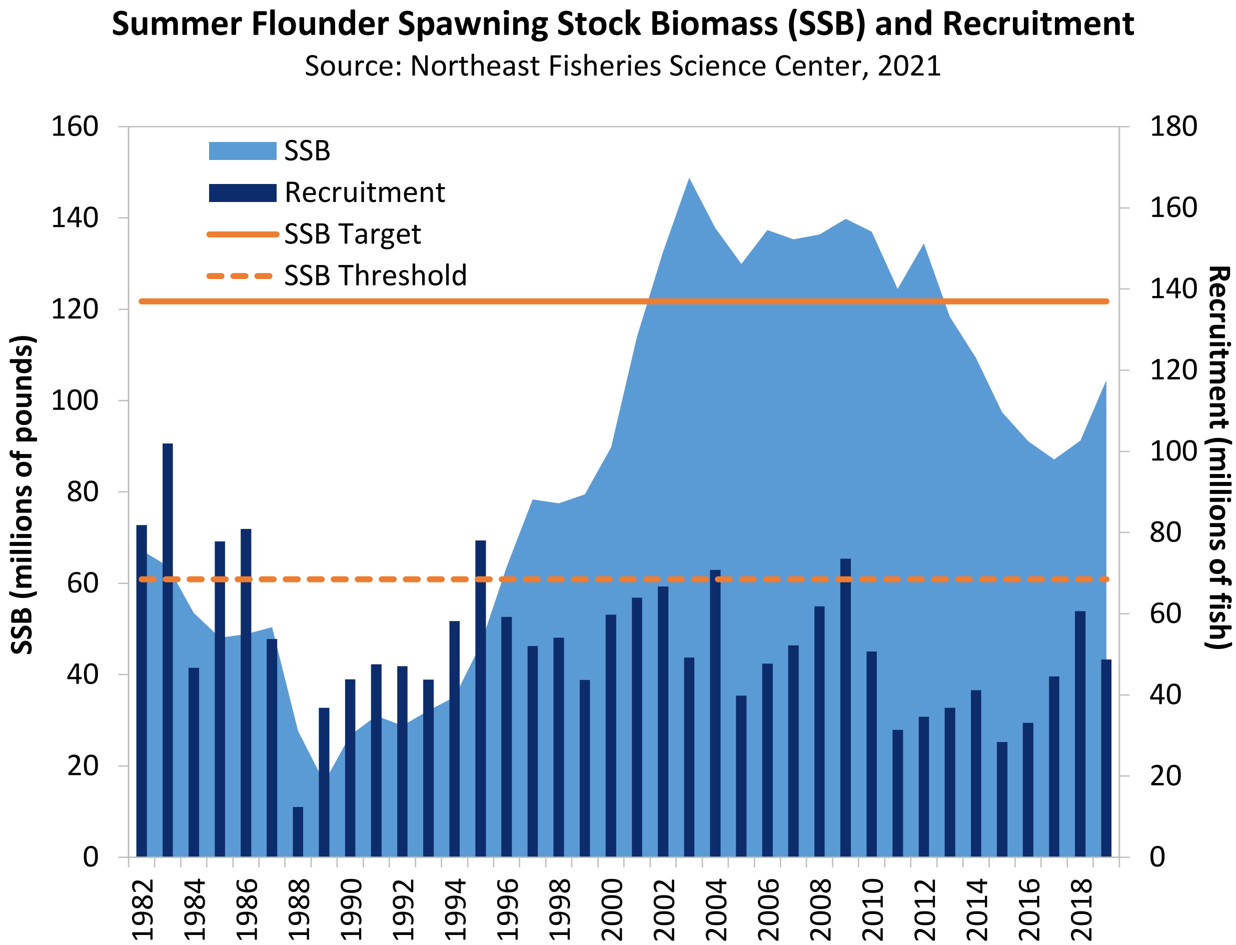



**Figure 1.** Summer flounder spawning stock biomass and recruitment. Source: 2021 Operational Assessment Prepublication Report, Northeast Fishery Science Center.

**2.3.2 Scup**

The most recent scup management track stock assessment was completed in June 2021, using data through 2019 (NEFSC 2021b). The assessment approach is a complex statistical catch-at-age model incorporating a broad array of fishery and survey data. Results from the 2021 assessment indicate that the scup stock was not overfished and was about two times the biomass target, and overfishing was not occurring, in 2019 (**Figure 2**). Fishing mortality was 32% below the threshold level defining overfishing. More detail on the assessment can be found in the draft report provided to the SCC.

The 2021 management track stock assessment provided the basis for setting fishery specifications for 2022–2023.

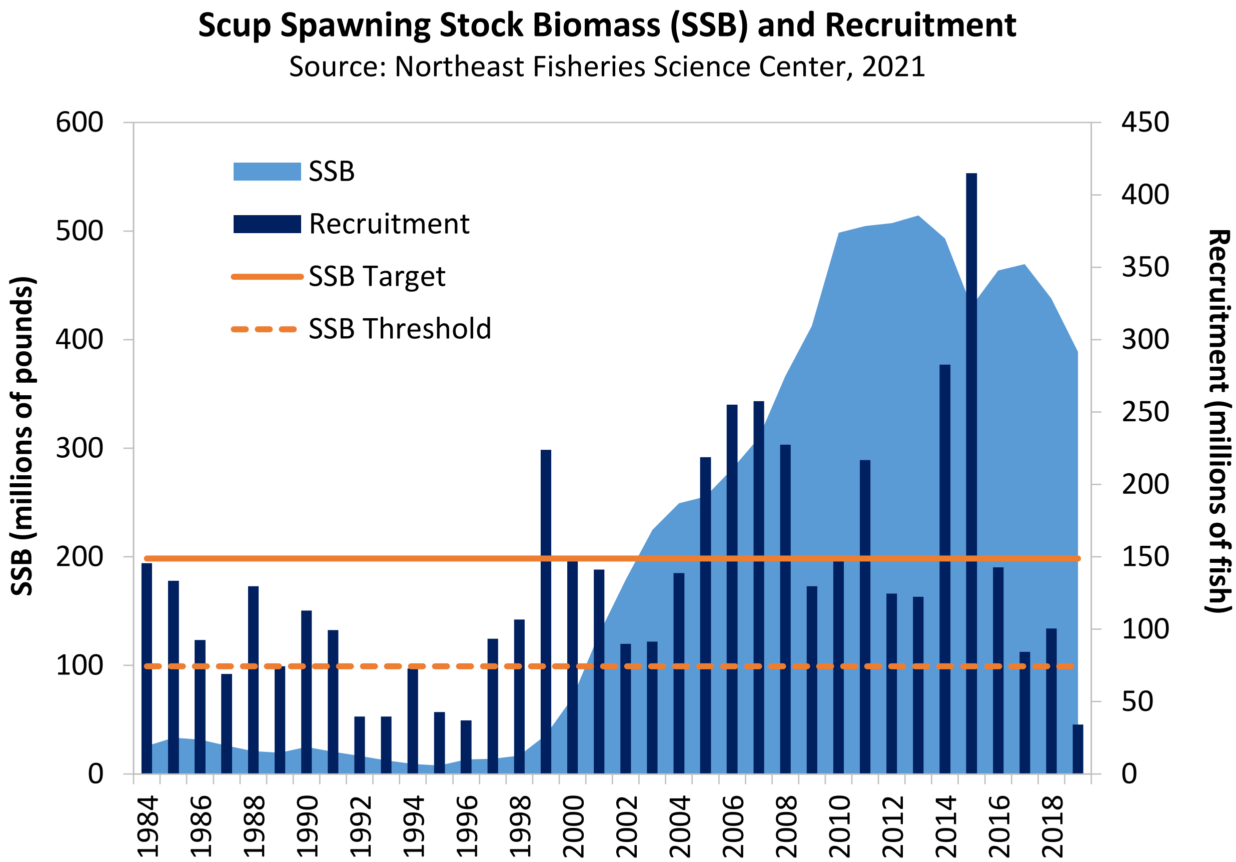



**Figure 2.** Scup spawning stock biomass and recruitment. Source: 2021 Operational Assessment Prepublication Report, Northeast Fishery Science Center.

### 2.3.3 Black Sea Bass

The most recent black sea bass stock assessment update was completed in July 2021, using data through 2019 (NEFSC 2021c). The assessment used a combined-sex, age-structured assessment model. The assessment modeled black sea bass as two separate sub-units (North and South) divided approximately at Hudson Canyon, from which results were combined for the coastwide stock status determination. Results from the 2021 assessment indicate that the black sea bass stock was not overfished and was about 2.2 times the target level, nor was overfishing occurring, in 2019 (**Figure 3**). Fishing mortality was 15% below the threshold level defining overfishing. The assessment required an adjustment to account for the significant retrospective pattern. This adjustment was only applied to the terminal year of the assessment and the adjusted values are used for management. Of the four species considered in this action, only black sea bass required a retrospective adjustment in the assessment. More detail can be found in the draft report provided to the SSC.

The 2021 management track stock assessment provided the basis for setting fishery specifications for 2022–2023.

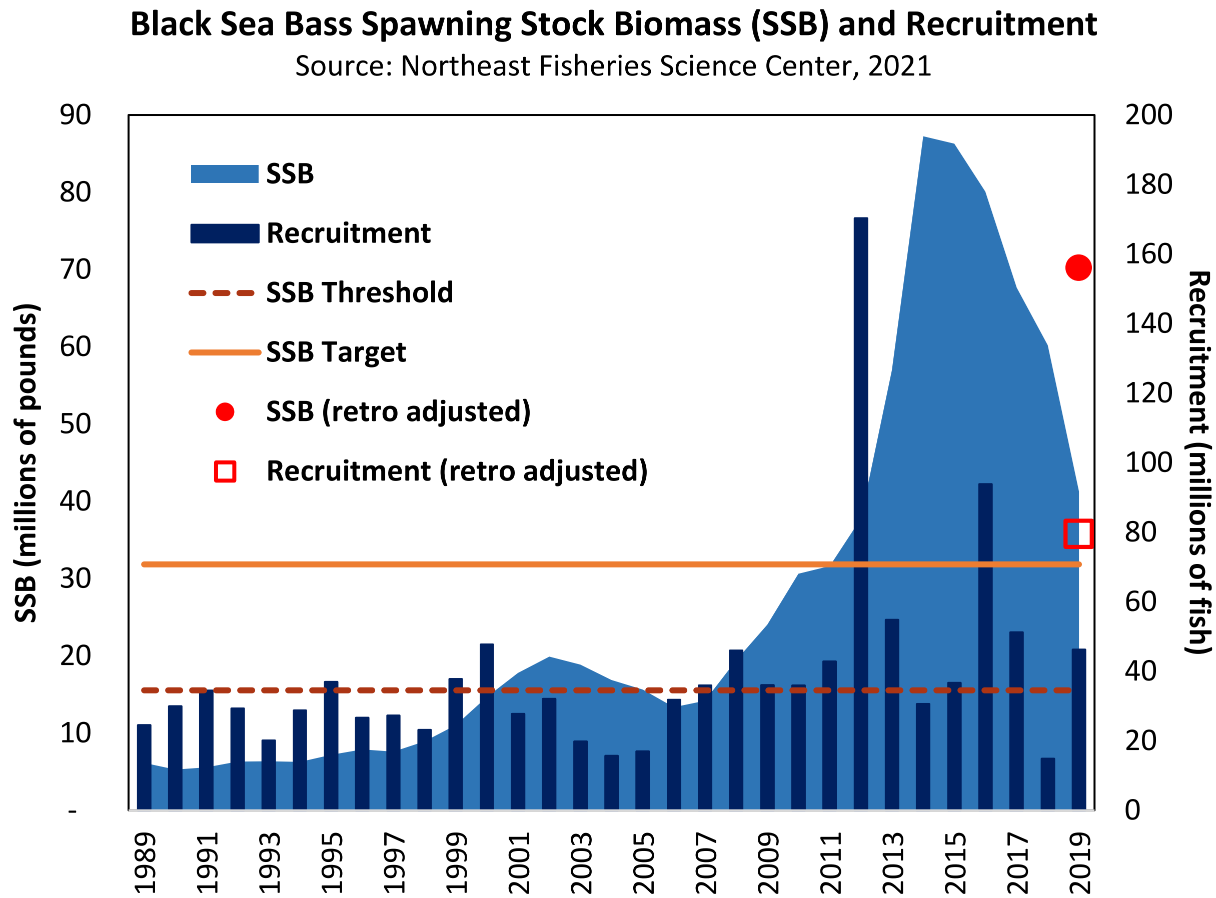



**Figure 3.** Black sea bass spawning stock biomass and recruitment with retrospective adjusted values to account for internal error. Source: 2021 Operational Assessment Prepublication Report, Northeast Fishery Science Center.

### 2.3.4 Bluefish

The most recent bluefish management track stock assessment was completed in June 2021, using data through 2019 (NEFSC 2021d). The assessment approach is a complex statistical catch-at-age model incorporating a broad array of fishery and survey data. Results from the 2021 assessment indicate that the bluefish stock was overfished and was 5% below the overfished threshold, but overfishing was not occurring in 2019 (**Figure 4**). Fishing mortality was 5% below the threshold level defining overfishing. More detail on the assessment can be found in the draft report provided to the SCC.

The 2021 management track stock assessment along with the preferred rebuilding plan selected jointly by the Board and Council at their June meeting in 2021 provided the basis for setting fishery specifications for 2022–2023.

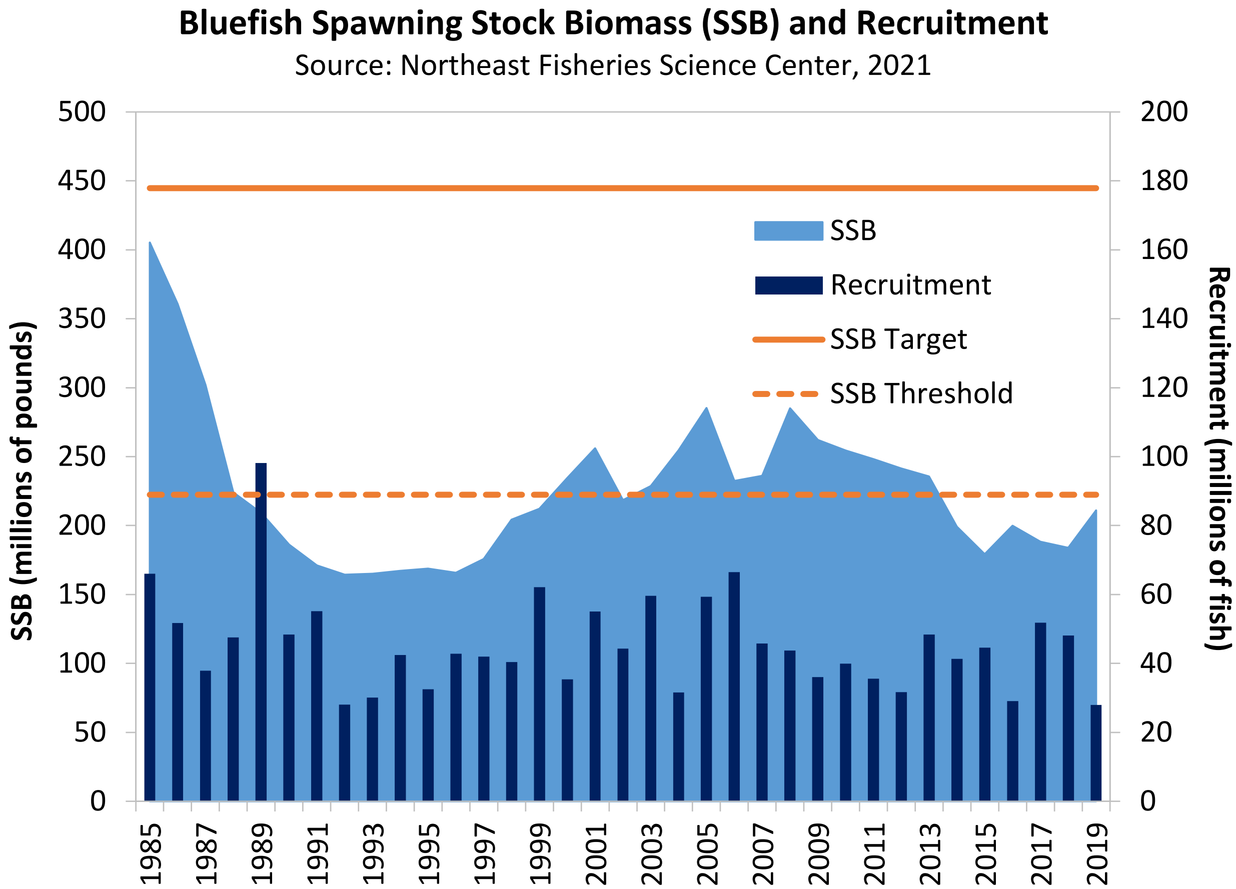



**Figure 4.** Bluefish spawning stock biomass and recruitment. Source: 2021 Operational Assessment Prepublication Report, Northeast Fishery Science Center.

## 2.4 Status of the Fishery

### 2.4.1 Summer Flounder

Recreational harvest peaked in 1983 at 36.74 million pounds, and declined to a time series low of 5.66 million pounds in 1989. A more recent review of recreational fishery performance from 2011 to present reveals an average of 12.59 million pounds with a high of 19.41 million pounds in 2013 and a low of 7.60 million pounds in 2018. Recreational harvest in 2020 was 10.06 million pounds, a 29% increase from the prior year's harvest of 7.80 million pounds. The total recreational catch (harvest plus live and dead releases) of summer flounder in 2020 was 33.32 million fish, slightly lower than the time series average of 34.46 million fish. The assumed discard mortality rate in the recreational fishery is 10%. In 2020, an estimated 80% of the harvest (in numbers of fish) originated from private/rental boats, while shore-based anglers and party/charter boats accounted for an average of 18% and 2% of the harvest, respectively. In addition, 61% of summer flounder harvested by recreational fishermen (in numbers of fish) were caught in state waters and about 39% in federal waters.

### 2.4.2 Scup

Most recreational scup catches are taken in states of Massachusetts through New York. From 2011 to 2020, recreational harvest has ranged from 8.27 million pounds in 2012 to 14.12 million pounds in 2019. In 2020, recreational harvest was 12.91 million pounds. The total catch (harvest plus releases) of scup in 2020 were 27.27 million fish, slightly higher than the ten year average of 27.07 million fish. The assumed discard mortality rate in the recreational fishery is 15%. In 2020, an estimated 62% of the harvest (in numbers of fish) originated from private/rental boats, while shore-based anglers and party/charter boats accounted for an average of 28% and 10% of the harvest, respectively. In addition, 90% of scup harvested by recreational fishermen (in numbers of fish) were caught in state waters and about 10% in federal waters.

### 2.4.3 Black Sea Bass

After a drastic peak in 1986 at 11.19 million pounds, recreational harvest averaged 5.02 million pounds annually from 1987 to 1997. Recreational harvest limits were put in place in 1998 and harvest generally increased from 1.92 million pounds in 1998 to 9.06 million pounds in 2015. In 2016 and 2017 harvest jumped up to 12.05 and 11.48 million pounds, respectively; however the 2016 and 2017 estimates are regarded as implausibly high outliers by the Technical Committee. In 2020, recreational harvest was estimated at 9.12 million pounds with recreational live discards from Maine to Virginia estimated to be 29.79 million fish. Assuming 15% hook and release mortality, estimated recreational dead discards are 4.47 million fish, equal to 51% of the total recreational removals (harvest plus dead discards).

### 2.4.4 Bluefish

From 2011-2020, recreational catch (harvest plus fish caught and released) of bluefish in U.S. waters of the Atlantic coast averaged 44.46 million fish annually. In 2020, recreational catch was estimated at 30.68 million fish. In 2020, recreational anglers harvested an estimated 9.34 million fish weighing 13.58 million pounds (6,160 metric tons). Harvest during 2018-2020 was exceptionally low compared to the ten year average of 25.69 million lbs. The 2020 average weight of landed fish is 1.45 pounds, which is also lower than the ten year average of 1.65 pounds. This lower average weight is due to the regional distribution of state landings in 2020. The majority of the recreational harvest (pounds) came from Florida (42%), North Carolina (16%), New Jersey (13%), and New York (11%). Fish from southern states (NC-FL) made up 59% of the landings and are typically smaller on average than fish caught in northern states (ME-VA). In 2020, recreational dead releases (15% of released alive fish) were estimated at 3.20 million fish.

## 3.0 Proposed Management Program

As a step towards broad-based management reform, the Board and Council are considering changing the process of how recreational management measures are set. The Board and Council are seeking public comment on each of the options included in this Draft Addendum. As previously stated, the Council is considering the same options through a framework action.

These management changes are considered through the management programs of the Commission and the Council. The Council is bound by the requirements of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), including requirements for ACLs, accountability measures, and prevention of overfishing. NOAA Fisheries will not approve measures that are inconsistent with the MSA. NOAA Fisheries provides guidance throughout development of Council actions to ensure that the preferred options selected for implementation are consistent with the MSA and other applicable laws.

As proposed, a single option would be selected for all four species. It is not intended that one harvest control rule option would be used for some species and a different option for others. All harvest control rule approaches involve various combinations of input metrics, flexibilities, and accountability measures with the goal of standardizing management measure setting and providing stability to these recreational fisheries. A table for comparison across all options can be found in Appendix 1 ***[to be included with supplemental briefing materials for Oct 21 Policy Board and Council meeting]***.

Stocks under an approved rebuilding plan are subject to the measures of that rebuilding plan, which may differ from the measures under the options below. None of the options in this document are meant to replace rebuilding plan measures. In some instances, measures implemented through the options below may be used as temporary measures until a rebuilding plan is implemented, which can take up to two years after the stock is declared overfished. Once a stock is no longer in a rebuilding plan, measures may be set using the options below.

### 3.1 Management Options to Set Recreational Management Measures

**A. Status Quo (Current Recreational Measures Setting Process)**

Section 2.2 describes the process used in recent years to set recreational measures. The details of this process are not defined in the FMPs and can be modified without an addendum or other change to the FMPs. For example, it is not required that preliminary current year MRIP data be used for summer flounder, scup, and black sea bass and that a multi-year average of final full-year data be used for bluefish. The Monitoring and Technical Committees have considerable flexibility in how they use the data to recommend measures aimed at preventing RHL and ACL overages. The following sections summarize the language currently in the Commission's FMPs regarding recreational measures for each species. Under the no action option, these sections of the FMPs could remain unchanged[2].

[2] Under the no action option, predicted harvest under any combination of measures could continue to rely on the methods described above, or option methods could be used if deemed appropriate. For example the Council and Commission are supporting the development of statistical models for predicting harvest based on management measures and other factors. These models could be used under the no action option.

**1. Summer Flounder**

As outlined in section 3.1 of Addendum XXXII, management measures are set annually through a specification process. The process involves the following steps:

- At the joint meeting with the Council typically in December, the Board and Council will decide whether to specify coastwide measures to achieve the coastwide RHL or conservation equivalent management measures using guidelines agreed upon by both management authorities. If the latter, the Board will then be responsible for establishing recreational measures to constrain harvest to the RHL.
- The Technical Committee (TC) will continue to evaluate harvest estimates as they are released, and project how suites of possession limits, size limits and seasons might impact recreational landings in each region. In recommending adjustments to measures (reductions, liberalizations or no change), the TC will examine several factors and suggest a set of regional regulations, which when combined, would not exceed the RHL. These factors could include but are not limited to stock status, resource availability (based on survey and assessment data), and fishery performance (harvest, discards, effort, estimate uncertainty, inter-annual variability), as well as the standards and guiding principles set forth below. The Board will use information provided by the TC to approve a methodology for the states to use in developing regional proposals, typically at the Commission's Winter Meeting.
- The states will collaborate to develop regional proposals for the current year's recreational measures that include possession limits, size limits and season length pursuant to the Board-approved methodology. These proposals will be reviewed by the TC to ensure the data and analysis are technically sound.
- **The Board will review proposals, TC recommendations, and establish final measures at the Commission's winter meeting.** Once the Board has approved the measures and the states have promulgated them, the Commission will send a letter to the Regional Administrator certifying the Board approved measures, in combination, will achieve but not exceed the RHL.

The Board also uses a set of standards and guiding principles to structure the development of measures during specification setting (Addendum XXXII Section 3.1.1).

**2. Scup**

Management measures are set annually through a specifications process. The process typically involves the following steps:

- At the joint meeting with the Council typically in December, the Board and Council will determine whether to maintain status quo coastwide measures or a liberalization or reduction in measures are needed to achieve the coastwide RHL.

- States will then proceed to develop proposals, typically the states MA-NY, but other states could have adjustments, for the upcoming year's recreational measures that include possession limits, size limits and season length. These proposals will be reviewed by the TC to ensure the data and analysis are technically sound.
- The Board will review state proposals, TC recommendations, and establish final measures at the Commission's winter meeting.

**3. Black Sea Bass**

As outlined in section 3.2 of Addendum XXXII, management measures are set annually through a specification process. The process involves the following steps:

- At the joint meeting with the Council typically in December, the Board and Council will decide whether to adopt coastwide measures or if the states will implement measures to constrain harvest to the RHL. If the latter, the Board will then be responsible for establishing recreational measures to be implemented in state waters to constrain harvest to the RHL.
- The TC will continue to evaluate harvest estimates as they are released, and project how suites of possession limits, size limits and seasons might impact recreational landings in each region. In recommending adjustments to measures (reductions, liberalizations or no change), the TC will examine several factors and suggest a set of regulations for regions, which when combined, would not exceed the RHL. These factors can include but are not limited to stock status, resource availability (based on survey and assessment data), and fishery performance (harvest, discards, effort, estimate uncertainty, inter-annual variability), as well as the standards and guiding principles set forth below. The Board will use information provided by the TC to approve a methodology for the states to use in developing regional proposals, typically at the Commission's Winter Meeting.
- The states will collaborate to develop regional proposals for the current year's recreational measures that include possession limits, size limits and season length pursuant to the Board-approved methodology. These proposals will be reviewed by the TC to ensure the data and analysis are technically sound
- **The Board will review state proposals, TC recommendations, and establish final measures at the Commission's winter meeting.** Once the Board has approved the measures and the states have promulgated them, the Commission will send a letter to the Regional Administrator certifying the Board approved measures in combination will achieve but not exceed the RHL.

The Board also uses a set of standards and guiding principles to structure the development of measures during specification setting (Addendum XXXII Section 3.2.1).

## 4. Bluefish

As outlined in section 5.1.4.1.3 of Amendment 1, management measures are set annually through a specifications process. The process typically involves the following steps:

- At the joint meeting with the Council typically in December, the Board will determine whether to maintain status quo coastwide measures or a liberalization or reduction in measures are needed to achieve the coastwide RHL.
- In order to achieve the annual RHL, recreational fisheries will be constrained by a coastwide regime of coastwide size limits, bag limits, and seasons. Once a basic regime for these limits is established, typically at the joint meeting with the Council in December, states will be given the opportunity to vary these measures in accordance with the Commission's Conservation Equivalency process[3].
- A state may submit a proposal for a change to its regulatory program to the Commission. Such changes shall be submitted to the ASMFC staff, which will distribute the proposal to the Management Board, the Plan Review Team, the Technical Committee, the Stock Assessment Subcommittee, and the Advisory Panel.
- States must submit proposals at least two weeks prior to a planned meeting of the Technical Committee.
- The ASMFC staff is responsible for gathering the comments of the Technical Committee, the Stock Assessment Subcommittee, and the Advisory Panel and presenting these comments to the Management Board at the Commission's winter meeting.
- The Management Board will decide whether to approve the state proposal for an option management program if it determines that it is consistent with the harvest target and the goals and objectives of the FMP.

## 5. Current Accountability Measures for Summer Flounder, Scup, Black Sea Bass, and Bluefish

The Magnuson-Stevens Fishery Conservation and Management Act requires Council FMPs to contain provisions for ACLs and "measures to ensure accountability." The National Standards Guidelines state that accountability measures (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

[3] http://www.asmfc.org/files/pub/ConservationEquivalencyGuidance_2016.pdf

and correct the problems that caused the overage in as short a time as possible." (50 CFR 600.310 (g)).

The current recreational AMs were established through an omnibus amendment in 2013 (Amendment 19 to the Summer Flounder, Scup, and Black Sea Bass FMP and Amendment 4 to the Bluefish FMP). The AMs are included in the Council's FMP. They are not included in the Commission's FMP; however, any changes to the AMs considered through this action will be considered by both the Council and Commission.

Proactive AMs include adjustments to the management measures for the upcoming fishing year (as described in previous sections), if necessary, to prevent the RHL and ACL from being exceeded. Measures to prevent the RHL from being exceeded are ultimately intended to also prevent ACL overages, which in turn prevents overfishing.

Given the timing of MRIP data availability, the regulations do not allow for in-season closure of the recreational fishery if the RHL or ACL is expected to be exceeded. Therefore, measures must be set in a manner that is reasonably expected to constrain harvest to the RHL.

Reactive recreational AMs include a set of possible responses to exceeding the recreational ACL, depending on stock status and which limits are exceeded. Paybacks of ACL overages may be required in a subsequent fishing year, depending on stock status and the scale of the overage, as described below. ACL overages in the summer flounder, scup, and black sea bass recreational fisheries are evaluated by comparing the most recent 3-year average recreational ACL against the most recent 3-year average of recreational catch (i.e., landings and dead discards). If average catch exceeds the average ACL, then the appropriate AM is determined based on the following criteria:

1. If the stock is overfished ($B < ½ B_{MSY}$), under a rebuilding plan, or the stock status is unknown:

   The exact amount, in pounds, by which the most recent year's recreational ACL has been exceeded will be deducted in the following fishing year, or as soon as possible once catch data are available.

2. If biomass is above the threshold, but below the target ($½ B_{MSY} < B < B_{MSY}$), and the stock is not under a rebuilding plan:

   a. If only the recreational ACL has been exceeded, then adjustments to the recreational management measures (bag, size, and seasonal limits) would be made in the following year, or as soon as possible once catch data are available. These adjustments would take into account the performance of the measures and conditions that precipitated the overage.

b. If the ABC is exceeded in addition to the recreational ACL, then a single year deduction will be made as a payback, scaled based on stock biomass. The calculation for the payback amount is: *(overage amount) * $(B_{MSY}$-B)/½ $B_{MSY}$*.

3. If biomass is above the target (B > $B_{MSY}$):

Adjustments to the recreational management measures (bag, size, and seasonal limits) would be considered for the following year, or as soon as possible once catch data are available. These adjustments would take into account the performance of the measures and conditions that precipitated the overage.

Reactive recreational AMs for the bluefish recreational fishery are very similar to the process described above with a few key differences. First, ACL overages are evaluated on a 1-year basis as opposed to a 3-year average. Second, if a transfer between the commercial and recreational sectors caused the transferring sector to register an ACL overage, then instead of applying an overage payback to the transferring sector, a transfer in a subsequent year would be reduced by the amount of the ACL overage.

**B. Percent Change Approach**

This option proposes a mechanism for providing 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 option differs from the no action option (status quo) in that it includes an explicit consideration of biomass compared to the target level ($B/B_{MSY}$) derived from the latest stock assessment when determining if the recreational management measures should be liberalized, reduced, or remain unchanged. The amount of change varies based on the magnitude of the difference between the average MRIP estimate from the two preceding years, including a confidence interval (CI) around that estimate, and the average RHL for the upcoming two years, as well as considerations related to $B/B_{MSY}$.

Table 1 displays the resulting pre-defined management responses associated with each outcome. Starting with the first column, the RHL for the upcoming two-year specifications period is compared to the CI[4] of the most recent two years of MRIP estimates, or an alternative predictor of harvest based on a statistical methodology, with an associated CI. The MRIP estimates are intended as a proxy for expected harvest in the upcoming years under status quo measures. Depending on whether the average RHL is above the upper bound of the CI, within the CI, or below the lower bound of the CI, the management responses are narrowed down to rows A, B, and C, respectively. The second column narrows down the suite of management responses further by taking into consideration the $B/B_{MSY}$ ratio. The third column displays the resulting

[4] When developing a CI from two years of MRIP data, the PDT/FMAT recommends the use of a joint distribution 80% confidence interval that takes into consideration the PSE of each individual years' MRIP estimate and the variability of the estimates between years. This recommendation is based on an analysis of several years of MRIP data for each species.

percent change in measures required for the upcoming two years. The percent change in measures is mirrored up and down to provide similar consideration of the need for reductions and opportunities for liberalization.

As shown in Table 1, when the RHL is within the CI under status quo measures, this approach allows for an incremental liberalization when stock status is greater than 150% of the target or an incremental reduction for stocks below the target. When the RHL is above the CI, this approach allows for liberalizations that scale in proportion to stock health. Conversely, when the RHL is below the CI, this approach requires reductions that scale with the health of the stock.

This option 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 and the potential for continued significant overages under the current allocations for some species). The FMAT/PDT is considering ways to define the appropriate starting point for each species 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.

**Table 1.** Approach to enacting changes in measures under the percent change approach. [1][5]

| Future RHL vs MRIP Estimate | | $B/B_{MSY}$ | Change in Measures | |
|---|---|---|---|---|
| Row A | Future 2-YR avg. RHL greater than upper bound of 2-YR MRIP estimate CI | > 1.5 | 40% Liberalization[3] | |
| | | 1 - 1.5 | 20% Liberalization[3] | |
| | | < 1 | 0% (Status Quo) | |
| Row B | Future 2-YR avg. RHL within CI of 2-YR MRIP estimate | > 1.5 | 10% Liberalization | |
| | | 1-1.5 | 0% (Status Quo) | |
| | | < 1 | 10% Reduction | |
| Row C | Future 2-YR avg. RHL less than lower bound of 2-YR MRIP estimate CI | > 1.5 | 0% (Status Quo)[2] | 10% Reduction[2] |
| | | 1-1.5 | 20% Reduction[3] | |
| | | < 1 | 40% Reduction[3] | |

[1] 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.
[2] The PDT/FMAT has not yet reached consensus on a recommendation for assigning the appropriate management response when the RHL is lower than the CI and biomass is higher than 150% of the target. Two options discussed by the FMAT/PDT are listed here.
[3] The PDT/FMAT is still in the process of determining whether the change in measures be capped such that the percentage change in measures does not exceed the percentage difference between the two-year average RHL and the two-year average MRIP point estimate.

[5] The two year average MRIP estimate with associated CI is intended as a predictor of future harvest under status quo measures. This may be replaced with statistical model based approaches for predicting harvest.

***Accountability Measures under the Percent Change Approach***

Under this option, measures will be more restrictive when stock status is poor and more liberal when stock status is good. This could be considered a proactive AM. In addition, when the upcoming RHL is below the lower bound of the CI of the expected harvest estimate (either a 2 year MRIP estimate or a model-based estimate), measures will be proactively reduced by a predetermined percent when the stock is less than 150% of the target level. Reductions will also be taken if the stock is below the target even when the RHL is within the CI, helping to rebuild the stock back to the target.

This option requires minimal changes from the current reactive AMs described in section 3.1-A-5. The current reactive AMs would be modified such that when paybacks are required, the payback could be spread evenly across two years to help facilitate the use of constant measures across two years. When a payback is applied, the percent change would be determined based on the reduced ACL.

Consideration could also be given to options 6 and 7 listed in section 3.2. These options consider modifications to the metrics considered when biomass is above the threshold but below the target and a scaled payback of a past overage may be needed.

**C. Fishery Score Approach**

The fishery score is a simple formulaic method that combines multiple metrics into one easy to interpret value. Based on the score, the stock would be placed into one of four bins with corresponding management measures. A new fishery score would be calculated every two years to align with the anticipated schedule of management track stock assessments for these species. The fishery score would be based on four metrics: Biomass (B) relative to the target ($B_{MSY}$), Recruitment (R), Fishing Mortality (F), and Fishery Performance, as described in more detail below. Each metric has a weight assigned to it, determined by the Monitoring Committee such that metrics with a stronger relationship to harvest would have more weight in the fishery score while still accounting for metrics that impact harvest but may not drive harvest. Additional metrics may be added and weighting schemes adjusted as more data become, based on the recommendations of the Monitoring/Technical Committees.

The fishery score is 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. The fishery score value would correspond to a predetermined bin. For the purpose of explanation of the methodology, the fishery score will range from 1 to 5. The bins are defined as displayed in (**Error! Reference ource not found.**).

| Bin | Fishery Score | Level of Concern | Stock Status and Fishery Performance Outlook | Measures |
|---|---|---|---|---|
| 1 | 4-5 | Low Risk | Good | Most Liberal |
| 2 | 3-3.99 | Medium Risk | Moderate | Liberal |
| 3 | 2-2.99 | High Risk | Poor | Restrictive |
| 4 | 1-1.99 | Highest Risk | Very Poor | Most Restrictive |

**Table 2.** Fishery score bins and the associated level of concern, stock status, and measures that are associated with each bin.

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 and Technical Committees 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.

Measures associated with each of the four bins would aim to achieve a range of harvest that is appropriate for the stock conditions associated with each bin. The measures in each bin would be anticipated to produce a range of possible harvest values, given uncertainty and variability in the harvest data. Considerations related to confidence intervals and other statistical metrics and models could be used to define the appropriate range of expected harvest and the measures associated with each bin. Although the fishery score is calculated based on multiple factors, the measures associated with each bin could be defined based on four categories of biomass and the associated level of harvest deemed appropriate for that biomass level. The most liberal bin (bin 1, fishery score of 4-5 in the example above) could be associated with biomass greater than 150% of the target level. The next most liberal bin (bin 2, fishery score of 3-3.99) could be associated with biomass above the target, but less than 150% of the target. The next lowest bin (bin 3, fishery score of 2-2.99) could be associated with biomass below the target and above the threshold. The most restrictive bin (bin 4, fishery score less than 2) could be associated with biomass below the threshold (however; if the stock is under a rebuilding plan, the most restrictive fishery score measures may be temporary until replaced by rebuilding plan measures). Although the measures associated with each bin would be based on biomass compared to the target, placement of a year's measures within one of the four bins would be driven by multiple factors. For example, if the recruitment and fishery performance metrics have low scores, then the stock may be placed in a more restrictive bin with more restrictive measures than would occur based on biomass considerations alone. The opposite could occur if multiple metrics have high scores. In this way, the measures would be reflective of a combination of biomass relative to the target and assumed future conditions (e.g., high recruitment assumed to result in higher biomass in the future, allowing for more liberal measures).

***Determining Metric Values***

The following section provides an example of how the metrics listed above could be used to generate a fishery score value ranging from 1 to 5.

***$B/B_{MSY}(W_B)$***

Biomass from the most recent stock assessment would be given a value of 1-5 based on the following criteria, which are loosely based on other aspects of the management program (e.g., the Council's risk policy).

- 5: Biomass is equal to or greater than 150% of the target
- 4: Biomass is less than 150% of the target, and equal to or greater than the target
- 3: Biomass is below the target, and equal to or greater than 75% of the target
- 2: Biomass is below 75% of the target, and equal to or above the threshold (which is ½ the target and defines an overfished state)
- 1: Biomass is below the threshold

***$F/F_{MSY}(W_F)$***

The proposed categories for fishing mortality consider whether the most recent fishing mortality estimate is at, above, or below the threshold level. Only three increments were selected for fishing mortality as other aspects of the management program consider only whether F is at, above, or below the target.

- 5: $F/F_{MSY}$ is at least 5% less than 1
- 3: $F/F_{MSY}$ within 5% of 1
- 1: $F/F_{MSY}$ is at least 5% greater than 1

***Recruitment($W_R$)***

To determine the recruitment metric, the most recent estimate of recruitment will be compared to the 20th, 40th, 60th, 80th, and 100th percentiles of the distribution of the time series of recruitment used in stock projections. This percentile categorization of the relative strength of an incoming year class was deemed more informative than measuring trends in recruitment, especially given the highly variable nature of recruitment from year to year. Assessing where recruitment fell in the percentile distribution was determined a more appropriate measure of recruitment's impact on future levels of biomass.

- 5: terminal year R in the 81-100 percentile
- 4: terminal year R in the 61-80 percentile
- 3: terminal year R in the 41-60 percentile
- 2: terminal year R in the 21-40 percentile
- 1: terminal year R is in the 0-20 percentile

***Fishery performance ($W_{FP}$)***

Fishery performance is evaluated by comparing the confidence interval derived from the most recent two-years of MRIP harvest estimates to the two-year average RHL. The score is determined by where the average RHL appears in relation to the 2 year MRIP CI.[6] The following three categories are used for this metric:

- 5: 2-yr avg. RHL above upper bound of CI
- 3: 2-yr avg. RHL within CI
- 1: 2-yr avg. RHL below lower bound of CI

***<u>Accountability Measures under the Fishery Score Approach</u>***

Under this option, measures are set based on a variety of factors such that they are more restrictive when stock status is poor and more liberal when stock status is healthy. This is considered a proactive AM. In addition, as described above, this method can also provide an early warning of deteriorating stock conditions which can inform the setting of measures.

As under the no action option, ACL overages would be evaluated by comparing the most recent 3-year average recreational ACL against the most recent 3-year average of recreational catch (i.e., landings and dead discards). If average catch exceeds the average ACL, then the appropriate AM is determined based on the following criteria:

1. If the stock is overfished ($B < ½ B_{MSY}$), under a rebuilding plan, or the stock status is unknown:

    a. The stock is placed in the most restrictive bin. These may be temporary measures until replaced by measures required by a rebuilding plan, which can take up to two years to implement.

    b. If the stock was already in the most restrictive bin or the measures in the most restrictive bin are otherwise expected to continue to result in overages,

[6] When developing a CI from two years of MRIP data, the PDT/FMAT recommends the use of a joint distribution 80% confidence interval that takes into consideration the PSE of each individual years' MRIP estimate and the variability of the estimates between years. This recommendation is based on an analysis of several years of MRIP data for each species. The use of MRIP data in this context is intended as a proxy for expected future harvest under status quo measures. This may be replaced with statistical modelling approaches for predicting harvest, with associated CIs, if such approaches are available in the future.

then those measures must be modified as soon as possible following the determination of the overage such that they are reasonably expected to prevent future overages.

2. If biomass is above the threshold, but below the target (½ $B_{MSY} < B < B_{MSY}$), and the stock is not under a rebuilding plan:

a. If only the recreational ACL has been exceeded, then the stock would remain in its current bin, but the measures associated with that bin and all other bins, will be re-evaluated with the goal of preventing future ACL overages.

b. If the ABC or $F_{MSY}$ (as determined through section 3.2) is exceeded in addition to the recreational ACL, then the stock must drop down a bin and a re-evaluation of measures in all bins is triggered.

3. If biomass is above the target ($B > B_{MSY}$):

Consideration should be given to adjusting the management measures associated with each bin, taking into account the performance of the measures and the conditions that precipitated the overage.

**D. Biological Reference Point Approach**

Under this option, 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 grouped into seven bins, as illustrated in Table 3. Each bin would have a set of default measures which would be implemented the first time the stock is placed in that bin.

To define the bins under this option, fishing mortality (F) would be considered in two states (i.e., overfishing: above the threshold or not overfishing: equal to or below the threshold) while $B/B_{MSY}$ would be further divided to provide managers and anglers with more responsive levels of access. The following categories of $B/B_{MSY}$ are proposed.

- Biomass is greater than or equal to 150% of the target.
- Biomass is greater than or equal to the target but less than 150% of 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).

Recruitment and trends in biomass are secondary metrics under this option which are used to fine tune default measures <u>only</u> 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 bin, the fishery would be subject to the default measures. If the bin 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 bin are only allowed in bins 1 and 2, which are associated with a healthy stock status. Restrictions and/or re-evaluation within a bin can be required based on secondary metrics for bin 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 bin would be based on predetermined guidelines.

Liberalizations within a bin are not permitted when biomass is below the target level or when F exceeds $F_{MSY}$. For example, if a stock in bin 2 (F below $F_{MSY}$ and biomass above $B_{MSY}$, but below 150% of $B_{MSY}$) remains in bin 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 bin 1, triggering a new set of default measures more relaxed than those from bin 2. Alternatively, if biomass is below the target, then the stock would move to a more restrictive bin (bins 3-6).

Stocks in bin 3 are not subject to overfishing and are not overfished, but are below their target biomass level. Stocks in bins 4-6 are experiencing overfishing. The goal of the management measures in bins 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 bins 1-2, where measures would not be adjusted in this circumstance. Additionally, when a stock is in bins 4-6 (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 automatically fall into bin 7 until an approved rebuilding plan is implemented. Stocks under a rebuilding plan must comply with the requirements of the rebuilding plan, and the rebuilding plan measures may differ from the pre-defined measures in this option.

Measures for bins 1-7 would aim to achieve a range of harvest that is appropriate for the stock conditions associated with each bin. The measures in each bin would be anticipated to produce a range of possible harvest values, given uncertainty and variability in the harvest data. Considerations related to confidence intervals and other statistical metrics and models could be used to define the appropriate range of expected harvest and the measures associated with each bin. Measures within each bin will take into consideration small changes to allow for liberalizations or reduction to allow for the flexibility to fine tune measures based on both recruitment and biomass trends in addition to the current biomass and fishing mortality levels[7].

| | F ≤ Fmsy | F > Fmsy |
|---|---|---|
| 150%Btarget ≤ B | R↑ / R↓<br>B↑: liberal / liberal<br>B↓: default / default<br>**1** | R↑ / R↓<br>MRIP ≤ RHL/ACL, B↑: default / restrictive<br>MRIP ≤ RHL/ACL, B↓: restrictive / restrictive<br>MRIP > RHL/ACL, B↑ B↓: restrictive; re-evaluate measures<br>**4** |
| Btarget ≤ B < 150%Btarget | R↑ / R↓<br>B↑: liberal / liberal<br>B↓: default / default<br>**2** | R↑ / R↓<br>MRIP ≤ RHL/ACL, B↑: default / restrictive<br>MRIP ≤ RHL/ACL, B↓: restrictive / restrictive<br>MRIP > RHL/ACL, B↑ B↓: restrictive; re-evaluate measures<br>**5** |
| Bthreshold ≤ B < Btarget | R↑ / R↓<br>B↑: default / restrictive<br>B↓: restrictive / restrictive<br>**3** | R↑ / R↓<br>MRIP ≤ RHL/ACL, B↑: default / restrictive<br>MRIP ≤ RHL/ACL, B↓: restrictive / restrictive<br>MRIP > RHL/ACL, B↑ B↓: restrictive; re-evaluate measures<br>**6** |
| B < Bthreshold | **MOST RESTRICTIVE/REBUILDING PLAN** **7** | |

Table 3. Biological Reference Point table showing bins as a result of different combinations of stock conditions. The < refers to 'greater than' and the > refers to 'less than'. A line present underneath the symbol means 'equal to'.

[7] The PDT/FMAT has not yet reached consensus on a recommendation for assigning the appropriate management measures for each bin. Proposed options will be related to biomass levels, but the exact methodology that is appropriate is still under development.

***<u>Accountability Measures under the Biological Reference Point Approach</u>***

Under this option, measures are set based on a variety of factors such that they are more restrictive when stock status is poor and more liberal when stock status is healthy. Each bin has two sets of measures associated with it: a default set and either a more liberal or more restrictive set of measures. This is considered a proactive AM due to the auto-regulatory movement of a stock among bins based on stock status.

As under the no action option, ACL overages would be evaluated by comparing the most recent 3-year average recreational ACL against the most recent 3-year average of recreational catch (i.e., landings and dead discards). When average catch exceeds the average ACL, then the appropriate AM is determined based on the following criteria:

1. If the stock is overfished ($B < ½ B_{MSY}$), under a rebuilding plan, or the stock status is unknown:

    a. The stock is placed in the most restrictive bin. These may be temporary measures until replaced by measures required by a rebuilding plan, which can take up to two years to implement. This is incorporated into the option as described above and will occur regardless of whether a reactive AM has been triggered.

    b. If the stock was already in the most restrictive bin or the measures in the most restrictive bin are otherwise expected to continue to result in overages, then those measures must be modified as soon as possible following the determination of the overage such that they are reasonably expected to prevent future overages.

2. If biomass is above the threshold, but below the target ($½ B_{MSY} < B < B_{MSY}$), and the stock is not under a rebuilding plan:

    a. If only the recreational ACL has been exceeded, then the stock would remain in its current bin, but the measures associated with that bin and all other bins, will be re-evaluated with the goal of preventing future ACL overages.

    b. If the ABC or $F_{MSY}$ (as determined through section 3.2) is exceeded in addition to the recreational ACL, then the next most restrictive measures would be implemented (i.e., either the more restrictive measures in the current bin, or, if the stock is already at the most restrictive measures in a bin, then the more liberal measures in the next lower bin). A re-evaluation of measures in all bins is also triggered.

3. If biomass is above the target ($B > B_{MSY}$):

   Consideration should be given to adjusting the management measures associated with the current bin (either bin 1 or 2), taking into account the performance of the measures and the conditions that precipitated the overage.

**E. Biomass Based Matrix**

This option 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 bin. Bin A represents the optimal conditions, while Bin 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 bins to six.

The specific combination of management measures that are appropriate for each bin will be species specific. However, the conditions that drive the bins can be the same across all species.

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 (the threshold is half of the target and defines an overfished condition)
- Overfished = The stock is below the threshold

When biomass exceeds 150% of the target level, regardless of the biomass trend, bin 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.

Measures associated with each of the six bins (A-F) would aim to achieve a range of harvest that is appropriate for the stock conditions associated with each bin. Stock condition would be defined based on the biomass categories listed above and whether the biomass trend is stable, increasing, or decreasing. The measures in each bin would be anticipated to produce a range of possible harvest values, given uncertainty and variability in the harvest data. Considerations related to confidence intervals and other statistical metrics and models could be used to define the appropriate range of expected harvest and the measures associated with each bin.

**Table 4.** Recreational management measure matrix under the biomass based matrix approach.

<table>
<tr><th colspan="2" rowspan="2"></th><th colspan="3">Biomass Trend</th></tr>
<tr><th>Increasing</th><th>Stable</th><th>Decreasing</th></tr>
<tr><td rowspan="4">Stock Status</td><td>Abundant</td><td colspan="3">Bin A</td></tr>
<tr><td>Healthy</td><td>Bin A</td><td colspan="2">Bin B</td></tr>
<tr><td>Below Target</td><td>Bin C</td><td colspan="2">Bin D</td></tr>
<tr><td>Overfished</td><td>Bin E</td><td colspan="2">Bin F</td></tr>
</table>

***Accountability Measures Under the Biomass Based Matrix***

Under this option, measures are set based on a variety of factors such that they are more restrictive when stock status is poor and more liberal when stock status is healthy. This is considered a proactive AM.

As under the no action option, ACL overages would be evaluated by comparing the most recent 3-year average recreational ACL against the most recent 3-year average of recreational catch (i.e., landings and dead discards). If average catch exceeds the average ACL, then the appropriate AM is determined based on the following criteria:

1. If the stock is overfished ($B < ½ B_{MSY}$), under a rebuilding plan, or the stock status is unknown:

    a. The most restrictive measures would be implemented. These may be temporary measures until replaced by measures required by a rebuilding plan, which can take up to two years to implement.

    b. If the most restrictive measures were already in place, or are otherwise expected to continue to result in overages, then those measures must be modified for the upcoming fishing year such that they are reasonably expected to prevent future overages.

2. If biomass is above the threshold, but below the target ($½ B_{MSY} < B < B_{MSY}$), and the stock is not under a rebuilding plan:

    a. If only the recreational ACL has been exceeded, then the stock would remain in its current bin, but the measures associated with that bin and all other bins, will be re-evaluated with the goal of preventing future ACL overages.

    b. If the ABC or $F_{MSY}$ (as determined through section 3.2) is exceeded in addition to the recreational ACL, then the measures associated with the next more restrictive bin would be implemented and a re-evaluation of measures in all bins would be triggered.

3. If biomass is above the target ($B > B_{MSY}$):

Consideration should be given to adjusting the management measures associated with all bins, taking into account the performance of the measures and the conditions that precipitated the overage.

### 3.2 Accountability Measures Comparisons

The options in this section consider a change to one component of the reactive AMs. Specifically, they address situations when a reactive AM has been triggered and biomass is above the threshold but below the target level. All other components of the AMs are summarized along with options A-E above. The options described below could be used in combination with any of the other options listed above, including the no action option. These changes are only considered for the recreational AMs. No changes to the commercial AMs are considered through this action.

**A. Catch compared to the ABC**

Under this option, when a reactive AM has been triggered by a recreational ACL overage and the most recent biomass estimate is between the target and the threshold, catch relative to the ABC would also be considered. The response to the overage would be more restrictive if the ABC was also exceeded (e.g., a payback would be required or the stock would be placed in a more restrictive bin, depending on the option). If only the recreational ACL was exceeded, the response to the overage would be less strict (e.g., measures would be revised but a payback would not be required or the stock would remain in its current bin, depending on the option).

**B. Fishing mortality compared to an F threshold**

This option maintains ACL evaluations within the AMs, but rather than considering if the ABC was also exceeded, consideration would be given to if the fishing mortality threshold ($F_{MSY}$) was also exceeded. The intent behind this option is that it considers if total fishery removals negatively impacted the stock based on the most recent information. For example, catch in a past year may have exceeded the ACL, but a subsequent stock assessment update may indicate that the stock did not suffer notable negative impacts if the fishing mortality threshold was also not exceeded. The most recent fishing mortality estimate considers more recent information and relies on less assumptions than the information used to set a previous year's ACL. To set the ACL and ABC, projections must be made that make assumptions about how the fishery may perform. This approach using a fishing mortality comparison would look at data that represents what actually transpired in the fishery or stock during the time being evaluated, according to the most recent stock assessment. If regularly updated estimates of total fishing mortality compared to the threshold are not available, then this comparison would default to the ABC comparison described above.

The FMAT/PDT is still in the process of fully analyzing the potential benefits and challenges with this approach and can provide additional information to the Board and Council at a future meeting.

## 4.0 Compliance

TBD

## 5.0 Literature Cited

Northeast Fisheries Science Center (NEFSC). 2019. Operational Stock Assessment Report

NEFSC. 2021a. Summer Flounder Management Track Assessment Report.

NEFSC. 2021b. Scup Management Track Assessment Report.

NEFSC. 2021c. Black Sea Bass Management Track Assessment Report.

NEFSC. 2021d. Atlantic Bluefish Management Track Assessment Report.

MAFMC. 2003. Amendment 13 to the Fishery Management Plan for Black Sea Bass. Available at: http://www.mafmc.org/sf-s-bsb

## Appendix 1. Comparison of Options

*Will be included in supplemental materials.*

# Memorandum

**Date:** October 1, 2021

**To:** Mid-Atlantic Fishery Council and ASMFC Policy Board

**From:** Joint PDT/FMAT for Recreational Reform

**Subject:** Overview of work, major accomplishments, and timeline recommendations.

Since May 2021, a joint Plan Development Team (PDT) and Fishery Management Action Team (FMAT) has been working on the Recreational Harvest Control Rule Framework/Addendum as part of the Recreational Reform Initiative. A Draft Addendum document developed by the PDT/FMAT is included with the briefing materials for the Interstate Fisheries Management Program Policy Board's (Policy Board's) and Mid-Atlantic Fishery Management Council's (Council's) October 2021 meeting. The same options included in the Draft Addendum will be included in the Council's framework action and both the Council and Policy Board will approve the same final range of options and the same preferred alternative.

Through the Commission's addendum process, public comment will be collected via state hearings and a written comment period and will be presented to both the Policy Board and Council. Additional hearings will not be held though the Council process to avoid redundancy, and furthermore, hearings are not typically held for Council framework actions. For this reason, a draft framework document has not been presented. However, as previously stated, both the Council and the Policy Board will approve the same final range of options which will be included in both the Draft Addendum and the framework.

The PDT/FMAT recommendations for the management options have been incorporated into the Draft Addendum document. This memorandum summarizes additional PDT/FMAT recommendations not included in the Draft Addendum.

## Postponing Approval of Final Range of Options for Draft Addendum/Framework and Approval of Draft Addendum for Public Comment to December 2021 or February 2022

The Policy Board and Council previously intended to approve a Draft Addendum for public comment and a final range of options for the framework/addendum in October 2021. The PDT/FMAT requests additional time to fully develop the options and to further develop two statistical models which can be used to inform the recreational measure setting process under the framework/addendum options.[1] These two statistical models will be critical for thorough analysis

[1] More information on the models is available here: https://www.mafmc.org/council-events/2021/ssc-peer-review-panel-sept20

of the options and will greatly improve the process for setting management measures under any of the options.

A sub-group of the Council's Science and Statistical Committee (SSC) recently reviewed both models. A final report is expected shortly. It will be provided to the Policy Board and Council and will be reviewed by the PDT/FMAT for consideration regarding further development of the options in the Draft Addendum/Framework. Comments made during the review indicated that additional work on both models will likely be recommended. Depending on further consideration of the SSC recommendations, and any additional work needed to improve these models, the PDT/FMAT may be in a position to present a more complete set of options for the framework/addendum and a Draft Addendum for approval for public comment in December 2021 or February 2022. A revised draft timeline for completion of the framework/addendum is presented below. This timeline is subject to change pending considerations such as the work needed to refine the statistical models, other priority actions, and constraints on staff time.

- October 2021
  - Policy Board and Council provide guidance on further development of the Draft Addendum/Framework during their October 21, 2021 meeting.
  - PDT/FMAT continues to refine the Draft Addendum/Framework options and consider next steps for using the two statistical models reviewed by the SSC.
- December 2021
  - Policy Board and Council consider approval of a final range of options for the framework/addendum and a Draft Addendum document for public hearings. *Pending further refinements of the options by the FMAT/PDT and considerations related to further refinement of the two statistical models, this may need to occur in February 2022 rather than December 2021.*
- Winter 2022
  - Public hearings on the Draft Addendum.
  - Continued development of models for use in measure setting.
  - PDT/FMAT and Advisory Panel meetings to consider input received during public hearings and develop recommendations for final action on the Draft Addendum/Framework.
- Spring 2022
  - Policy Board and Council review public comments, AP input, and PDT/FMAT recommendations, and consider final action on the Addendum/Framework.
  - Completion of Northeast Fisheries Science Center (NEFSC) socioeconomic survey (see section on workshops below).
  - Development of NEPA document for Council framework.
- Summer 2022
  - Data available from NEFSC survey to inform models to begin exploring measures for 2023 based on harvest control rule option selected.
  - Federal rulemaking on Council framework, likely to extend into the fall.
- Fall/Winter 2022
  - Consider recreational management measures for 2023 with the Monitoring Committee and Advisory Panel for final approval by the Council and Policy Board.

**Use of Example Measures in Addendum/Framework**

The options in the Draft Addendum/Framework do not set or consider specific management measures (bag, size, and season). The options instead focus on the methodology for setting those measures. The PDT/FMAT has determined it would not be appropriate to provide example measures associated with the options in the Draft Addendum/Framework for a number of reasons. One fundamental reason is that it is simply not possible to generate example measures for all options for all species with a robust and consistent methodology at this point in time. As noted above, two statistical models are currently in development which would greatly assist in the ability to generate measures for each of the harvest control rule options. However, these models are currently being refined and are not immediately available for use.

The options in the Draft Addendum/Framework do not require a specific method for setting management measures and instead define a conceptual process. The Monitoring/Technical Committees are then able to refine the methods for developing measures without a management document. This allows for timely incorporation of new data or model updates to develop the most appropriate measures for the recreational fishery.

In addition, if states retain the ability to implement conservationally equivalent measures, there is no guarantee that example measures taken out to public hearings would be the final implemented measures.

Lastly, example measures are misleading to the public as they give the impression that the example measures are expected to be implemented, which would not necessarily be the case.

The PDT/FMAT also noted that the selection of a preferred harvest control rule approach should be based on the merits of the conceptual process of the option, not the final resulting measures.

**Stakeholder Workshops**

In August 2021, the Policy Board and Council considered a PDT/FMAT recommendation to conduct stakeholder workshops to gather input on preferences regarding recreational management measures. Considering the revised draft timeline presented above, the PDT/FMAT now recommends against holding these workshops as they would not provide additional information of value beyond efforts already planned for 2022 by the NEFSC. The goal of the workshops was to gather input on angler preferences for measures, separate from the options considered in the Draft Addendum/Framework. Public hearings on the options in the Draft Addendum/Framework will still occur.

Based on the draft timeline presented above, recreational measures could be set based on this Draft Addendum/Framework starting in 2023. The NEFSC plans to conduct a survey of anglers' preferences for measures for summer flounder, scup, and black sea bass in early 2022. This survey is based on accepted and statistically robust surveying methodologies that have been peer reviewed and used in this and other regions. The survey will collect similar information as was planned for the stakeholder workshops. This information will be available by late 2022 and can help inform the setting of recreational measures for 2023 for summer flounder, scup, and black sea bass. The PDT/FMAT initially recommended holding workshops in late 2021 or early 2022 to collect this information with the goal of using it to inform 2022 recreational measures. Now that it is no longer recommended to use the harvest control rule for 2022, the PDT/FMAT recommends using the planned NEFSC survey rather than additional smaller-scale workshops to gather this information. In addition, the considerable staff time to conduct the workshops can now be dedicated to completing the Addendum/Framework and other high priority actions for these species.

The planned NEFSC survey will not address bluefish. However, the bluefish rebuilding plan will be implemented in 2022 with a target rebuild date of 2028 and the harvest control rule options are not meant to replace the rebuilding plan. If there is a desire to hold stakeholder workshops on angler preferences for bluefish, it may be appropriate to do this at a later date after additional progress with rebuilding has been made.

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# MEMORANDUM

**Date:** October 1, 2021

**To:** Council and Policy Board

**From:** Brandon Muffley, Council staff

**Subject:** SSC Sub-Group Review of Recreational Models

On Monday, September 20, 2021, the Mid-Atlantic Fishery Management Council (Council) convened a panel consisting of members of the Council's Science and Statistical Committee (SSC) to review two recreational management models.

The two models, a recreational fleet dynamics model and an economic recreational demand model, are being considered for use in developing management measures under the alternatives considered through the Recreational Harvest Control Rule Framework/Addendum for summer flounder, scup, black sea bass, and bluefish. These models could also be used under the current process for setting recreational management measures. The peer review panel was tasked with identifying potential benefits, uncertainties, and appropriate approaches and considerations of each model for use in setting recreational management measures.

A final report from the peer review will be posted with the briefing materials for the Council and Policy Board's October 21, 2021 meeting once it is available.

Background materials on the peer review and the two models, including terms of reference for the review, presentations, and overviews of the two models are available here: https://www.mafmc.org/council-events/2021/ssc-peer-review-panel-sept20.

# Mid-Atlantic Fishery Management Council

# Sub-Group of the Scientific and Statistical Committee

## Peer Review Report of Recreational Fishery Models


Jorge Holzer[1,2], Yan Jiao[1,3], and Cynthia Jones[1,4]

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[4]Old Dominion University, Department of Ocean and Earth Sciences


### Executive Summary


The Mid-Atlantic Fishery Management Council (Council) convened a peer review panel consisting of members of the Council's Science and Statistical Committee (SSC) to review two potential recreational management models[1]. A Recreational Fleet Dynamics Model (referred to in the report as RFDM) was developed by Dr. Jason McNamee (Rhode Island Dept. of Environmental Management, RIDEM) and collaborators Corinne Trusedale (RIDEM, Division of Marine Fisheries) and Savannah Lewis (Atlantic States Marine Fisheries Commission, ASMFC) for summer flounder and black sea bass. A Recreational Economic Demand Model (referred to in the report as REDM) was developed by Andrew (Lou) Carr-Harris (NMFS Northeast Fisheries Science Center) for summer flounder.

These two models are being considered for use by the Council's Fishery Management Action Team (FMAT) and the ASMFC's Plan Development Team (PDT) in the development and analyses of alternatives for the Council and ASMFC Recreational Reform Initiative[2]. The potential use of these models would be part of the development of a Harvest Control Rule currently being considered as one component of the Recreational Reform action. The goal of the peer review was to help identify the potential utility, benefits, uncertainties, and limitations of each model for use by the FMAT/PDT during the Harvest Control Rule development and to provide any guidance as to whether these models represent an improvement to the current


[1] Dr. Lee Anderson from the SSC participated in the peer review meeting.
[2] For more information about the Recreational Reform Initiative, please see: https://www.mafmc.org/actions/recreational-reform-initiative

process and methods used by the Council and ASMFC technical groups to set recreational measures.

The peer review meeting was held on September 20, 2021 from 10:00 a.m. - 4:00 p.m. via webinar and was open to the public to listen in and ask questions. The agenda, meeting materials, and presentations can be found on the peer review meeting page at: https://www.mafmc.org/council-events/2021/ssc-peer-review-panel-sept20.

*Summary of Key Peer Review Conclusions and Recommendations*

- Both models rely on MRIP data, though to a different degree, and are therefore subject to the limitations and uncertainties stemming from these MRIP data.
- The REDM is a simulation model which relies on the quality of the 2010 angler choice experiment data and population dynamics model. While the model has been properly specified and is sound, below we present some recommendations that may prove useful.
- The RFDM model selection process that the team has adopted is unclear and the model specifications need to be revised when considering space, time, population size and regulation variables. Also, it may be worthwhile to consider the correlation between harvest and discard when specifying and estimating the models.
- The review panel recommends that, upon implementing the revisions described below, both models be considered by the management/technical teams. For example, the performance of the RFDM could be benchmarked against that of the REDM for a couple of years. After the relevant improvements to the model coming from that process are implemented, the RFDM may be ready for use in fisheries for which bioeconomic models are unavailable due to a lack of angler preference survey data.

The peer review panel would like to thank Dr. McNamee, Dr. Carr-Harris, Ms. Trusedale, and Ms. Lewis for their commendable work and effort to develop these recreational models and for engaging in an open dialogue to address all of the questions asked by the panel. We would also like to thank Julia Beaty (Council staff) for her very valuable and informative presentation on the current process to set recreational management measures and an overview of the Recreational Reform Initiative.

**<u>Response to the Terms of Reference</u>**

The peer review panel addressed each of the Terms of Reference (*italics*) provided by the Mid-Atlantic Fishery Management Council and consensus responses (standard font) are provided below. Individual panel member reports that address the same Terms of Reference are provided as Appendix 1-3.

1. *Are the theoretical and statistical model specifications consistent with professional standards?*

*a. Was the model's design and specification clearly described?*

Both RFDM and REDM models are well described in the background documents provided to this panel. While the description of the model is fairly clear in both cases, it would be useful to more clearly spell out the role that MRIP data play in each model. As far as the panel understands, the catch data comes from catch-per-unit effort obtained from the on-site survey of anglers (APAIS) wherein a survey agent often is able to examine the landings and the mail survey for effort (FES) wherein the household self-reports the number of trips that have been taken in each two-month wave. Additionally, discard information is obtained from anglers on site (APAIS) who self-report the species and number of discards. When discards are high, uncertainty is present that is not accounted for in the modeling framework.

The RFDM model uses MRIP data disaggregated to the year, state and wave levels. The RFDM models are a set of regression models to estimate harvest and discard by fitting to the MRIP data. The explanatory variables considered include year, wave, space, regulation variables such as bag and size limits and number of days the season is open, SSB, and interaction terms. The name of the RFDM may be revised to reflect what was done since the model does not attempt to capture behavior by individual anglers or by the fleets.

The REDM model is based on data from a 2010 angler choice experiment survey, MRIP data, and the stock assessment results from a statistical catch-at-age model. The 2010 choice experiment survey provides data to estimate anglers' preferences and predict behavior under different regulations, fish caught and fish release across 4 survey regions: ME-NY, NJ, DE/MD, VA/NC. The anglers' estimated preferences are then coupled with a biological submodule that uses population projections from the most recent stock assessment. The model is currently simulated to match the number of summer flounder directed trips in 2019. In turn, that simulation results in a number of so-called choice occasions (i.e. each simulated instance in which an angler must decide whether to go fishing or to do something else). When projecting next year's recreational harvest, previous year's number of simulated choice occasions, recreational selectivity and catch per unit of effort were used. The REDM relies on data reported through surveying anglers on site. The assumption is that the data are representative of the general population of anglers. However, the data are likely overrepresent the most avid anglers. Below are suggestions on how to address this bias (see ToR #3b on page 8).

*b. Are the underlying data sufficient to derive model estimates?*

Both models treated MRIP data as true observations, so the model results can only be interpreted as such. Any bias in the MRIP data will be carried through in both models. These considerations notwithstanding, the MRIP data are the most complete time-series on recreational effort and harvest coastwide. In addition, the REDM also uses information collected from a choice experiment survey administered as a follow-up to the Access Point Angler Intercept Survey (APAIS) conducted in 2010.

As mentioned earlier, the REDM selects anglers that were encountered in the on-site APAIS survey, and avid anglers are over-represented. Thus, a correction must be made to address the avidity bias that exists in the APAIS survey. Additionally, since the choice experiment survey was conducted in 2010, consideration might be given to conducting another choice experiment survey to reflect the current angler choices and preferences.

The population level projected recreational harvest relies on the number of calibrated choice occasions and recreational selectivity. The peer review panel suggests the role of the number of calibrated choice occasions may be evaluated in two ways: 1) calibrate the model using each of the individual past 5-7 years of data to see whether the resulting calibrated choice occasions are similar to the number currently used; 2) use the same number of the calibrated choice occasions from 2019 and the corresponding regulations for previous years to generate the number of trips in these years, and then compare them with the MRIP observed number of trips for a given year.

2. *How does the scale at which the model is operating (coast, regional, or state; wave or annual; fishing mode) affect the results?*

The RFDM model uses MRIP data disaggregated to the level of year, state and wave. As such, this model has the potential to provide wave-specific, year-specific, and state-specific harvest and discard estimates. However, it is worth highlighting that the MRIP survey was designed to have the lowest variance for species of interest when aggregated at the largest scale of region and year. When these data are disaggregated to state and wave, the variance increases resulting in wide confidence intervals. This may undermine the ability of the model to provide guidance for safe regulations that sustain the stock.

The REDM model is currently specified at the year and subregion levels (ME-NY, NJ, DE-MD, VA-NC) because the 2010 choice experiment survey was conducted at that subregion level. The model can readily be specified at the wave level by specifying wave-specific catch-at-length and number of fish caught per trip distributions. Disaggregation at the state level -to capture heterogeneity of anglers' preferences- would ideally entail an update of the angler preference survey. Alternatively, and given that the 2010 survey collected information on respondents' demographics, the utility function could be specified as a function of demographic characteristics (e.g., through the opt-out), which would then allow the simulation model to use state-level anglers' characteristics to predict impacts of management changes on effort, harvest, and welfare at the state level.

   a. *How does data availability, uncertainty, and variability affect model results, interpretation, and application?*

Both models rely on MRIP data, so if MRIP overestimates/underestimates the recreational catch and discards, both models will be impacted. In the REDM model, the calibration data come from MRIP in the same year. In prediction years, catch-at-length is derived from recreational selectivity, calculated from the calibration year, and projected population numbers at length. On the other hand, the RFDM relies exclusively on MRIP data for the estimation of the policy impacts on harvest and discards. The MRIP catch data includes the CPUE of landed fish which may have been observed by the survey agents but also the CPUE of discarded fish that is self-reported. These self-reported data may exhibit digit bias and can also be misidentified. Digit bias occurs when anglers don't keep track of regulatory discards or catch many of these fish and tend to estimate the number of discards, usually by stating common numbers, say 5, 10, 15 but not actually directly having counted discards. When discards are a small proportion of landings this may not result in much concern. For species with a large proportion of discards such as bluefish, when slot limits or other size limits are imposed, this issue is a cause of concern in the RFDM, which relies on self-reported discards.

b. *What key assumptions affect the underlying statistical analysis and interpretation of the results? Were these assumptions and relevant uncertainties identified and characterized?*

Both models rely, though to a different degree, on MRIP data. The REDM also uses a choice experiment survey to estimate anglers' preferences. The less reliable the data used are, the larger the uncertainty will be around the predictions that the models generate. All the relevant caveats regarding MRIP data apply here. Additionally, in the case of the choice experiment survey, the possibility that the population of respondents may not be representative of the general angler population (e.g., due to response bias or avidity bias) should be considered. As discussed in this report, there are alternative ways to address this concern.

Regarding the models' assumptions:

The RFDM assumes that the harvest and discard components of catch for a given species are independent and specified as separate and independent equations, which may have an impact on the uncertainty bounds around the predictions of the reduced-form model. Accounting for correlation of the error term across equations, which is likely to exist since both equations are dealing essentially with the data from the same fishing trips, may increase efficiency, and thus reduce the uncertainty bounds around the predictions. Moreover, as stressed earlier, the assumption of this model that, whatever the management measures for black sea bass, there will be zero effect on the harvest and discards of summer flounder, seems untenable given that these species are typically caught together in the same trips.

Additionally, in the RFDM, the model selection process is based on AIC and *p*-values but is not well described and not consistently employed. Of concern is the fact that the RFDM uses different sets of policy variables (e.g., bag limit, size limit, length of the season) in the harvest and discard equations. These management measures impact the fishing trip and should therefore be included in both equations (is it reasonable, for example, to assume that closing the season for summer flounder would only impact harvest but leave discards unchanged?). Moreover, the partial effects of the bag limit and size limits have counterintuitive signs in some of the specifications presented, particularly for black sea bass. The selection of interaction terms does not seem reasonable either. Additionally, the year effect is not correctly specified (treated as numerical but should be categorical). In sum, the team may want to consider revising their model selection approach and how some of the variables are treated.

The REDM explicitly uses anglers' preferences to determine how different sets of management measures, through their impact to keep or release, will impact anglers' effort and welfare. Thus, estimating anglers' preferences correctly is important for the performance of this model. The authors of the REDM have carefully specified an indirect utility model that accounts for angler heterogeneity, and the estimated coefficients have the expected signs and result in willingness-to-pay for kept and released fish that are consistent with similar estimates in the literature.

Regarding the models' predictions:

The team that developed the RFDM presented, in Figures 8, 9, 14 and 15 of the background documentation within-sample predictions for the entire coast (rather than at the state level). Absent out-of-sample predictions at the state level, the review panel is unable to assess the ability of the RFDM to predict the impact of management changes. Likewise, it was suggested that the team shows what level of harvest and discards the model would project if the fishery were closed (either through a zero-bag limit or a zero-day season). This is relevant, as a fishery closure could be a management option and the models should be able to predict zero harvest for a complete fishery closure.

The author behind the REDM presented predictions at the state level for 2019While the prediction of impacts on harvest and discards for the region were very close to the actual outcome, as expected predictions at the state level sometimes overestimated and others underestimated these impacts. It is suggested the author predicts additional years (i.e., out-of-sample predictions) to further assess model performance. Likewise, it may be worthwhile exploring how changing the calibration year (i.e., the baseline number of choice occasions) may impact the model's ability to predict policy impacts on harvest and releases.

3. *Is the model appropriate for estimating and predicting the impacts of bag, size, and season limits on recreational catch or harvest? Are the methods in the Recreational Economic Demand Model appropriate for estimating changes in recreational effort or fishing demand?*

    a. *Does the modeling approach represent an improvement over current methods used to estimate impacts of management measures?*

Yes, both methods, when revised, have improvements over the current methods used to estimate the impacts of management measures. They both provide methods to evaluate changes of single or multiple factors simultaneously either based on statistical relationships (RFDM) or based on a simulated process model (REDM). The models' ability for dealing with more than one regulation change should be better than the current method.

The RFDM is built on appropriate statistical methods to evaluate harvest and discard changes in response to a combination of alternative policies. It uses a general additive model (GAM) and has penalties for overfitting. It provides a model-based approach to evaluating impacts of regulations on harvest and discards. Separate models were built for harvest and discard for summer flounder and black sea bass, as though harvest and discard are independent from each other. Upon revision and further refinements, this model would provide a statistical evaluation of proposed harvest control rules that are currently done in an ad hoc manner. Moreover, multiple regulation changes could be evaluated simultaneously.

The REDM uses appropriate methods for estimating changes in the recreational effort and welfare by simulating scenarios with alternative management regulations. This model is built on well-established, peer-reviewed methods for economic utility models. This model combines MRIP-based data with the results from an economic choice survey in a simulation framework to evaluate alternate regulatory scenarios for the harvest, release, and likelihood of taking a fishing trip for summer flounder and black sea bass and alternate harvest target species. It links the behavioral and biological components and is designed to estimate changes in recreational effort, fishing demand, and angler welfare.

b. *What are the strengths/limitations of the modeling approach for informing management measures, especially at the regional, state, wave, or mode level? Are there specific recreational fishing measures for which use of the model would not be recommended?*

The RFDM model is constructed to inform management measures at the regional, state, and wave level based on the past calibrated MRIP records. However, the current model selection and model construction have problems and need to be revised before being used to inform management measures. Its strengths are that it uses the recalibrated MRIP time series and the model can be used to evaluate its efficacy based on how well it reflects the outcomes of historic regulations.

One RFDM weakness, as currently configured, is that the model includes Wave as a model component that is smoothed. Because Wave is actually a categorical variable, this is an inappropriate specification, and it should be used as a categorical variable without smoothing. Depending on the number of points added by smoothing, the variance associated with this model component may be underestimated. The model is currently fit to all the available data, but a better practice is to fit the model to a portion of the data and to test for fit against the remaining data portion. Another potential weakness is that harvest and discard models are independent, whereas these quantities are not independent of one another. Moreover, because summer flounder and black sea bass are often caught together, there is a good motivation to also link species.

The REDM's strengths are that it uses choice simulations specific to regional, state and wave tailored to targeted species in these areas and times and based on regulations for bag and size limits. The model can project future behavioral responses to regulatory modifications based on past years' performance, under the reasonable assumption that behavior and preferences won't show radical change over short time periods. It is powerful because it is based on MRIP access-site interviews wherein catches were observed but also on a subsequent choice survey of these same anglers.

The REDM's weakness, as with any model relying on economic add-on surveys taken on site, is that it doesn't sample the full frame of marine recreational anglers in these regions. In relying on the on-site contacts of anglers to whom surveys were subsequently sent, it over-samples avid anglers from the entire population of marine anglers. Anglers who fish more frequently have a higher probability of being sampled. While MRIP provides the correct estimate of harvest and discard, it doesn't adequately represent the regulatory preferences of the full marine-angling community. This can be corrected by weighting avidity frequencies available through the Fishing Effort Survey. Alternatively, anglers' preferences (i.e. the opt-out) may be specified as a function of demographics (since the 2010 choice experiment survey collected this information from respondents). Moreover, there was considerable self-selection and non-response (~68%) to the choice survey, that should be addressed, if possible. While 2019 simulation estimates approximate MRIP catch at the regional level, harvest or discard estimates of summer flounder at the state level exhibited different degrees of discrepancy with the actual data: harvest for New Jersey, Connecticut, Massachusetts, and Maryland (which jointly contributed 55% of summer flounder recreational landings in 2019) are predicted with less than 5% error, but the discrepancy is larger for Delaware, New York, North Carolina, Rhode Island and Virginia. Lack of fit was also seen for black sea bass for some states, though the model predicts well the harvest in New York (whose contribution to the total black sea bass harvest in 2019 was 36%). The model also assumes 100% compliance to regulations and the peer review suggests the authors consider incorporating noncompliance behavior into the model once reliable estimates of noncompliance become available.

c. *What are the implications of using the model to predict future catch/harvest based on historical data? Are there limits on the magnitude of change in catch/harvest or stock status beyond which use of the model would not be recommended?*

The RFDM model can also provide estimates of uncertainty about its predictions. However, as input MRIP data are disaggregated to year-state-wave estimates, the smaller unit survey sample sizes upon which the predictions are based will increase uncertainty. It is expected that the model will provide the most precise estimates at higher levels of aggregation. The background documentation provided to the panel, however, does not include out-of-sample predictions to assess the predictive power of the model beyond the coastwide aggregation.

In recalibrating the MRIP dataset, most species effort data converge to the old MRFSS data that relied on telephone surveys for effort before telephone surveys became unreliable. This is not true for bluefish and this species could be problematic. The issue of convergence can provide a guide for use with appropriate species to apply this model.

The REDM is based on a long time series of harvest and discard estimates from the MRIP and as the model is revised its performance can be calibrated against this time series using the scenario of appropriate state year-specific regulations. The panel has suggested modifications that may improve fit, such as correcting for avidity bias. The panel also wonders how the number of calibrated choice occasions (i.e., currently obtained by calibrating the model to match the number of trips in 2019) will affect projected effort and harvest.

d. *Can the modeling approach support development of multi-year bag, size, and season limits? If so, what criteria should be applied or developed to assess the reliability of the multi-year projections?*

The RFDM could prove valuable in providing guidance for multi-year bag, size, and season regulations upon further model revision and development as suggested in this document. Further development that links the RFDM and the REDM could provide valuable guidance that encompasses not only predictions of harvest and discard under regulatory scenarios but could also include measures of angler participation. This would be an important advance to management.

The REDM has the potential of providing guidance on the selection of multi-year bag, size and season limits upon revision. When the model was calibrated against 2019 estimated harvests and discards, it showed appreciable differences for some of the states. Upon revision, the model fitting is likely to improve and prediction error to decrease to better inform managers of the uncertainty of predictions.

4. *Provide guidance for the following future model use considerations:*
   a. *Could the model be modified to incorporate other species (e.g., scup, bluefish)?*

Yes, both models are set up to be modified and incorporate other species; however, there are likely species-specific data considerations depending upon the model. Given the existing data availability, both models could readily be applied to scup but may require additional data and/or analysis for bluefish. For example, the 2010 choice experiment survey did not include bluefish. This information underlies the angler preference estimation in the REDM and a new survey that includes bluefish would need to be conducted. In addition, the recalibrated MRIP data for bluefish show an increasing trend in discards that is now equal to the recreational harvest. Discard estimates are generated from self-reported information and are therefore more uncertain. Given the interaction between harvest and discards on a fishing trip, model parameterization and estimations should consider these trends and uncertainties in the underlying MRIP data.

b. *Could future model runs be conducted by other individuals (e.g., Council/ASMFC staff or Monitoring/Technical Committee members) without major modifications?*

Yes, both models are currently constructed to allow other technical staff/members to run the models without major modifications. Since most technical staff/members do not have an economic background, the REDM may require some additional training to fully understand bioeconomic models and stated preference techniques. The peer review panel also notes that full documentation as to how both models were revised and/or addressed peer review recommendations is needed prior to other technical staff/members running the models.

c. *How easily could the model be updated with additional years of data or additional variables?*

Both models can easily be updated with additional years of data and additional variables. The REDM may take longer to update and may necessitate additional or updated surveys to obtain information on changes in angler preferences, particularly as species distribution and availability changes.

# Mid-Atlantic Fishery Management Council
# Sub-Group of the Scientific and Statistical Committee

## Peer Review Report of Recreational Fishery Models

October 10, 2021

Individual Peer Review Report:
Dr. Jorge Holzer, University of Maryland

In addition to the comprehensive consensus report developed by the peer review panel, each member developed an individual report with detailed responses to each Term of Reference (*italics*) provided by the Mid-Atlantic Fishery Management Council and the responses (standard font) are provided below.

**<u>Response to the Terms of Reference</u>**

1) *Are the theoretical and statistical model specifications consistent with professional standards?*
    a. *Was the model's design and specification clearly described?*

"The recreational Fishery Fleet Dynamics Model" (referred to below as Reduced-Form Model)

The title of the paper describing this approach is misleading as the model does not attempt to capture behavior by individual anglers' or by the fleet of charter and party boats. Absent a module explicitly modeling fleet dynamics, it was suggested the name given to this model be revisited to better reflect what the approach is doing.

The model was well-described, but the model selection process (the specification of the equations finally selected as the preferred model) is unclear and seems somewhat ad hoc. In other words, it is unclear how the authors arrive at their preferred specifications in Tables 5-8. The reviewers highlighted the fact that selecting the models based on the Akaike information criterion (AIC) is not a good strategy in this context, given that the differences in AIC between the models considered are immaterial. Likewise, some of the claims regarding the partial effects, particularly those corresponding to the policy variables (i.e., bag and size limits) are not substantiated by the model results or by the explanations provided during discussion. In particular, the counterintuitive effects of the bag and size limits in the black sea bass harvest model (they have the opposite effect of the expected effect of these policies), are concerning. It is recommended that the authors look at alternative specifications that ensure the partial effects of the policy variables are of the expected sign.

"Recreational Fluke MSE Economic Modeling Overview" (referred to below as Structural Bioeconomic Model)

The model design and specification were clearly described. A detailed exposition of the two components of the model: i) the estimation of anglers' preferences module, and ii) the fishery simulation module, was provided by the author during the panel review presentation.

b. *Are the underlying data sufficient to derive model estimates?*

While more and better data is always welcomed, each model relies on the amount of data that allows it to derive empirical estimates. Importantly, the data requirements and capabilities of the two models are very different. The reduced-form model is essentially a curve fitting exercise which seeks to predict harvest and discards under different policy scenarios using only MRIP data. As such, that model is unable to predict changes in effort or angler welfare. The structural bioeconomic model, on the other hand, explicitly models the angler's behavioral response to alternative regulations. Thus, this model can predict not only changes in harvest and discards, but also changes in effort level and angler satisfaction (i.e., welfare). This is important as it would allow the Council to choose combinations of management measures that, conditional on achieving the conservation goals, optimize the economic efficiency of the fishery. The difference in capabilities between these two models, however, come at a cost, namely, data requirements and model complexity, which are higher for the structural model. Additional points raised during the peer review are discussed below:

The recreational Fishery Fleet Dynamics Model" (Reduced-Form Model)

The model currently assumes that, for each species, the harvest and discards equations are independent. It was noted that this is not necessarily the case as harvest and discards for a given species essentially correspond to the same trips and anglers. In these circumstances, the error terms of the two equations may be correlated. As such, joint estimation of the system comprising the two equations may result in more efficient estimates. In turn, efficiency will be important when deriving uncertainty bounds around the predictions that will be used by the Council to study the effects of management changes. Furthermore, since anglers typically catch summer flounder and black sea bass together and is the total number of kept and released fish of both species (summer flounder and black sea bass) that determines angler satisfaction, it is expected that changes in management affecting one of the species may have an impact on the harvest and discards of the other species through the effect on effort. Thus, if feasible, it may be worthwhile exploring the possibility of estimating the entire system of equations jointly.

Additionally, the peer review committee stressed the fact that the policy variables included as explanatory variables in the harvest and discard equations should be the same in both equations. The rationale is simply that those management measures regulate the fishing trip, and therefore, impact both harvest and discards. In other words, it makes little sense, for example, to expect a change in the number of days the season is open, to affect only the harvest of black sea bass and not the discards as well. Thus, the review panel suggested the authors explore alternative specifications with the same policy explanatory variables in both equations, the harvest and discard equations.

"Recreational Fluke MSE Economic Modeling Overview" (Structural Bioeconomic Model)

The panel highlighted the importance for the overall performance of the model of getting anglers' preferences right. These preferences are estimated using the data from the choice experiment survey. Thus, modelers should spend time exploring credible alternative specifications of the indirect utility. The author of this model has done a nice job, but he may want to consider exploring other specifications. On a related topic, avidity bias may play a role here as survey respondents are typically more avid than the average angler. However, since the survey collected avidity and other demographic information, it was suggested that one way to address the possibility of avidity bias is to model the opt-out option in terms of avidity and other demographic information of respondents. Then, in the simulations, the opt-out can be adjusted to the relevant population by using that population demographic characteristics.

2) *How does the scale at which the model is operating (coast, regional, or state; wave or annual; fishing mode) affect the results?*
    a. *How does data availability, uncertainty, and variability affect model results, interpretation, and application?*
    b. *What key assumptions affect the underlying statistical analysis and interpretation of the results? Were these assumptions and relevant uncertainties identified and characterized?*

Both models naturally rely on data, and thus unavailability of data would undermine or prevent their use. Moreover, the less reliable the data used are, the larger will be the uncertainty around the predictions that the models generate. An advantage of the bioeconomic model over the reduced-form model, however, is that it explicitly characterizes the trade-offs faced by anglers and their expected behavioral response. In these circumstances, model results are easier to interpret intuitively. This feature may be important in discriminating between plausible and implausible outcomes when analyzing predictions, especially when data is scarce.

As in the discussion of ToR1, the assumption of independence of the harvest and discards equations for a given species, may have an impact on the uncertainty bounds around the predictions of the reduced-form model. Accounting for correlation of the error term across equations may increase efficiency. Moreover, as stressed earlier, the assumption of this model that, whatever the management measures for black sea bass, will not affect harvest and discards of summer flounder seems untenable given that these species are typically caught together in the same trips.

As for the resolution of the models, the structural bioeconomic model can predict the impact of management changes at the regional and coast level, and the wave or annual level. During the presentation, results were shown at the regional and coast levels for year 2019. On the other hand, the reduced-form model has the potential to predict the impact of management changes at the state, regional and coast levels, and wave or annual levels. The models do not currently provide predictions disaggregated by fishing mode.

The author of the structural bioeconomic model showed state-level predictions for 2019. It was suggested by the panel that the author presents out-of-sample predictions (i.e., for years prior to 2019). The authors of the reduced-form model, on the other hand, showed in-sample predictions at the entire coast level in Figures 8, 9, 14 and 15. The authors were asked to provide out-of-sample predictions at the state level (drop some data, re-estimate the model, compare the prediction of the newly estimated model for the period of data dropped with the actual data, and calculate the square prediction error; when this process is repeated many times, the mean squared prediction error can be used for model selection)[1], which is the level at which bag and size levels are typically set. Absent these out-of-sample predictions at the state level, it is not possible to assess how well the models predict the impact of changes in policy on harvest and discards. In this same vein, it was requested that the authors of the reduced-form model show what level of harvest and discards the model would project if the Council closed the fishery (either through a zero-bag limit or a zero-day season). This is relevant, as a fishery closure should always be in the regulator's tools box and the models should be able to predict zero harvest for a complete fishery closure. As shown during the presentation, the structural bioeconomic model can predict zero harvest associated with a fishery closure, as expected.

3) *Is the model appropriate for estimating and predicting the impacts of bag, size, and season limits onrecreational catch or harvest? Are the methods in the Recreational Economic Demand Model appropriate for estimating changes in recreational effort or fishing demand?*
    a. *Does the modeling approach represent an improvement over current methods used to estimateimpacts of management measures?*

Yes, both models represent an improvement over the current methods as they bring structure and statistical methods to the analysis of alternative policies on harvest and discards. Regarding the economic demand model, it is a structural model that links the behavioral and biological components and is designed to estimate changes in recreational effort, fishing demand, and angler welfare.

    b. *What are the strengths/limitations of the modeling approach for informing management measures especially at the regional, state, wave, or mode level? Are there specific recreational fishing measures for which use of the model would not be recommended?*

The structural bioeconomic model is a more powerful model as it uses anglers' preferences to characterize the effort response to changes in regulation, and from that response predicts harvest, discards, and anglers' welfare. The reduced-form model is unable to characterize the trade-off anglers face and therefore is unable to predict changes in effort and anglers' welfare. However, as indicated earlier, this model requires less data and can be updated much more quickly than the

[1] *k*-fold cross validation has been suggested as a model selection algorithm robust to overfitting since at least Stone (1974). Stone, M. (1974). "Cross-Validatory Choice and Assessment of Statistical Predictions." In: Journal of the Royal Statistical Society. Series B (Methodological) 36(2), pp. 111–147.

structural model. Thus, if the authors of the reduced-form model can show specifications that provide good out-of-sample predictions at the state level (as requested by the peer review panel), then the model could be used for analyzing fisheries for which there is currently no survey data available to populate a structural model. Moreover, it was suggested that the structural model applied to black sea bass and summer flounder can be used as a benchmark for the reduced-form model. Under this strategy, that model could be improved to try to match the predictions of the bioeconomic model, and after that it could be used in fisheries for which there is not enough data to develop a structural bioeconomic model.

c. *What are the implications of using the model to predict future catch/harvest based on historical data? Are there limits on the magnitude of change in catch/harvest or stock status beyond which use of the model would not be recommended?*

As explained earlier, it is unclear how either model predicts out-of-sample. In the case of the reduced-for model, it is also unclear how it performs in predicting unusual years at the state level. When both teams provide the corresponding predictions, it will be possible to assess the models' predicting power. However, as highlighted above, the reduced-form model seems unlikely to predict a fishery closure satisfactorily, and the partial effects of the bag and size limits currently have counterintuitive signs. From the evidence provided to the review panel, the structural bioeconomic model seems better equipped to provide good predictions at the state level.

d. *Can the modeling approach support development of multi-year bag, size, and season limits? If so, what criteria should be applied or developed to assess the reliability of the multi-year projections?*

While both models could produce multi-year predictions to inform the setting of multi-year management measures, this strategy is not recommended at this stage. In the view of the review panel, the models should be first used to predict changes year by year first, and only after satisfactory performance should they be used to recommend multi-year management measures.

4) *Provide guidance for the following future model use considerations:*

a. *Could the model be modified to incorporate other species (e.g., scup, bluefish)?*

For the case of scup, the answer is yes for both models. However, the choice experiment survey that underlies the angler's preferences estimation in the structural model, which was conducted in 2010, does not include bluefish. Including bluefish into this model would require a new survey, which would require time to design and conduct. On the other hand, the reduced-form model can easily and readily incorporate new species, including bluefish (especially under the current assumption of independence of harvest and discards across species).

b. *Could future model runs be conducted by other individuals (e.g., Council/ASMFC staff or Monitoring/Technical Committee members) without major modifications?*

The answer is yes for both models, but the structural model is more complex and requires understanding of bioeconomic models and of stated preference techniques (i.e., random utility models). As such, it would take longer to train a new person to run and update this model.

c. *How easily could the model be updated with additional years of data or additional variables?*

Both models can readily be updated with more data and variables, but it would take longer time to update the structural bioeconomic model than the reduced-form model.

# Mid-Atlantic Fishery Management Council
# Sub-Group of the Scientific and Statistical Committee

## Peer Review Report of Recreational Fishery Models

October 9, 2021

Individual Peer Review Report:
Dr. Yan Jiao, Virginia Tech University

In addition to the comprehensive consensus report developed by the peer review panel, each member developed an individual report with detailed responses to each Term of Reference (*italics*) provided by the Mid-Atlantic Fishery Management Council and the responses (standard font) are provided below.

**Response to the Terms of Reference**

1) *Are the theoretical and statistical model specifications consistent with professional standards?*
    a. *Was the model's design and specification clearly described?*

The design and specifications of both the Recreational Fleet Dynamics Model (RFDM) and the Recreational Economic Demand Model (REDM) are clearly described. Both models used MRIP data and both models treated MRIP data as true observations.

The RFDM models are based on the MRIP data disaggregated to the level of year, state and wave. The RFDM models are a set of regression models to estimate harvest and discard by fitting to the MRIP data and the variables considered in the models include YEAR, regulation variables SSB and some interaction terms.

The REDM model is based on data from a 2010 angler choice experiment survey, the MRIP data, and the stock assessment results from a statistical catch-at-age model. The 2010 angler choice experiment survey provides data to evaluate the angler behavior under different regulations, fish caught and fish release across 4 survey regions (ME-NY, NJ, DE/MD, VA/NC). The angler's choice estimated given regulations conditions is integrated in the population projection based on the most recent stock assessment specification with the recreational harvest simulated based on a process model of the angler's choice. When projecting next year's recreational harvest previous year's # of simulated choice occasions, recreational selectivity and catch per unit of effort were used.

    b. *Are the underlying data sufficient to derive model estimates?*

Both models treated MRIP data as true observations, so the model results can only be interpreted as such. Any bias in the MRIP will be carried on in both models.

The RFDM model may be revised to consider estimating trips under various regulation situations and population sizes. Such estimate may be used to provide input for the REDM model.

The angler choice survey was done in 2010. The council may consider another up-to-date survey to reflect the angler choice and may also look into the stakeholder types and preferences without responses.

The population projected recreational harvest replies on the # of simulated choice occasions and recreational selectivity. Both of them may be verified by comparing the past 5-7 year data to see whether using results from previous years are robust or not especially the # of simulated choice occasions which directly decide the # of trips in the projected year.

2) *How does the scale at which the model is operating (coast, regional, or state; wave or annual; fishing mode) affect the results?*

The RFDM models are based on the MRIP data disaggregated to the level of year, state and wave. I feel the scale that the RFDM is operating is appropriate based on its purposes. This model can provide wave-specific, year-specific and state-specific harvest and discard estimates and can meet the model for the need of both monitoring and recreational regulation considerations.

The REDM model is at the time step of 2 months and the state-specific results are reported but the angler preference survey is based on 4 coastal survey regions. It does not function to provide suggestion on the monitoring and do function to simulate the potential changes in harvest given regulation changes although I have concerns on how the # of trips is simulated.

a. *How does data availability, uncertainty, and variability affect model results, interpretation, and application?*

Both models treat MRIP as true observations, so if MRIP overestimates the recreational catch and discard, both models will do so correspondingly. The REDM model only considered the surveys from the anglers responded. These concerns are understandable given the data availability but their influence on the recreational harvest and discard prediction may be explored through sensitivity analysis and extra add-on surveys such as a new angler preference survey. Both models can provide probabilistic estimates of the results of interests.

b. *What key assumptions affect the underlying statistical analysis and interpretation of the results? Were these assumptions and relevant uncertainties identified and characterized?*

In the RFDM model, the variable selection process is based on AIC and p value but are not well described and the results don't seem to match what was used in variable selection. The Year effect is treated as linear which is of high concern both statistically and biologically. The effects of bag limit and size limit do not seem to be reasonable in some cases also. The selection of interaction terms does not seem reasonable also. Overall, the team may consider revising how the variables are treated or considered, and selected in the models. After the year effect and interaction terms are better considered, the effect of the policy considerations may make sense. The model performance may be evaluated through both model fitting and model prediction. The scale of the data is in the state level, so some correlations between harvest and discard may be hidden but it may be worthwhile to investigate the performance of modeling harvest and discard together through multivariate regressions.

The RFDM model may compare the pattern of the effect of year and the fishable biomass. Usually, the year effect is to function the change of the population size. If the year-specific population size can replace the year effect then the model can be used to predict future year's recreational harvest given population size and regulation variables.

The REDM model is in the scale of year and regions. Sensitivity runs may be done to evaluate the influence of the combination of survey regions. The results provided to compare the model projected versus the MRIP observed is at the state level, and there are a couple of states with much higher differences. Exploration of the reasons that cause such large differences is important for the application of this model and management purposes. The REDM model also simulates the number of choice occasions so that the derived # of trips matches the MRIP estimated # of trips. The description of the process is clear but it is unclear how the use of the # of the simulated choice occasion will influence the year to be projected. Such uncertainty may be evaluated through more than one calibration since the population model can be from the stock assessment results.

Potential alternative approaches may be considered by the REDM: 1) simulate the work for multiple years with MRIP estimates in the past to evaluate the uncertainty of the # of choice occasions; 2) find an alternative external approach to predict the potential # of trips. This may be combined with the RFDM model idea by investigating the # of trips from each state given the alternative regulations, fishable population size, wave and co-occur economically valuable species, etc. The uncertainty of the # of calibrated choice occasions may be evaluated through 2 ways: 1) calibrate based on the bioeconomic model in the past 5-7 year data to see whether the resulted calibrated choice occasions are similar; 2) use the same # of the calibrated choice occasions from 2019 to generate the # of trips in the past years given their population and regulations through the integrated bioeconomic model, and compare them with the MRIP observed # of trips.

The REDM may also scale down the temporal scale of the angler choice experiment from year to season or waves to expand its potential application in fisheries monitoring (see Julia's presentation and related document). The RFDM model clearly demonstrated wave effect in both harvest and discard, and likely # of trips although no studies or presented in the provided document.

3) *Is the model appropriate for estimating and predicting the impacts of bag, size, and season limits on recreational catch or harvest? Are the methods in the Recreational Economic Demand Model appropriate for estimating changes in recreational effort or fishing demand?*

Both models have the potential for estimating and predicting the impact of the bag, size and season limits on recreational harvest or catch with further revision or verification (see TORs 1 and 2).

The REDM model is appropriate for estimating changes in the recreational effort of fishing demand after the uncertainty on how the use of the # of the simulated choice occasion will influence the recreational effort for the year to be projected, how the use of past one or two years' selectivity in population project and estimated recreational effort.

a. *Does the modeling approach represent an improvement over current methods used to estimate impacts of management measures?*

Yes, both methods have improvements over the current methods used to estimate the impacts of management measures. They both provide methods to evaluate changes of single or multiple factors simultaneously either based on statistical relationships (RFDM) or based on a simulated process model (REDM). The advantages for dealing with more than one regulation changes should be better than the current method.

b. *What are the strengths/limitations of the modeling approach for informing management measures, especially at the regional, state, wave, or mode level? Are there specific recreational fishing measures for which use of the model would not be recommended?*

The RFDM model has the function to inform management measures at the regional, state, wave level based on the past MRIP records. However, the current model selection and model construction have problems and need to be revised before being used for informing management measures.

The REDM model has the function to inform management measures at the regional and year and wave level based on an angler choice survey and a forward projecting stochastic catch-at-age model with parameters from the catch-at-age stock assessment. The angler choice model did not consider wave differences in angler preference and combined angler behaviors in 4 regions, so these scales reflected in their ability to be used in the fisheries management measures.

c. *What are the implications of using the model to predict future catch/harvest based on historical data? Are there limits on the magnitude of change in catch/harvest or stock status beyond which use of the model would not be recommended?*

The year effect needs to be further considered in the RFDM model and a linear relationship is not acceptable which likely influences the effect of the other regulation/policy variables. The year effect may be compared with the change of the effect of catchable biomass to see whether the size of the stock or catchable size of the stock can replace the year effect. If the stock size can replace the year effect then the use of the model to predict future catch/harvest based on historical data is possible. If the year effect can't be replaced, some assumptions well adjusted may be used when doing future predictions. The model performance may be compared based on both model fitting and prediction.

The REDM model is designed for estimating changes in the recreational effort of fishing demand. Extra uncertainty evaluation on the use of the # of the calibrated choice occasion may be explored and addressed when projecting the recreational effort for the year to be projected. Questions on how the use of past one or two years' selectivity in population project and estimated recreational effort may vary worth to be explored to better use this model.

The range of the population size for the historical data may be clarified. If the future year stock size is out of the range of the historical stock size, the models may be used with caution.

d. *Can the modeling approach support development of multi-year bag, size, and season limits? If so, what criteria should be applied or developed to assess the reliability of the multi-year projections?*

Both models have the potential. The models should provide fitting error and prediction error or uncertainty based on historical multi-year population size, recreational catch, regulations, etc.

4) *Provide guidance for the following future model use considerations:*
   a. *Could the model be modified to incorporate other species (e.g., scup, bluefish)?*

Both models can be modified to incorporate other species. A new angler preference survey may be needed to incorporate new species and to provide up to date angler preference.

b. *Could future model runs be conducted by other individuals (e.g., Council/ASMFC staff or Monitoring/Technical Committee members) without major modifications?*

Both models can be conducted by other individuals without major modifications. The REDM is a simulation model once the estimation of angler choice preference is done, so should be handled reasonably.

c. *How easily could the model be updated with additional years of data or additional variables?*

Both models should be easily updated with additional years of data. The RFDM model should be easily updated with additional variables also; the REDM model may need some moderate level of modification if additional variables are included which requires revising both the angler choice preference analysis and the simulation of the projected recreational effort and harvest.

# Mid-Atlantic Fishery Management Council
# Sub-Group of the Scientific and Statistical Committee

## Peer Review Report of Recreational Fishery Models

October 11, 2021

Individual Peer Review Report:
Dr. Cynthia M. Jones, Old Dominion University

In addition to the comprehensive consensus report developed by the peer review panel, each member developed an individual report with detailed responses to each Term of Reference (*italics*) provided by the Mid-Atlantic Fishery Management Council and the responses (standard font) are provided below.

**Response to the Terms of Reference**

1) *Are the theoretical and statistical model specifications consistent with professional standards?*
    a. *Was the model's design and specification clearly described?*

Both models had good documentation and relied on peer-reviewed papers as the basis of their construction. Like any model construction, it is difficult to write a fully complete description and this is what lead to some of our questions.

The Recreational Fleet Dynamics Model (RFDM) spelled out the equations they used in clear fashion. This model is still under development and will benefit from further revision. In a general additive model framework (GAM), it is comprised of a set of independent polynomial regression equations for harvest and for discards of summer flounder and black sea bass. It provides simulated estimates of harvest and discard under proposed regulatory changes. The model equations include year, state, wave, recruitment, bag and size limits, spawning stock biomass (SSB) and interaction terms. The depiction of the model would be better served with an exposition of the assumptions that underlie the use of Marine Recreational Information Program (MRIP) data that form the foundation of the model. MRIP has two components, the Access Point Angler Intercept Survey (APAIS) conducted on site to estimate catch- and discards-per-angler trip and the Fishing Effort Survey (FES), a mail survey to estimate the number of angler trips. Combined, they produce estimates of total harvest and discards.

The Recreational Economic Demand Model (REDM) is more complete and is built on two peer-reviewed papers presented to the panel. It relies on an economic choice model undertaken in 2010 and statistical catch-age age models developed for stocks in 2019. Using the preferences that were evaluated from the 2010 survey, it simulates angler preferences in 2019. The model simulates angler choice, based on 2010 survey responses, to alternative bag and size limits under regulatory changes for 2019 MRIP data. The Economic choice model of 2010 relied on data reported through surveying anglers on site as part of the APAIS. The assumption of the REDM is that this survey provided a random draw from the population of anglers and it did not. It over-represented the most avid anglers. (I will discuss this more below). Depending on the use of the model, this should be made clear in the model exposition and the implications should be stated for how it is best used.

Both models rely in part on MRIP estimates of harvest and discard data and take these data to be true representations of catch and harvest. Although these MRIP data are the best available science, they also have limitations that impact models and model formulation as I discuss below.

b. *Are the underlying data sufficient to derive model estimates?*

The MRIP data that are used for both models are the most complete time-series of data coastwide that are available not only for summer flounder and black seas bass, but for other predominantly recreational species. There are additional surveys such as the American Littoral Society's tagging study that captures data on harvests and discards of summer flounder and black sea bass that might also be used in conjunction with the MRIP data in future model development. The MRIP surveys were designed to have the lowest variance for species of interest when aggregated at the largest scale of region and year. The FES is conducted at the region, state and two-month wave levels. The APAIS is also conducted at region, state and wave levels but also can be evaluated at finer scale of localities and smaller time frames. When both of these data are disaggregated to state and wave, the variance increases. Depending on the species and wave, the variance can be quite large and depends on the sample size that the particular state had available – some states augment the MRIP survey with more sampling. When management uses confidence intervals as suggested in the August 2, 2021 memo on Harvest Control Rules, one has concern that disaggregation will result in wide confidence bands that would provide less guidance for safe regulations that sustain the stock.

The RFDM also uses statistical catch-at-age stock assessments for both species. Such assessments are well vetted but also rely on MRIP data as their basis. These data often have high variance, especially when evaluated at finer scale.

Because the REDM used the 2010 choice survey to select anglers who were encountered in the on-site survey, avid anglers are over-represented. While there is no problem using the CPUE data obtained from an on-site survey for expansion estimates of catch and discard, they do pose issues when used for economic expansions where the assumption is made that anglers are randomly selected from all angling households. When used for an economic survey, a correction must be made for the avidity bias that exists in the APAIS survey. If the goal is to determine what the general population of anglers values, the current REDM model specification lacks this correction. If the goal of the model is to evaluate what the most active anglers value, then this correction may not have to be made. Nonetheless this issue in these data needs to be explicitly addressed and stated. The panel discussed weighting avidity based on demographics as one approach to correcting avidity. The correct demographic weighting should be available in the NMFS Fishing Effort Survey (FES). Because the economic choice model was conducted in 2010, the model also assumes that angler preferences have no changed over the ensuing decade, even given changes in regulations and angler demographics.

2) *How does the scale at which the model is operating (coast, regional, or state; wave or annual; fishing mode) affect the results?*
    a. *How does data availability, uncertainty, and variability affect model results, interpretation, and application?*

The MRIP survey is structured as a stratified and nested design. The APAIS is stratified by state. Nested within state are wave and within wave there is a probabilistic draw on day-work shift and access points that make up the sampling frame. It is a design that is the most variable at the lowest level and variance decreases at the highest level of aggregation. The FES is also a weighted probability survey done by mail, drawn on wave within state, with greater sampling in coastal areas and supplemented from the states' list frame of marine angler license holders. These surveys are complex and I've oversimplified for expository sake.

The RFDM operates on disaggregated data by year, state, and wave based on combined APAIS and FES estimate of harvest and discard. When querying how regulatory changes will affect harvest and discard this is appropriate because regulations are made at the state level.

The REDM is based on year and four regions (ME-NY, NJ, DE/MD, VA/NC) but also can provide output at the state level. At the regional level, the model performed well. I noted in the final report that the model performs less well at the state level, where there can be wide discrepancies between model predictions and actual occurrences. For the 2019 simulation, harvest or discard estimates of summer flounder for New Jersey, Connecticut, Massachusetts, and Maryland are predicted well, but the discrepancy is larger for Delaware, New York, North Carolina, Rhode Island and Virginia. Lack of fit was also seen for black sea bass for some states. These discrepancies need to be resolved because regulatory action is taken at the state level.

    b. *What key assumptions affect the underlying statistical analysis and interpretation of the results? Were these assumptions and relevant uncertainties identified and characterized?*

The importance of stating the assumptions cannot be overemphasized as noted in the previous TOR. While there are assumptions in constructing the model processes that need to be more clearly addressed, the elephant in the room are all the assumptions that emanate from the use of MRIP calibrated data. These data demand a clear understanding of their implicit biases- avidity, self reporting, non-response- that will influence the outcome of the best designed model. These are the only data available across time and region that have been based on statistically valid sampling protocols. However, no large-scale sampling can be done without the full understanding of population and sampling frames.

The 2010 choice survey upon which the REDM is dependent must evaluate the anticipated effect of avidity bias on the model's ability to represent the entire population of anglers, or state clearly that its results favor avid anglers predominantly. This model also had a substantial proportion of non-response that is typically of economic surveys done through add-on mail surveys. Were the 2010 respondents representative of all anglers or were they different than the larger population?

One way to query this might be to evaluate the demographics of the respondents to the nonrespondents based on APAIS data from 2010. The REDM also assumes that the angler preferences have remained the same over a decade. Were the model used for other species, preferences may change.

Likewise, the RFDM relies on the validity of self-reported discards. Typically, these data show digit-bias when discards aren't valued or when there are many of them (replying to the survey agent that there were 5 or 10 discards rather than 6 and 9) and anglers may over- or under-report discards depending on the current regulations. This may be minor or not and is difficult to assess. It is most important in fisheries where there are many discards such as for bluefish.

3) *Is the model appropriate for estimating and predicting the impacts of bag, size, and season limits on recreational catch or harvest? Are the methods in the Recreational Economic Demand Model appropriate for estimating changes in recreational effort or fishing demand?*

    a. *Does the modeling approach represent an improvement over current methods used to estimate impacts of management measures?*

Both models have value for management, upon revision and if their limitations are accounted for in management decisions. I would anticipate that they will have real value when they are used together. This would be a major improvement over the ad hoc approaches that are used now. The models would predict the impact of multiple regulations on harvest and discards, and angler welfare.

Currently, the RFMD model uses smoothing to render categorical data (year and wave) for inclusion as continuous variables, which they are not. The smoothing adds data points to the dependent variables and this increases the degrees of freedom that the model uses. Although the model is penalized for overfitting, a modeling approach that uses these dependent variables appropriately as categorical variates may result in increased variance and decreased degrees of freedom. As such the estimates and predictions could be optimistic and greater certainty assumed.

Currently as configured the REDM is predicting the valuation and response to management regulations of the avid angling community, not the general population of anglers. This is a problem that can be remedied and will improve the value of the model. Because it is based on a choice model conducted in 2010, it would be valuable for the survey to be repeated, if feasible. Although choices may still be the same a decade later, this assumption should be tested. Moreover, when applied to different species, the 2010 survey may not reflected the choices of those anglers, especially if there are differences in fishing effort by season because of species availability.

    b. *What are the strengths/limitations of the modeling approach for informing management measures, especially at the regional, state, wave, or mode level? Are there specific recreational fishing measures for which use of the model would not be recommended?*

Both models have much to recommend them.

The RFDM model uses long time series of MRIP data and should provide greater certainty for large regional and yearly predictions but less certainty when used to predict state and wave predictions. States that add more sampling events to MRIP data will usually have less uncertainty depending on species spatial and temporal distributions. The statistical catch-at-age models use the aggregate data to provide predictions and so the uncertainty at state and wave level may be underestimated at the level where regulations will be promulgated. I noted that during the presentation that the model results presented at our meeting include only the private boat mode. Depending on the species, shore and for hire may also be important sources of data, especially for species such as bluefish.

The REDM performed well at the region level. It has the promise of simulating bag and size limit regulations of projected harvest, discard, and angler satisfaction. The model is subject to biases present in the data acquisition and so it will provide better insights where the sampling is adjusted for avidity or where avidity is less of an issue.

c. *What are the implications of using the model to predict future catch/harvest based on historical data? Are there limits on the magnitude of change in catch/harvest or stock status beyond which use of the model would not be recommended?*

The RFDM uses a long time series of revised MRIP estimates of landings and discards. Effort data for black sea bass and summer flounder used to develop the estimates converge well with previous MRFSS telephone survey estimates of effort. However, this is not true of all species for which this model may be applied in the future. For example, bluefish data do not converge through time in the calibrations and the impact of this on predictions is hard to ascertain.

The REDM relies on the stated preferences of anglers in 2010. I would anticipate that it simulates the regional preferences well when close to that period. However, if angler preferences have changed in the ensuing decade because of regulatory changes, species availability or abundance, the model may not predict well the impact of future regulatory measures. One indicator might be available in the MRIP demography data which might show whether the demographics of the marine angling community have changed. If climate change has altered fish distributions or angler behavior, then the choice preferences from 2010 may not as accurately reflect current angler choices. As offshore waters warm, we may also see a redistribution of effort to cooler waves which is currently not a focus of the model predictions.

d. *Can the modeling approach support development of multi-year bag, size, and season limits? If so, what criteria should be applied or developed to assess the reliability of the multi-year projections?*

Both models have the potential. The models should provide fitting error and prediction error or uncertainty based on historical multi-year population size, recreational catch, regulations, etc. to be more useful. The limitation and strengths discussed above will influence the accuracy of multi-year predictions.

4) *Provide guidance for the following future model use considerations:*
   a. *Could the model be modified to incorporate other species (e.g., scup, bluefish)?*

Although these models may be useful for scup, there are considerable concerns with their application to bluefish. The discards for bluefish have been steadily increasing and now equal the harvest. Moreover, the discard numbers and sizes are all self-reported data which can be much less certain. It is less clear if avidity bias is as much of a concern for summer flounder, but this has not yet been ascertained.

   b. *Could future model runs be conducted by other individuals (e.g., Council/ASMFC staff or Monitoring/Technical Committee members) without major modifications?*

Both models when revised and fully documented should be able to be run by council and ASFMC staff, many of whom are well qualified to do so.

   c. *How easily could the model be updated with additional years of data or additional variables?*

Both models, upon revision, should be easily updated. The concern for the REDM is that the choice survey may be outdated and should probably be done each decade or so. This will add additional expense to updating the model. Add-on surveys to APAIS require good survey sampling practice (initial mailing, reminder mailings, a check on non-respondents).

Table 1: Metrics considered when setting recreational measures under each option in this Draft Addendum/Framework. Primary metrics determine which harvest control rule bin a stock is in; secondary metrics are only used if, through the evaluation of the primary metrics, the stock stays in the current bin. Metrics considered through accountability measures may differ from those shown below. See section 3.1 for more details on the options.

| **Option** | **Metrics used to set measures** | | | | | **Measures are pre-determined** | **Expected number of sets pre-determined measures** | **Measures specified for 1 or 2 years** |
|---|---|---|---|---|---|---|---|---|
| | **Expected harvest*** | **Biomass compared to target level** ($B/B_{MSY}$) | **Fishing mortality compared to threshold level** ($F/F_{MSY}$) | **Recent recruitment** | **Biomass trend** | | | |
| **No action** | Primary | | | | | No | N/A | 1 |
| **Percent change** | Primary | Primary | | | | No | N/A | 2 |
| **Fishery score** | Primary** | Primary** | Primary** | Primary** | | Yes | 4 | 2 |
| **Biological reference point** | Only when $F>F_{MSY}$ | Primary | Primary | Secondary | Secondary | Yes | 13 | 2 |
| **Biomass based matrix** | | Primary | | | Primary | Yes | 6 | 2 |

*Expected harvest refers to expected harvest under status quo measures compared to the upcoming year(s)' RHL and could be based on past MRIP estimates, including consideration of confidence intervals for those estimates, or a model-based estimate of harvest, including considerations related to uncertainty in that estimate.

**As described in the Draft Addendum, the fishery score metrics may not be weighted evenly. The Monitoring/Technical Committees will recommend the appropriate weight for each metric. These weights can be modified through the specifications process.

# Percent Change Option

Alternative considers future RHL, recent MRIP time-series average estimate, and the relationship of Biomass to Bmsy to determine what percent change should occur for management measures. Percent changes provide similar consideration for reductions and liberalizations.

## 1 RHL compared to MRIP estimate

Determine if the RHL for the upcoming management period is above, below, or within the confidence interval of the most recent MRIP time-series estimate.

## 2 Compare Biomass to Bmsy

Compare the Biomass estimate from the stock assessment to the biological reference point (Bmsy). Biomass categories are as follows:

- 150% above Bmsy
- between 100 and 150% Bmsy
- less than 100% of Bmsy

## 3 Find percent change in measures

The RHL and Bmsy comparison determines the appropriate management response. Measures will either be liberalized, restricted, or status quo. There are three different percentages by which measures can be liberalized or reduced .

## 4 Set Management Measures

Management measures are based on pre-defined % changes from the status quo.

# Fishery Score Option

This infographic explains how the Fishery Score will function to select the management measure bin for summer flounder, scup, black sea bass, and bluefish

## STEP 1

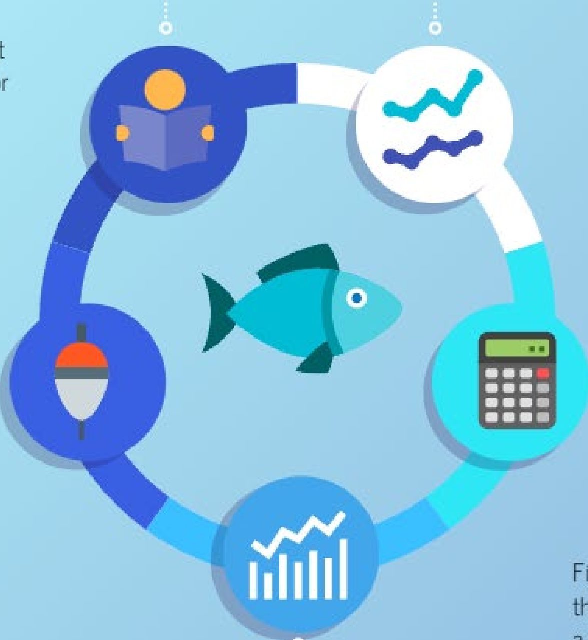
### Stock Assessment Results

An updated stock assessment is completed and approved for management use.

## STEP 2

### Calculate Fishery Score Metrics

Fishing mortality, biomass, recruitment, and fishery performance metrics are drawn from the stock assessment and recent MRIP estimates.



## STEP 3

### Use Formula to Calculate Fishery Score

Fishery Score metrics are entered in the Fishery Score formula to produce a value ranging from 1 to 5. On this scale, 1 is the lowest possible score and 5 is the highest possible score.

## STEP 4

### Determine Management Step Based on Fishery Score

Based on the calculated Fishery Score, the stock is placed into one of four bins. Each bin has an associated level of concern, stock status, and a pre-determined set of management measures.

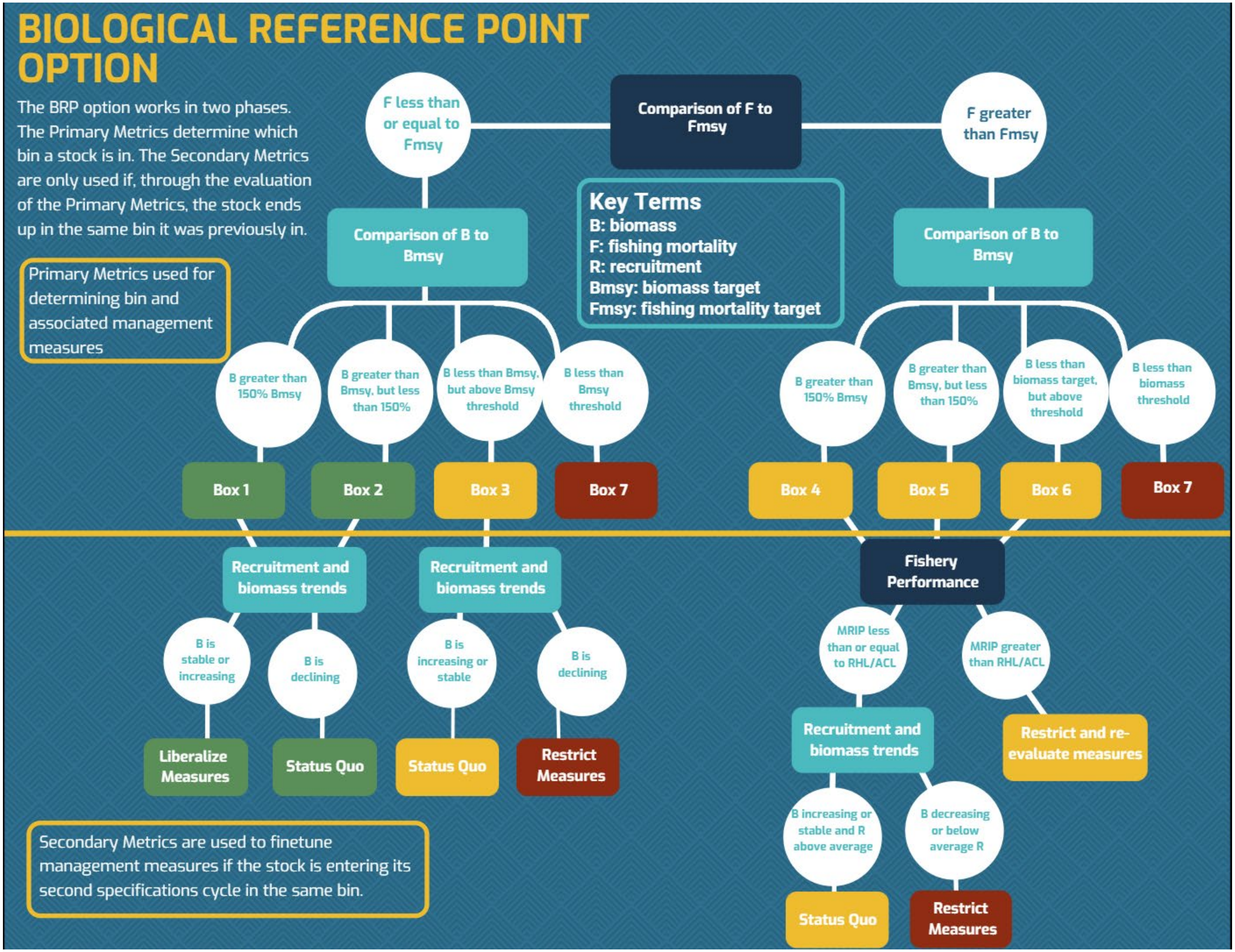
## STEP 5

### Adapt New Measures if Needed

If the Fishery Score caused the stock to move from one bin to another, then the new pre-determined management measures will be applied. If the stock remains within the same bin, measures will remain the same.

Fishery Score bins and the associated stock status, fishery performance outlook, and measures that are associated with each bin.

| Bin | Fishery Score | Stock Status and Fishery Performance Outlook | Measures |
|---|---|---|---|
| 1 | 4-5 | Good | Most Liberal |
| 2 | 3-3.99 | Moderate | Liberal |
| 3 | 2-2.99 | Poor | Restrictive |
| 4 | 1-1.99 | Very Poor | Most Restrictive |


BIOLOGICAL REFERENCE POINT OPTION
The BRP option works in two phases. The Primary Metrics determine which bin a stock is in. The Secondary Metrics are only used if, through the evaluation of the Primary Metrics, the stock ends up in the same bin it was previously in.
Primary Metrics used for determining bin and associated management measures
Comparison of F to Fmsy
F less than or equal to Fmsy
F greater than Fmsy
Key Terms
B: biomass
F: fishing mortality
R: recruitment
Bmsy: biomass target
Fmsy: fishing mortality target
Comparison of B to Bmsy
Comparison of B to Bmsy
B greater than 150% Bmsy
B greater than Bmsy, but less than 150%
B less than Bmsy, but above Bmsy threshold
B less than Bmsy threshold
B greater than 150% Bmsy
B greater than Bmsy, but less than 150%
B less than biomass target, but above threshold
B less than biomass threshold
Box 1
Box 2
Box 3
Box 7
Box 4
Box 5
Box 6
Box 7
Recruitment and biomass trends
Recruitment and biomass trends
Fishery Performance
B is stable or increasing
B is declining
B is increasing or stable
B is declining
MRIP less than or equal to RHL/ACL
MRIP greater than RHL/ACL
Liberalize Measures
Status Quo
Status Quo
Restrict Measures
Recruitment and biomass trends
Restrict and re-evaluate measures
B increasing or stable and R above average
B decreasing or below average R
Status Quo
Restrict Measures
Secondary Metrics are used to finetune management measures if the stock is entering its second specifications cycle in the same bin.

# Biomass Based Matrix Approach

**Defines bin conditions based on two factors: stock status (i.e., biomass relative to Bmsy or proxy) and the most recent trend in biomass (increasing, stable, or decreasing). These parameters create a three-by-four matrix to determine which step is appropriate.**

## Stock Status is determined

Based on the relationship of biomass to the Bmsy the stock status is categorized as either abundant, healthy, below target, or overfished

## Biomass Trend Evaluated

A stock's biomass trend is considered increasing, stable, or decreasing.

## Bin Determined

Based on the stock status and biomass trend, the stock can be anywhere between Bin A (optimal conditions) and Bin F (worst conditions).

## Determine Management Measures

Each bin has a set of pre-determined measures that depend on what step the stock is on. If the bin is the same as in the prior years, measures remain status quo.

Recreational management measure matrix under the Biomass Based Matrix Approach

| | | Biomass Trend | | |
|---|---|---|---|---|
| | | Increasing | Stable | Decreasing |
| | Abundant | Bin A | | |
| | Healthy | Bin A | Bin B | |
| Stock | Below Target | Bin C | Bin D | |
| Status | Overfished | Bin E | Bin F | |