



Atlantic States Marine Fisheries Commission

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MEMORANDUM

TO: Summer Flounder, Scup, and Black Sea Bass Management Board
FROM: Summer Flounder, Scup, and Black Sea Bass Technical Committee
DATE: December 6, 2017
SUBJECT: Summary of Technical Committee Work on Smoothing Approaches

State MRIP harvest estimates, used to determine both the performance of the current year's measures as well as develop measures for subsequent years, can fluctuate significantly due to a number of factors in effort and harvest data; data which seem biologically unfeasible and are not believed to represent reality. To address these unrealistic harvest estimates, the Summer Flounder, Scup, Black Sea Bass Technical Committee (TC) needs to recommend an objective process and rationale for identifying, evaluating, and potentially adjusting unrealistic values. Identifying anomalous harvest estimates can help with developing more effective and stable management measures, through a decision tree type process. For example, the process might include the following steps:

- 1. Initial review of current year's MRIP harvest estimates to determine if any data appear to be anomalous by comparing against harvest in recent years. NOTE:** The initial review is inherently subjective - the subsequent steps help move from subjective to objective identification. Despite this subjectivity, criteria will be developed to help with this portion of the data vetting.
- 2. Identify outliers using ____ method.**
- 3. Smooth outlier using ____ method.**
- 4. Use smoothed estimate for the purpose of ____.**

If this is how the process should be set up, the TC needs to agree on how to fill in the blanks in each of these steps. Below are descriptions of each step, discussions had by the TC thus far, and pertinent questions that still remain regarding each item.

1. METHOD FOR IDENTIFYING OUTLIERS

- At the TC/MC meeting in November, there was general agreement that the **Modified Thompson's Tau (MTT)** expression, a statistical method to identify outliers, could serve as an objective approach to evaluate MRIP harvest estimates.
- The TC is interested in exploring other methods, for example, Winsorization, another statistical approach to minimize the influence of outliers.
- Identifying outliers is a multi-step process including the following steps:
 - Gross time series analysis to see if any estimates appear anomalous, considering impacts of changes in regulations
 - Review of data at the intercept level (Look for factors that may have contributed to anomaly, e.g. large weights, high catches, few intercepts, many intercepts, obvious errors)

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- Official review of MRIP data
 - Outlier detection using determined method (e.g. MTT)
- There is not agreement on whether to apply the outlier ID method to scan all final MRIP harvest data for outliers when they are being used for management measure decisions. (This would be more objective than eyeballing the estimates and then deciding to apply or not)
- After time series review, suspect MRIP data should be scanned for outliers at multiple levels (by state, by wave, mode, etc.) to determine if a single strata is responsible for the anomaly so the specific MRIP data can be reviewed.
- There was concern regarding the MTT method's ability to recognize low outlier estimates as opposed to high estimates. The method is sensitive to the absolute difference between an estimate and the mean of the dataset. However, if a time series is usually low, it is possible that a very low estimate may not be identified in the analysis. It is uncertain whether there is a way to adjust the sensitivity of MTT.
- There is an interest in incorporating PSEs into outlier identification, possibly in the initial review of MRIP data.

2. METHODS FOR SMOOTHING

A. Proportional Harvest Method

- This method uses the average ratio of one wave's harvest to another over a specified timeframe (determined by finding years where regulations did not change significantly) to calculate a more likely wave estimate.
- Discussion on pros and cons of approach
 - Pro: simplicity of approach and easy to understand math
 - Pro: could be applied at the regional or coastwide level
 - Con: appropriate candidate years for calculating harvest ratios would have to be determined or reevaluated for each estimate
- Northern states have opted to use this method in adjusting the 2016 New York Wave 6 harvest estimate for the purpose of projecting 2017 harvest to come up with example recreational measures for Draft Addendum XXX. They chose the candidate years of 2012 – 2016 to calculate the average ratio because it was the more recent timeframe where there was minimal change in regulations year-to-year, and yielded the largest revised harvest estimate which would help to control expectations for the projections and proposed example measures.
- **NOTE:** If this process were applied to future MRIP anomalies, it would be have to be adjusted for every case, with multiple decision points. The example used here was only for New York, Wave 6 in 2016 with specific candidate years to develop the ratio. If an estimate for a different state or wave or even species is identified as an outlier to be smoothed, the TC will have to decide what the most appropriate years to average are (based on change in regulations) and which wave to calculate a ratio with (based on similarity of regulations, effort, consistent harvest proportions?). Thus there may not necessarily be a standard protocol involved in this approach.
 - The TC will need to develop general criteria for how to apply this method.
 - Remaining questions: 1) would the revised estimate be incorporated into harvest estimates going forward, "replacing" the anomalous value? 2) if an anomalous estimate was smoothed and used for projecting harvest, and then in a subsequent year additional ratio comparisons are needed that would include an old anomalous estimate, would the revised value be used or the original value?

- There is general concern regarding the use of smoothed estimates in future ratios to smooth estimates.

B. Gaussian Process Regression (GPR)

- This approach assumes that that inter-annual changes in harvest should be related to each other in time, meaning that effort and potential for harvest should not change by orders of magnitude from year t to year $t+1$.
- GPR generated harvest estimates are 'smoothed' both ways (i.e. high estimate may be smoothed down; 'low' or 'average' estimate may be smoothed up)
- Discussion on pros and cons of approach
 - Pro: smooths data for entire time series, removing outlier, likely anomalous harvest estimates, and creating less inter-annual variability
 - Pro: has application beyond sea bass to both summer flounder and scup
 - Pro: could be used to predict harvest estimates for the upcoming year
 - Con: May present challenges for Managers when GPR harvest estimates are higher than MRIP estimates
 - Con: Likely will require additional training for all TC/MC members for generating state, regional, and coastwide estimates
 - Con: Likely will create disconnect between rec data used in the stock assessment model and rec data used for management measures evaluation
- Overall, the group was in agreement that while this approach is promising and it is relevant for all three species (summer flounder, scup, and black sea bass), if this approach were to be adopted in the future, there would need to be set of criteria and/or procedure used to determine when it were to be applied; from a logistical standpoint, GARFO and MAFMC staff would also need assistance in incorporating this into their evaluation of accountability measures.
- Further analysis is needed to determine whether this method produces a retrospective pattern when the time series is truncated.
- Further work will be done to develop estimates on the regional level (i.e. MA-NJ) as well as try to predict the harvest for the next year based on the prior year.

C. Control Rules

- The concept presented recommends using stock assessment information such as the status of the stock and/or fishing mortality to trigger management response. Control Rules could replace the current method of evaluating the current year's harvest estimates with the following years Recreational Harvest Limit (RHL) on an annual basis.
- PSEs could be incorporated into the control rules to determine when a proposed liberalization or reduction is necessary by using PSEs around the terminal year estimate when comparing to the next year's RHL.
- Discussion of Pro's and Con's
 - Pro: as stocks decline, management measures don't liberalize and as stocks expand, management measures don't become more restrictive.
 - Pro: Regulations would change less frequently providing stability, better compliance, and ease to law enforcement.
 - Pro: Using Control Rules could reduce dependence on MRIP estimates and the annual variability associated with them.
 - Pro: Doesn't require chasing the RHL on an annual basis.

- Con: Would likely require changes to the FMP framework.
- Con: Current Accountability Measure Amendment does not allow for overages without changing management measures.
- The TC is interested in further development of using Control Rules, but more time and work is needed to lay out how it would be set up before giving a full pitch to the Board and Council.
- These changes would likely require modifications to the Council and Commission's FMPs.

3. WHEN TO USE SMOOTHING

- The TC has generally agreed that using MRIP point estimates for evaluating harvest against RHL and for making projections can be inadequate. So far smoothing has been discussed in the context of adjusting MRIP harvest estimates for these purposes.
- Smoothing has multiple applications: projections, allocations, evaluation of harvest against RHL (determining required liberalization or reduction) and crafting measures.
- The TC still needs to agree on whether smoothing should be used consistently in any of these applications. Simulations to test the effects of using smoothed estimates for various applications will be helpful.

4. GENERAL NEEDS

- For the TC to continue work on developing these methods, the Board would need to task them.
- If the Board is interested in using smoothing approaches for setting measures in 2018, they will need to prioritize this task to ensure completion of work by **early February 2018**.
- If the Board is interested in having the TC develop Control Rules, the Board should specify whether this work will be done prior to the 2019 fishing season, or later.