



## New England Fishery Management Council

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### MEMORANDUM – TYPO CORRECTED

(Revised December 1, 2022, with a minor typo correction on page 5.)

**DATE:** October 19, 2022  
**TO:** Scientific and Statistical Committee  
**FROM:** Monkfish Plan Development Team  
**SUBJECT:** **Monkfish specifications for FY 2023 - 2025**

This memorandum forwards information to support recommendations by the Scientific and Statistical Committee for setting the Overfishing Limit and Acceptable Biological Catch (ABC) for the Monkfish Northern Fishery Management Area (NFMA) and Southern Fishery Management Area (SFMA) for Fishing Years (FY) 2023 - 2025. The Monkfish Plan Development Team (PDT) met by webinar on September 27 and October 18, 2022, to develop this memo.

#### ***1. OVERVIEW***

Monkfish has been assessed and managed in two areas, northern and southern. This memorandum provides information to support OFL and ABC recommendations for FY 2023 – 2025 by the Scientific and Statistical Committee (SSC). To develop recommendations, the PDT reviewed 2016, 2019, and 2022 stock assessments and peer review reports, SSC reports, PDT reports, and survey information. The 2022 management track assessment for monkfish was peer reviewed on September 20 and 22, 2022.

The monkfish regulations state: “The Councils or the PDT shall calculate ABC values for each monkfish stock based on the ABC control rule established in the FMP. These calculations shall be reviewed by the SSC, guided by terms of reference developed by the Councils. The SSC shall either concur with these ABC calculations, or provide alternative recommendations for each stock and describe the elements of scientific uncertainty used to develop its recommendations.” Failure of the monkfish analytical assessment in 2016 has precluded use of the existing control rule, and index-based assessments have been used to provide catch advice on an interim basis. However, ABC setting has not followed a clear and consistent method. Two ABC approaches are included in this memo; one is consistent with the catch-setting method identified in the 2016, 2019 and 2022 assessments and an alternate approach that was discussed during the 2022 peer review.

Section 2 of this memo provides a history of prior assessments and catch setting. Section 3 summarizes the 2022 assessment. Section 4 provides potential OFLs and ABCs for SSC consideration. Responses to the SSC recommendations made in 2019 during FY 2020-2022 specifications setting are in Section 5. Refer to the 2022 assessment report (Deroba 2022), the fishery performance report (NEFMC 2022), and the PDT memo on setting the discard deduction for other supporting information.

#### **Key Points:**

- The PDT recommends that the OFLs for the northern and southern monkfish management areas be undetermined.
- The PDT provides ABCs calculated using the Ismooth approach and using recent ABCs, but recommends against the latter approach.

## ***2. PRIOR STOCK ASSESSMENTS AND SPECIFICATION SETTING***

The term “PlanBsmooth” (now called “Ismooth”) has been used to describe the index-based assessment method and it has been equated with the method used for Georges Bank cod since 2015. However, the terms “PlanBsmooth” and the “GB cod method” have been used to describe multiple specific methods for catch setting over the years between assessment teams, the PDT, and the SSC. This section attempts to clarify some of that history.

### *FY 2011-2013*

*PDT, SSC, Council:* Amendment 5 to the Monkfish FMP, implemented in 2011, revised methods to derive the monkfish OFLs and ABCs and set specifications for FY 2011-2013 using these methods and the SARC 50 assessment (in 2011). Amendment 5 also described the following control rules:

$$OFL = \text{exploitable biomass } (B_{current}) * \text{the fishing mortality threshold } (F_{max})$$

$$ABC = \text{exploitable biomass } (B_{current}) * \text{average exploitation rate}$$

The average exploitation rate were periods of increasing biomass, 1999-2006 in the North and 2002-2009 in the South. Since 2010, the SSC has considered these control rules interim proxies until more precise aging methods can be incorporated into the assessment. “...considerable uncertainties in the assessment model preclude its use to determine probability of exceeding the projected Overfishing Level of catch” (SSC report to Council, 2010).

Through Amendment 5, the Council recommend OFLs be set for FY2011-2013 at 22,729 mt in the north and 28,263 mt in south and ABCs at 17,485 mt in north and 13,326 mt in south. These ABCs were set consistent with the control rule. This was informed by the Data-Poor Working Group assessment. After the Council taking final action, the 2010 monkfish assessment (SARC 50) was finalized.

*Assessment:* The monkfish stock assessment in 2010 (SARC 50) was an analytical assessment that used the SCALE model (had been in use since 2007), concluding that monkfish was not overfished and overfishing was not occurring but recognized significant uncertainty in this determination.

*PDT:* SARC 50 resulted in needing to recalculate the FY 2011-2013 ABC specifications (using the control rule) to ABCs of 7,592 mt in the NFMA and 12,316 mt in the SFMA.

*Council and NMFS:* NMFS approved the recalculated ABC for the south based on the SARC, lowering the ABC from 13,326 mt to 12,316 mt, given this recalculated ABC remains higher than the previously approved ACT from A5. However, NMFS disapproved the proposed specifications for the north in Amendment 5 because the recalculated ABC from the SARC was lower than the ACT from A5, leaving status quo specifications in place. Part-way through FY 2011 via Framework 7, the Council recommended a reduction in the ACT for the north so that the recalculated ABC from the SARC was higher than the ACT and thus consistent with A5. The Council also reconfirmed the SFMA ABC from the SARC (12,316 mt). NMFS reduced northern ACT and the revised effort controls while being consistent with recent scientific advice using the SARC recalculated ABC in the north ([Framework 7 Final Rule](#)).

### *FY 2014-2016*

*Assessment:* The 2013 operational assessment, that informed FY 2014-2016 specifications, also used the SCALE model and concluded that monkfish was not overfished and overfishing was not occurring.

*PDT:* The years in which the average exploitation rate was calculated for the ABC was updated to 2006-2011 in the North and 2002-2009 in the South.

*SSC:* The SSC recommended OFLs for FY 2014-2016 be lowered to 17,805 mt and 23,204 mt for the northern and southern areas, respectively, but maintain status quo ABCs (7,592 mt for north, 12,316 mt for south). These recommendations were based on seemingly conflicting considerations in stock status (e.g., monkfish was above biomass targets and stable or increasing survey trends, but continuing retrospective patterns in the stock assessment and below average recruitment) that suggest that neither drastic increases, nor decreases to existing catch levels were warranted at this time

*Council:* The SSC recommendations for OFL and ABC were accepted through Framework 8 (NEFMC 2014).

#### FY 2017-2019

*Assessment:* The 2016 operational assessment, that informed FY 2017-2019 specifications, did not update the SCALE model because its use was invalidated by age validation research (Richards 2016). This assessment concluded that many of the biological reference points were no longer relevant due to invalidation of the growth model (e.g., no estimation of absolute biomass,  $F_{max}$  could not be recalculated), and thus were not updated. Stock status was determined to be unknown. A strong 2015-year class was identified in both the survey and the discard data. The review panel for the assessment concluded that using a survey index-based method for developing catch advice was appropriate. For providing catch advice, a method called “PlanBsmooth” or the “Georges Bank cod method” was used that set catch advice based on the recent trend in NEFSC trawl survey index. This method calculates the proportional rate of change in smoothed survey indices (average of fall and spring NEFSC surveys) over the most recent three years. This rate is the slope of the regression which is then multiplied by the most recent three years average of fishery catch to determine catch advice (Equation 1):

*Equation 1:*  $Trawl\ survey\ multiplier * latest\ 3\text{-}year\ average\ catch = catch\ advice$

*Peer Review:* This method was accepted during the assessment peer review. The multipliers were 102% in the NFMA and 87% in the SFMA.

*PDT:* The PDT then recommended status quo OFLs and ABCs for both management areas for a few reasons: the confidence intervals were overlapping (1.0-1.3 in north, 0.76-1.0 in south), catch had been below the TAL in recent years, the expectation that the 2015-year class would enter the fishery during the specification years, and status quo had not resulted in overfishing in prior years.

The PDT had not reached consensus on how the survey trend adjustment should be applied. In case the SSC did not agree with the PDT’s status quo recommendation, the PDT prepared candidate ABCs using Equations 2-4 below, calling Equation 2 the “Georges Bank cod strategy” (GB cod method):

*Equation 2:*  $Trawl\ survey\ multiplier * latest\ 3\text{-}year\ average\ catch = OFL; ABC = 0.75 * OFL$

*Equation 3:*  $Trawl\ survey\ multiplier * latest\ ABC = ABC$

*Equation 4:*  $Trawl\ survey\ multiplier * latest\ ACT = ABC$

*SSC:* However, the SSC agreed with the PDT and recommended status quo OFLs and ABCs; the Council recommended and NOAA Fisheries approved status quo (ABCs were 7,592 mt in NFMA, 12,316 in SFMA).

#### FY 2020-2022

*Assessment:* The 2019 assessment, that informed FY 2020-2022 specifications, continued use of the PlanBsmooth method due to ongoing uncertainties (described above). The assessment continued to see a strong recruitment event from 2015 that led to an increase in biomass in 2016-2018, though abundance declined in 2019 as recruitment returned to average levels (NEFSC 2020). PlanBsmooth was described in the assessment report as Equation 1 (above). The assessment multipliers were 1.0 in the south and 1.2 in the north.

*Peer Review:* The peer review was presented with the PlanBsmooth method as Equation 1 and did not refute its use in the peer review report.

*PDT:* The PDT, with input by the NEFSC, recommended status quo OFLs and developed ABCs using Equation 3 (above) and called it the PlanBsmooth method and the GB cod method. The PDT recommended status quo ABC in the south (12,316 mt) and a 10% increase in the north (8,351 mt), which was more cautionary than the result of using Equation 3 (20% increase).

*SSC:* The SSC then recommended that the OFLs could not be determined because “analytical assessments are not available from which to estimate stock status criteria and biological reference points.” The SSC

further concluded that the “current ABC control rule” (likely referring to the rule approved through Amendment 5, p. 2 of this memo) could not be used as a basis for making an ABC recommendation. The SSC approved the PDT recommendations for ABCs (Equation 3) and called it the GB cod strategy.

The Council recommended, and NMFS adopted, the ABCs as recommended by the PDT and SSC. However, the Council recommended, and NMFS adopted, status quo OFLs (17,805 mt for NFMA and 23,204 mt for SFMA). At the time, the advice from the NEFSC was to not officially change stock status to unknown or OFLs to undetermined after a failed analytical assessment. At the time, there was a national-level NOAA Fisheries working group that was developing a policy to ensure more consistency for determining when stock status should change from known to unknown. The [Procedural Guidance for Changing Assessed Stock Status from Known to Unknown](#) stemming from that work became effective in November 2020.

### **3. 2022 MANAGEMENT TRACK ASSESSMENT**

*Assessment:* The 2022 management track assessment did not include an analytical assessment that could determine absolute biomass or fishing mortality. The PlanBsmooth method was again used to develop catch advice, though the name has been changed to “Ismooth” to distinguish from other “Plan B” approaches. Like the 2016 and 2019 assessments, this assessment concluded that the status of monkfish remains unknown. The Ismooth method for setting catch advice was again described as Equation 1 (above), the survey multiplier applied to recent catch. The multipliers were 0.829 for NFMA; 0.646 for SFMA. The fishery catch time series was updated, including a new discard mortality rate for scallop dredges (reduced to 64% from 100%) and data corrections were made.

*Peer Review:* The 2022 assessment was peer reviewed on September 20, 2022, and the final peer review report was available to the PDT on October 7. The peer review agreed with the unknown status determination and the updates to the catch time series. The peer review did not reach consensus on whether catch advice should be by applying the multiplier to recent catch or to recent ABC (Equation 1 vs. 3), though most of the peer reviewers supported applying it to recent catch.

The PDT notes a factual error in the peer review report. The report states:

*“The Panel spent considerable time discussing the appropriate term which the multiplier should be applied against – ABC or catch. The former has been the practice since the Ismooth approach was first applied to monkfish and moving to catch would result in a major shift in catch advice. Applying the multiplier against the catch would result in a significant decrease in ABC advice.”*

The Ismooth approach was first applied to monkfish during the 2016 assessment, but the PDT and SSC then recommended status quo OFLs and ABCs for both management areas for FY 2017-2019 (Section 2). The use of Equation 3 (multiplier \* ABC) was not used at that time. In 2019, the PDT used a revised version of Equation 3, recommending a lower multiplier in the north than the assessment called for (1.1 vs 1.2), and that revised version of Equation 3 was recommended by the SSC. Thus, use of ABC (Equation 3) has not been the practice Ismooth was first used in the assessment. The PDT notes that either approach would result in a “significant decrease in catch advice” from FY 2020-2022 levels, though more so with using recent catch.

#### 4. FY 2023-2025 OFL AND ABC

##### Overfishing Limit

The PDT recommends that the OFLs for the northern and southern monkfish management areas be undetermined (Table 1). The lack of an analytical assessment in 2022 precluded the estimation of absolute biomass and a fishing mortality rate. An OFL cannot be calculated without these parameters. This differs from the status quo OFLs. The PDT feels that having undetermined OFLs is more consistent with the unknown stock status conclusion and that the status quo OFLs are based on an analytical assessment that was invalidated in 2016.

**Table 1. Potential monkfish FY 2023-2025 OFLs for SSC consideration.**

| Management Area | Status Quo OFL | PDT recommended OFL |
|-----------------|----------------|---------------------|
| Northern        | 17,805 mt      | undetermined        |
| Southern        | 23,204 mt      | undetermined        |

##### Acceptable Biological Catch

It is the general practice of PDTs to focus on forwarding ABCs to the SSC that are consistent with the assessment and/or control rule methods. Due to the lack of an analytical assessment, the parameters needed to apply the monkfish ABC control rule are not available, so use of the ABC control rule is not possible. The PDT forwards the Ismooth approach (Equation 1) as it has been presented in the past three assessments and accepted via peer review except in the latest, in which the reviewers did not reach consensus. For SSC discussion, the PDT also prepared ABCs based on recent ABCs (Equation 3), because a minority of reviewers supported consideration of applying the multiplier to recent ABC.

*Ismooth approach:* As presented in the assessment, the Ismooth approach (Equation 1) applies the multiplier to recent catch. Fishery catch data was used as updated in the 2022 assessment (e.g., corrections to the discard timeseries, use of 64% discard mortality for scallop dredges). The average catch over CY 2019-2021 was 6,465 mt in the NFMA and 5,655 mt in the SFMA. Use of Equation 1 results in the following ABCs for FY 2023-2025:

$$\text{North: } 0.829 * 6,465^1 \text{ mt} = 5,360 \text{ mt}$$

$$\text{South: } 0.646 * 5,655 \text{ mt} = 3,653 \text{ mt}$$

*Recent ABC approach:* The 2022 assessment peer review did not reach consensus on the use of the Ismooth approach for these specifications; a minority of reviewers supported consideration of applying the multiplier to recent ABC (Equation 3). The most recent ABCs are for FY 2020-2022: 8,098 mt in the NFMA and 12,316 mt in the SFMA (Table 2, p. 10). Use of Equation 3 results in the following ABCs for FY 2023-2025:

$$\text{North: } 0.829 * 8,098 \text{ mt} = 6,713 \text{ mt}$$

$$\text{South: } 0.646 * 12,316 \text{ mt} = 7,956 \text{ mt}$$

*PDT consensus statement:* The PDT recommends against basing FY 2023-2025 ABCs off recent ABCs. (use of Equation 3). The ABCs set for the last two specification cycles stem from an analytical assessment that was invalidated in 2016. Also, these ABCs were set using a previous timeseries of discard data with errors and assumptions that were updated in the 2022 assessment.

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<sup>1</sup> The memo presented to the SSC on October 26 had a typo in the Northern catch. The correct catch is 6,465 mt, not 6,425. The product of this equation (5,360 mt) was correct in the memo when it was presented.

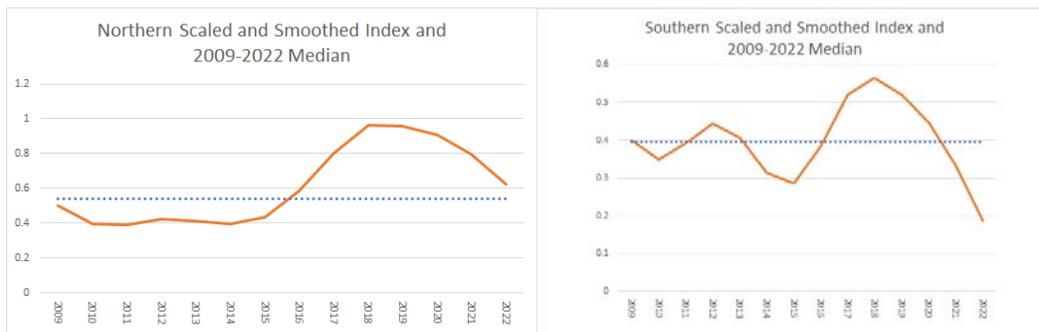
*Additional discussion:* In compliance with the Magnuson-Stevens Act, ABCs need to be set at levels that prevent overfishing and prevent a stock from becoming overfished, and the PDT concluded that use of the Ismooth approach would likely accomplish that outcome. This is particularly important in cases where the OFL is undetermined. The [Index-based Methods Working Group](#) and Legault et al. (in press) found that the Ismooth approach, in the face of multiple uncertainties, was likely to provide catch advice that prevents overfishing promotes long-term stability of catch and biomass. These peer-reviewed findings support the PDT’s conclusion.

The PDT is concerned with the continued lack of an analytical assessment and, while the past three assessments provided catch advice using the Ismooth approach, some PDT members have concerns about relying on the Ismooth approach for monkfish at the current time for several reasons.

There is concern that the uncertainty conveyed in the LOESS smooth confidence intervals (Deroba 2022, Figures 25 and 26) only include the uncertainty introduced by the smoothing function and not the uncertainties in the underlying indices. These uncertainties arise primarily from tow-by-tow catch variability, survey design, and changes in gear/vessels over time - including the switch from the *RV Albatross* to the *RV Bigelow* in 2009. The *RV Bigelow* is known to catch significantly more monkfish than the *RV Albatross* (Miller et al. 2010).

There is also concern when considering recent trends and what the Ismooth approach would have advised at several time periods. Focusing on the *RV Bigelow* time series (2009-), the smoothed Northern index started below the 2009-2022 median, then increased, then decreased to slightly above the 2009-2022 index median, essentially ending where it began (Figure 1). The smoothed Southern index has been above or below the 2009-2022 index median five times since 2009. While the 2022 smoothed value is unusually low, the 2015 value would have looked similarly low as a terminal year without the benefit of the LOESS smoothing from subsequent years that we see now. Also, the 2018 smoothed value would have looked higher as a terminal year without the smoothing from subsequent years that we see now. If one had used the Ismooth approach in the south with 2015 or 2018 as the terminal year, Ismooth would have advised changing catches opposite of how subsequent southern area survey indices trended, and with even more impactful multipliers than would be apparent now due to the terminal year issue.

**Figure 1. LOESS-smoothed applied to the survey indices (Figures 25 and 26 from 2022 monkfish assessment) for 2009-2022 with median line added**



Considering the full time series of the survey index (fall survey began in 1963, spring survey began in 1968), the biomass indices suggest that biomass in the NFMA and SFMA has been low in recent years. The Ismooth method rescales the survey indices by the time series mean, so the time series has a mean of one (Deroba 2022, Figures 25 and 26). In the NFMA, the Ismooth indices themselves (not the LOESS-smooth) have been below one since 2004. In the SFMA, the indices have been below one since at least 1990.

Use of the Ismooth approach would result in an ABC that is lower in the SFMA relative to the NFMA, an outcome consistent with results of the chainsweep study. The estimates of monkfish biomass resulting from the paired tow experiments using chainsweep and rock hopper gears (hereafter chainsweep study) were provided to address TOR 2 of the assessment. The chainsweep study has not been peer reviewed for its application specifically to monkfish, and has not been previously used in an official capacity in a monkfish assessment or for providing monkfish catch advice. Acknowledging that, the chainsweep study suggests higher biomass in the NFMA relative to the SFMA. If biomass is lower in the south relative to the north, the PDT is concerned that use of Equation 3 would result in higher ABC in the south.

Considering the chainsweep study further, if the outcomes approximate biomass, the results suggest relatively low exploitation rates in the NFMA in recent years (e.g., ~80,000 mt in 2021 compared to the catch of 5,932 mt). In the SFMA, exploitation rates may be higher (e.g., ~15,000 mt in 2021 compared to the catch of 4,346 mt). This would further support having a lower ABC for the SFMA relative to the NFMA.

The PDT recognizes that the ABCs under either approach would be substantially lower for FY 2023-2025 than the ABCs for FY 2020-2022. Recent catches have been below ABCs, a function of many factors including: biomass, world fish markets that affect price, fishing costs, effort controls in the monkfish fishery, and dynamics of other fisheries that incidentally catch monkfish (see the 2022 Monkfish Fishery Performance Report for related details). Impacts on the Total Allowable Landings will also depend on the approach used to set the discard deduction from the Annual Catch Target (see PDT memo on discard deduction approaches), but because there are no management controls on discards (e.g., no sub-ACLs for discards), reductions in future catch would likely come from reduced landings, unless drivers outside of the Monkfish Fishery Management Plan reduce monkfish discards in other fisheries.

## ***5. RESPONSES TO 2019 SSC RECOMMENDATIONS***

In August 2019, when recommending OFLs and ABCs for FY 2020-2022, the SSC made several other recommendations, which the PDT responds to here:

*SSC Recommendation #1:* Improve “age and growth information for conducting analytical assessments in the future” to allow for formal estimation of stock status criteria and reference points.

*PDT Response:* Unfortunately, a successful aging technique has not been found for monkfish. Recognizing this, the 2022 assessment peer review suggested that NOAA Fisheries instead focus on tracking cohorts via modes in length frequency data, especially when a relatively large cohort is believed to be ageing through the population. The success of such an approach has not been evaluated.

*SSC Recommendation #2:* Investigate “the 2015 recruitment event and its effect on discards and biomass trends. If the high discard rates in the current fishery are primarily due to the 2015 cohort, it is important to understand if discarding will decline as this year class becomes fully recruited to the fishery.”

*PDT Response:* The 2015 year-class was first seen in the 2016 assessment and was used, in part, as rationale for the conclusion that biomass was likely to increase, and both northern and southern indices approximately doubled from 2015 to 2018. However, the length data presented in the 2022 assessment indicate that the 2015 year-class did not track into the subsequent adult population. In the SFMA, discards were particularly high in 2016-2019, averaging 3,123 mt, and lowered to 2,318 mt on average in 2020-2021. In the NFMA, discards peaked in 2018-2019, averaging 1,167 mt (Deroba 2022, Table 1). This suggests that this year-class was heavily impacted by discarding, primarily in the scallop dredge fishery. The 2022 assessment peer review noted that there was a reduction in port sampling for individual lengths and age structures since 2019 and that if port sampling does not increase, then additional catch sampling should be done by observers to offset the loss in port sampling data.

The updated recruitment indices showed that recruitment in the north was high in 2020 relative to the time series (1963-2020), but not as high as the peak in 2015 (Deroba 2022, Figures 14 and 15). In the

south, 2020 recruitment was more like the long-term average. While this may be cause for optimism in the north, the PDT notes the recent history of the large 2015 year-class. Without new management measures that would prevent the incidental catch and discarding of juveniles, the PDT cautions against assumptions about recruitment into the fishery.

*SSC Recommendation #2:* Investigate “various alternative approaches for assessing monkfish as recommended by the peer review panel including surplus production models that incorporate process error and other data limited approaches (such as those available in the DLM toolkit and ICES assessment tools).”

*PDT Response:* Examining alternate assessment approaches was outside the scope of the 2022 assessment, which was a Level 2 management track assessment. The peer reviewers suggested that a delay-difference model be explored in the next research track assessment and the PDT supports this recommendation. The PDT notes that the DLM toolkit contains hundreds of alternatives and is uncertain what “ICES assessment tools” refers to specifically. The next monkfish assessment will be a management track in 2025, but a research track assessment is scheduled for 2027 in which alternate approaches can be explored.

*SSC Recommendation #4:* Examine “NEFSC survey abundances for monkfish during the 2020-2022 period to evaluate whether adjustments to the specifications might be needed to account for unanticipated changes in the abundance of monkfish in either of the two Management Areas. The SSC recommended that a “rumble strip” approach be developed (such as the approach used for scup) to ensure that the monkfish ABCs during the specification period are concordant with current stock abundance. The rumble-strip approach could examine various data such as survey abundance, size compositions, and fishery catch and length-frequencies to evaluate whether any unforeseen adverse changes had occurred in the monkfish populations in either of the two Management Areas. If so, a management action might be needed to be address this situation.”

*PDT Response:*

The NEFSC did not update monkfish survey indices between the 2019 and 2022 assessments. Annual updates for monkfish are not normally done outside of assessments. Also, there was no survey in 2020 due to the pandemic and there has been staff turnover within the NEFSC Population Dynamics Branch, the Greater Atlantic Fisheries Office, and the NEFMC staff supporting the monkfish management plan.

In 2013, the Scientific Uncertainty Subcommittee of the Mid-Atlantic Fishery Management Council SSC identified “rumble strip” approaches for setting multi-year ABCs, including a review in their subsequent performance ([see report](#)). There was some development of approaches for managing scup, but these were never approved and implemented through a Council action. At the time, scup management benefited from having an assessment completed, the results of which were used. This is not an immediately applicable case study and such an idea for management of monkfish would require substantial effort to develop and implement.

## 6. REFERENCES

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**Table 2. Monkfish specifications and fishery performance, 2011-2022**

|                                  | Year | Fishing Year Specifications (May 1 – Apr 30) |         |        |                   |       | Calendar Year Assessment Data |          |       | % ABC Caught | % ACT Caught | % TAL Landed |     |     |     |
|----------------------------------|------|--|---------|--------|-------------------|-------|-------------------------------|----------|-------|--------------|--------------|--------------|-----|-----|-----|
|                                  |      | OFL  | ABC=ACL | ACT    | Expected Discards | TAL   | Landings                      | Discards | Catch |              |              |              |     |     |     |
| Northern Fishery Management Area | 2011 | 22,729                                       | 7,592   | 6,567  | 713               | 5,854 | 3,328                         | 370      | 3,698 | 49%          | 56%          | 57%          |     |     |     |
|                                  | 2012 |  |         |        |                   |       | 4,081                         | 493      | 4,574 | 60%          | 70%          | 70%          |     |     |     |
|                                  | 2013 |  |         |        |                   |       | 3,355                         | 459      | 3,814 | 50%          | 58%          | 57%          |     |     |     |
|                                  | 2014 | 17,805                                       |         | 7,364  | 1,026             | 6,338 | 3,434                         | 484      | 3,918 | 52%          | 60%          | 59%          |     |     |     |
|                                  | 2015 |  |         |        |                   |       | 4,086                         | 572      | 4,658 | 61%          | 71%          | 70%          |     |     |     |
|                                  | 2016 |  |         |        |                   |       | 4,723                         | 734      | 5,457 | 72%          | 83%          | 81%          |     |     |     |
|                                  | 2017 | 8,351  | 8,101   | 1,477  | 6,624             | 7,105 | 840                           | 7,945    | 105%  | 108%         | 112%         |              |     |     |     |
|                                  | 2018 |  |         |        |                   | 6,009 | 1,253                         | 7,262    | 96%   | 99%          | 95%          |              |     |     |     |
|                                  | 2019 |  |         |        |                   | 6,084 | 1,080                         | 7,163    | 94%   | 97%          | 96%          |              |     |     |     |
|                                  | 2020 |  |         |        |                   | 5,587 | 723                           | 6,310    | 76%   | 78%          | 84%          |              |     |     |     |
|                                  | 2021 |  |         |        |                   | 5,121 | 802                           | 5,923    | 71%   | 73%          | 77%          |              |     |     |     |
|                                  | 2022 |  |         |        |                   |       |                               |          |       |              |              |              |     |     |     |
| Southern Fishery Management Area | 2011 | 28,263                                       | 13,326  | 11,513 | 2,588             | 8,925 | 5,271                         | 1,566    | 6,837 | 51%          | 59%          | 59%          |     |     |     |
|                                  | 2012 |  |         |        |                   |       | 5,674                         | 1,962    | 7,636 | 57%          | 66%          | 64%          |     |     |     |
|                                  | 2013 |  |         |        |                   |       | 5,207                         | 1,372    | 6,579 | 49%          | 57%          | 58%          |     |     |     |
|                                  | 2014 | 23,204                                       | 12,316  |        |                   |       | 11,947                        | 2,936    | 9,011 | 5,099        | 1,188        | 6,287        | 51% | 55% | 57% |
|                                  | 2015 |  |         |        |                   |       |                               |          |       | 4,550        | 919          | 5,468        | 44% | 47% | 51% |
|                                  | 2016 |  |         |        |                   |       |                               |          |       | 4,331        | 2,114        | 6,445        | 52% | 56% | 49% |
|                                  | 2017 |  |         | 3,796  | 3,544             | 7,339 |                               |          |       | 60%          | 61%          | 43%          |     |     |     |
|                                  | 2018 |  |         | 4,388  | 3,476             | 7,864 |                               |          |       | 64%          | 66%          | 49%          |     |     |     |
|                                  | 2019 | 4,373  | 3,358   | 7,732  | 63%               | 65%   | 49%                           |          |       |              |              |              |     |     |     |
|                                  | 2020 | 2,593  | 2,295   | 4,887  | 40%               | 41%   | 29%                           |          |       |              |              |              |     |     |     |
|                                  | 2021 | 2,005  | 2,340   | 4,346  | 35%               | 36%   | 22%                           |          |       |              |              |              |     |     |     |
|                                  | 2022 |  |         |        |                   |       |                               |          |       |              |              |              |     |     |     |

