SUMMER FLOUNDER, SCUP, AND BLACK SEA BASS FISHERY MANAGEMENT PLAN
Alternative Set 2: Commercial Quota Allocation
Proposed New Alternative: Dynamic Transboundary Approach

RI ASMFC Delegation

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Introduction

This proposal offers a new alternative for modifying the allocation of the commercial summer flounder quota. It involves a dynamic approach for gradually adjusting state-specific allocations using a combination of resource utilization (historical allocations) and current levels of resource distribution. The alternative is modeled after the Transboundary Management Guidance Committee (TMGC) approach, which was developed and used for the management of shared Georges Bank resources between the United States and Canada.

As noted by Gulland (1980), the designation of units for management entails a compromise between the biological realities of stock structure and the practical convenience of analysis and policy making. For summer flounder, the Atlantic Coast states from North Carolina to Maine - acting through and by the MAFMC, ASMFC, and GARFO – use a single management unit encompassing the entire region occupied by the stock, from the southern border of North Carolina northward to the U.S.- Canadian border. While there is a general scientific consensus that the summer flounder population has shifted its center of biomass to the northen portion of its range (Bell et al. 2014 and Peretti 2018), the current management structure, as reflected by current state-by-state allocations, does not recognize this new population dynamic. The Draft Amendment sets forth two Alternatives (2B-1 and 2B-2) that address this shift; however, both involve a single set of uni-directional adjustments to allocations, with relatively large increases/decreases from status quo for some states, enacted immediately upon implementation. This new alternative sets forth an approach that balances stability within the fishery, based on historical allocations, with gradual adjustments to the fishery, based on regional shifts in resource distribution emanating from updated stock surveys. The approach affords considerable flexibility, both with regard to initial configurization and application over time. A key feature involves the use of control rules to guard against abrupt shifts in allocations.

This new alternative draws upon established principles of resource sharing, which include consideration of access to resources occurring or produced in close spatial proximity to the states in the management unit and historical participation in the exploitation of the resources (Gavaris and Murawski 2004). The former has emerged from the changing distribution of the summer flounder resource and the effects this creates within the fishery. The latter recognizes traditional involvement and investment in the development of the fishery since the early 1990s. Both principles were incorporated in the TMGC approach; historical participation was initially afforded primary emphasis, then gradually down-weighted so that, after an eight-year phase-in period, the annual allocation was based primarily on resource distribution (Murawski and Gavaris 2004). The approach proposed here for summer flounder is similar; however, the proposal envisions a more gradual transition, giving more weight to historical participation at first, then slowly phasing in the distributional aspects over time. Details for the calculations used for the TMGC approach were described by Murawski and Gavaris (2004). Modifications to that approach are necessary, given key differences between the shared Georges Bank resources and the shared summer flounder resource. Those differences include the state-by-state allocation system currently in place for summer flounder, the need to translate from regional to state-specific allocations, and the need to accomodate multiple jurisdictional differences in the fishery.

This new alternative proposes use of existing state-by-state allocations to reflect initial values for historical participation (aka resource utilization) and proposes use of trawl survey information to determine the values for resource distribution; the two values are then integrated in the form of regional shares. Three regions are proposed: (1) ME - NY, (2) NJ, and (3) DE - NC. They emanate from the spatial stratification of the stock in to units that generally align with recreational management units for this species, which were developed to contend with some of the differences in the fishery from north to south. The regional shares are then sub-divided into state-specific allocations.

The overall approach can be modified by the Board and Council in various ways. For example, sub-alternatives can be developed for:

- the regional configuration (e.g., other regions beyond those proposed here);
- the values for historical participation/resource utilization (e.g., current, status quo allocations, or some variant thereof);
- the percentage weighting values for Resource Utilization and Resource Distribution (90:10, or some variant thereof);
- the increment of change in these values from one year to the next (10%/year, or some variant thereof;
- the periodicity of adjustments (e.g., annually vs. biannually); and
- the overall time horizon for the transition (e.g., 8 years vs. 16 years).

The control rule can also be evaluated via two or more sub-alternatives (e.g., a cap that's higher or lower than 5%).

Data and Methods

Formula

Adapted from the TMGC application (TMGC 2002), the approach for calculating the respective regional shares, which takes historical utilization in to account and adapts to shifts in resource distribution, is as follows:

$$\%RegionalShare = (\alpha_y * \sum_r StateSpecAlloc) + (\beta_y * \%ResDistr_{r,y}) \quad (1)$$

Where α_y = percentage weighting for utilization by year; β_y = percentage weighting for resource distribution by year; $\alpha_y + \beta_y = 100\%$; $StateSpecAlloc$ = state specific allocation; $ResDistr$ = resource distribution; r = region; y = year

Proposed regions:
Three regions are proposed: (1) ME - NY, (2) NJ, and (3) DE - NC.

Proposed values for historical participation/resource utilization:
See Resource Utilization section below

Proposed values for resource distribution:
TBD based on most recent trawl survey information

Proposed percentage weighting values for resource utilization and resource distribution:
The initial sharing formula is proposed to be based on the weighting of resource utilization (from historical allocations) by 90% and the weighting of resource distribution by 10%.

Proposed increments of change in the weighting values from one adjustment period to the next: 10% per period. Thus, 90:10 to begin, then: 80:20, 70:30, 60:40, 50:50; 40:60; 30:70; 20:80, then concluding at 10:90)

Proposed periodicity of the adjustments:
Annually.

Overall time horizon for the transition:
8 years. If commenced in 2020, it would conclude in 2027

With these - or alternative - parameters assigned, the region-specific shares then need to be prorated into the existing state-specific allocation structure. This can be accomplished by:

$$NewStateAllocation = \frac{Allocation_s}{\sum_r StateSpecAlloc} * \%RegionalShare \quad (2)$$

Where $Allocation_s$ = the specific state being calculated

Resource Utilization

Historical state-specific commercial allocations for summer flounder are codified in Amendment 2 and were modified in Amendment 4 to the Fishery Management Plan for Summer Flounder (FMP) (MAFMC.a. and MAFMC.b. 1993) (Table 2). These allocations can serve as the basis for the resource utilization values in the allocation formula. These values, as used in the formula, would remain consistent throughout the reallocation process, even as the final state allocations change over time, based on equations 1 and 2. This is philosophically consistent with the FMP, as this portion of the allocation formula is meant to represent the historical fishing aspects of the summer flounder fishery.

However, alternative strategies (set forth in the form of sub-alternatives) could be used to set the initial allocation design. That is, the initial resource utilization portion of the allocation design could be adjusted, via revised state allocations, before transitioning into the formulaic approach to be used as the process moves forward. For example, the initial allocations could be shifted to meet one or more of the following objectives:

1. Reallocate quotas based on the resource's northward shift in distribution and the effect on availability to the states' fisheries.
2. Recognize that VA and NC are unique in having the largest allocations, and in having lost access to a large portion of their original allocation that was based on state-waters harvest.
3. Recognize that NY's current, status quo allocation may be disproportionally low due to inaccurate or unreported landings during the reference period.
4. Hold ME and NH at their current, status quo allocations since they have not declared interest in the fishery.
5. Hold DE and MD at their current, status quo allocations given the relatively small levels of those allocations.
6. Recognize that the resource's center of biomass remains off the NJ coast and that the State has not lost access despite being grouped in the southern region per regional analysis.
7. Recognize that RI and NJ have large allocations relative to other northern states.
8. Recognize that CT has a disproportionately small allocation compared to other northern states, but may have limited prospects for growth.
9. Recognize that large revisions to allocation should be phased in to moderate their effects, unless mitigated by a coastwide quota increase.

One way to implement this type of approach would be the following, working from equation 2 above:

$$NewStateAllocation = \frac{Allocation_s + \lambda_s}{\sum_r StateSpecAlloc} * \%RegionalShare \quad (3)$$

Where λ = a state specific allocation additive factor, s = the state being calculated, and t = the year specific weighting factor.

This formula allows for a shift in initial (status quo) allocations to account for some, or all, of the objectives noted above.

Resource Distribution

Values for resource distribution can be obtained and calculated using scientific surveys, with results apportioned into regions. Since surveys are undertaken annually, the values for resource distribution, by region, can be recalculated and updated annually, biannually, or upon whatever timeframe is deemed most appropriate, affording an opportunity to regularly adjust allocations in synch with shifts in resource distribution. Such shifts may, or may not, follow consistent trends. Accordingly, the technique affords a dynamic approach, consistent with actual changes in resource distribution – contrasting with the one-time, fixed approaches set forth by Alternatives 2B-1 and 2B-2 in the Draft Amendment, which adjust allocations based on prior reference periods that may not align with current/future conditions and trends.

The process set forth below addresses total biomass, but it could be modified (and presented as a sub-alternative) to address exploitable biomass.

Drawing upon the TMGC approach, a swept area biomass, considered a relative index of abundance, can be computed in each stratum, then summed to derive the biomass index for each region. The biomass index estimate derived from each survey would represent a synoptic snapshot of resource distribution at a specific time during a year. Combining the results of multiple surveys requires an understanding of seasonal movement patterns and how much of the biological year each survey represents. For this reason, it is proposed to use the National Marine Fisheries Service (NMFS) Trawl Survey in combination with the North East Area Monitoring and Assessment Program (NEAMAP) Survey. These are both well-established surveys, currently used in the stock assessment, and are synoptic, covering both offshore and inshore strata. As proposed, the existing survey strata would be used to partition the survey information into three stock regions: (1) ME - NY, (2) NJ, and (3) MD - NC. The strata do not align perfectly with these three spatial configurations, but they are relatively close (Figures 1 and 2). Table 1 provides an example of how the strata could be applied for each region.

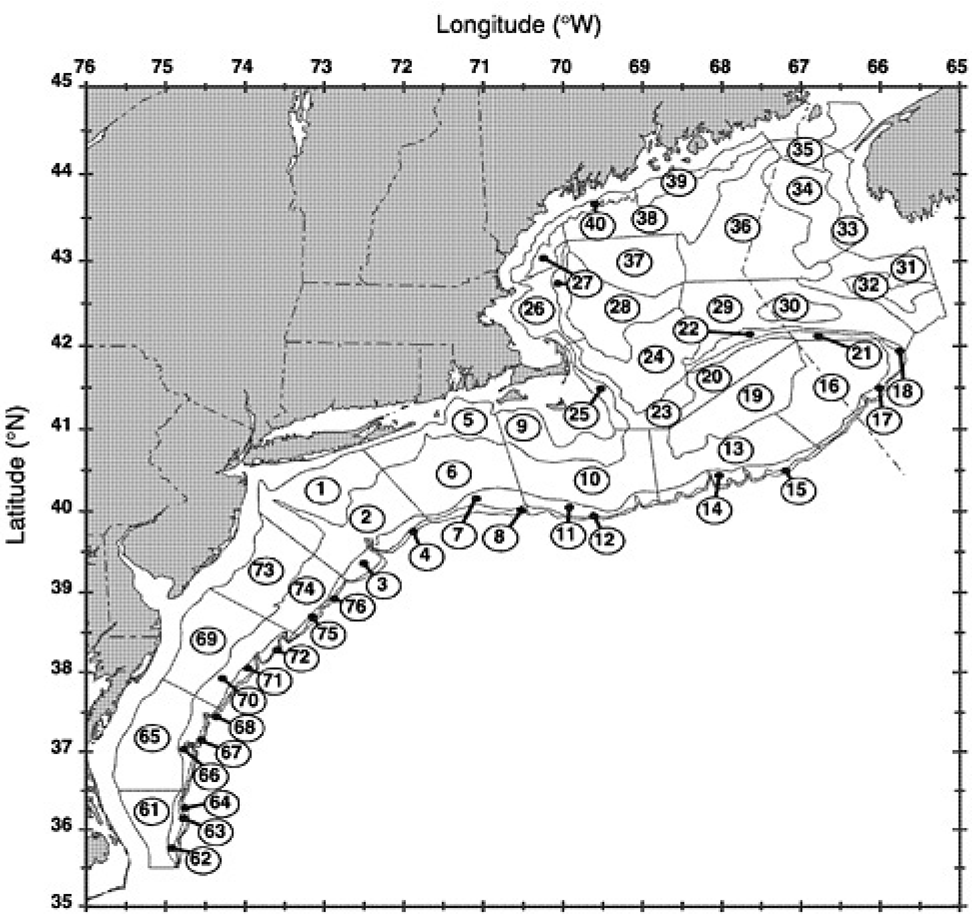

Figure 1: Map of National Marine Fisheries Service trawl survey strata.

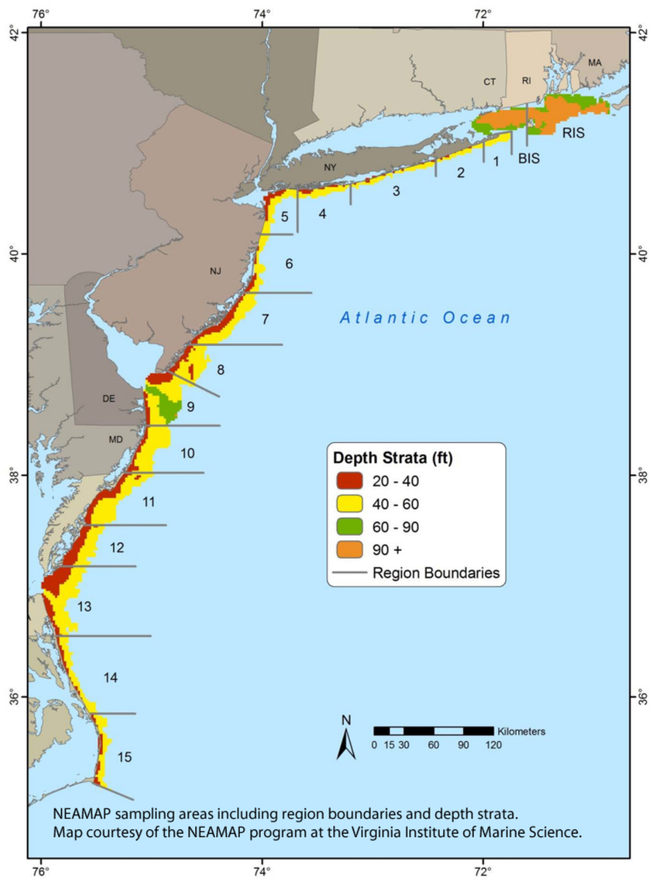

Figure 2: Map of North East Area Monitoring and Assessment Program trawl survey strata.

Table 1 - Strata or Region assigned to each region for resource distribution calculations.

Regions	NMFS Strata	NEAMAP Regions
Region 1: ME - NY	1 - 40	1 - 4, BIS, RIS
Region 2: New Jersey	3, 72 - 76	35 - 8
Region 3: MD - NC	61 - 71	9 - 15

*Note: This is a first cut, these should be finalized through discussions between the TC and survey staff.

This approach could be refined over time by developing area polygons that better align with the boards desired regional configuration. Then, using the spatial information from the surveys, the survey information could be partitioned into the polygons.

Additionally, there may be ways to use state survey information within the analysis – either directly by averaging those surveys into the swept area biomass calculations, or indirectly such as using them to verify or corroborate the information from the surveys used in the calculations. Such use of state survey information could be developed and integrated into the process over time via analysis and recommendations from the monitoring and technical committees.

A robust, locally weighted regression algorithm (Cleveland 1979), referred to as LOESS, could then be used to mitigate excessive variations in sampling results. Per the TMGC approach, a 30% smoothing parameter is proposed. Per the TMGC approach, that level of smoothing was chosen because it reflected current trends, was responsive to changes, and provided the most appropriate results for contemporary resource sharing. The recommended default of two robustness iterations also was adopted (Cleveland 1979). Resource distributions could then be updated annually by incorporating data from the latest survey year available and dropping data from the earliest survey used in the previous year so that a consistent window of data is maintained. After the surveys are combined, the LOESS smoother would be applied to the survey data. The fixed resource utilization (90% weighting in year 1) and the most recent resource distributions as calculated by the surveys (10% weighting in year 1) can then be applied to the sharing formula to determine regional allocation shares for the upcoming fishing year.

The benefit of this approach is that it could be performed annually with the most contemporary data. The drawback is that survey data are prone to variability. The LOESS smoothing and the control rule set forth below are designed to account for some of this variability to keep it from causing unreasonable changes in a single year.

As an alternative, a more sophisticated modeling approach could be developed to achieve the same information as above. Techniques like the use of the VAST model (Peretti 2018) have been shown to be appropriate for summer flounder and could be adopted, in lieu of the swept area biomass technique, as a method for calculating resource distribution by region.

Control Rule

In addition to the formula for calculating the regional allocations and then translating into the state specific allocations, additional measures could be added by way of a control rule. Such measures would enable various checks and balances to be incorporated into the process to guard against unintended consequences.

One such control rule, proposed here, is to guard against any abrupt change occurring to any regional allocation in any given year (or other time frame), and thus minimize short-term impacts, by capping the amount of any annual or bi-annual change to the regional shares at 5%. This can be shown as:

$$\%RegionalShare = \begin{cases} 5\%, & \text{if } \Delta AnnualChange > 5\% \\ \%RegionalShare, & \text{if } \Delta AnnualChange \leq 5\% \end{cases} \tag{1}$$

The effect would be to ensure that any changes to allocations occur incrementally, even in a case of large shifts in resource distribution in any given year or period. This control rule serves as an additional layer of protection against large changes, since the process outlined above already proposes to apply a 30% smoothing parameter to survey data to account for variability.

Flexibility

A key attribute of this proposed new approach for modifying the allocation system is its flexibility. All of the decision points set forth in this proposal, once agreed to, can be adjusted as the process moves forward. Such adjustments, emanating from routine reviews by the Board and Council, can address any of the range of parameters initially set by the Board and Council. The Board and Council could define how changes to the system would be considered and enacted moving forward - e.g., via Addenda and Frameworks, the specifications process, or some other mechanism. The ranges of parameters/issues that readily lend themselves to such adjustment include:

- The α and β parameters can be adjusted to change the way the utilization and distribution are weighted in the equation;
- The increment of change in the α and β parameters can be adjusted to increase or decrease the transition speed;
- The time horizon for the transition can be changed;
- The initial state allocations can be set at status quo, or shifted to accommodate various objectives;
- The way the LOESS algorithm is parameterized can be adjusted; and
- The control rule can be adjusted to be more or less protective of incremental changes

Given such flexibility, the Board and Council could decide to implement a transition program that begins in 2020, with either current, status quo allocations, or some variant thereof, and based on trawl survey information through 2018 (same information used for the 2019 operational stock assessment update), establish resource distribution values for each of the three regions. Using those parameters, and a weighting of allocations by 90% and resource distribution by 10%, enact new, slightly revised state-specific allocations for 2020. If the Board and Council opted for a transitional program involving 10% annual increments, until the weightings reached 10% utilization from historical allocations and 90% resource distribution, this sharing formula would transition from a 90:10 resource utilization-to-resource distribution weighting in 2020 to a 10:90 weighting by 2027. During every transitional period, the trawl survey information would be updated and factored into the resource distribution values. As such, each regional and associated state-specific adjustment would not necessarily be the same, whether in magnitude or direction.

Alternatively, the Board and Council could opt for a transitional program involving 10% increments every two years, or 5% annual increments, or 5% increments every two years, etc. Those alternatives would significantly slow the transition.

Table 2 - Current state by state allocations.

State	Current Allocation
Maine	0.048
New Hampshire	0.001
Massachusetts	6.820
Rhode Island	15.683
Connecticut	2.257
New York	7.647
New Jersey	16.725
Delaware	0.018
Maryland	2.039
Virginia	21.317
North Carolina	27.446
Total	100.000

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