



Atlantic States Marine Fisheries Commission

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MEMORANDUM

April 20, 2015

To: Tautog Management Board
From: Tautog Technical Committee
RE: Clarification to Selecting a Regional Stock Definition for Tautog Management

Summary

In February 2015, the Tautog Management Board approved the *2015 Benchmark Stock Assessment and Peer Review Reports*¹ for management use, but tabled the selection of a regional stock definition. The Tautog Technical Committee (TC) prepared this memo to clarify the selection of a regional breakdown for management. The memo explains the biological and fisheries data analyses used to weigh the strengths and weaknesses of the four stock unit definitions. It also presents additional MRIP data analysis completed after the assessment, and the overfished and overfishing status based on biological reference points from the age structure assessment program (ASAP) assessment model presented in the stock assessment.

The 2015 Tautog Benchmark Stock Assessment presents three regional stock unit options for managing tautog as alternatives to the current coastwide stock unit. ASAP is the assessment model used to determine stock status and reference points. It is the preferred approach because of its (1) ability to incorporate available age information and uncertainty in the catch and survey data and (2) good performance and stability even at small regional scales. Based on the reference points calculated using the methods presented in the assessment report, the stock status and overfishing levels for the different regional definitions are listed in Table 1. The TC determined a three-region approach provides the best balance between a smaller geographical scale and data richness/reliability. It considers both “preferred” and “highly regarded” three-region breakdowns to be reasonable from a scientific standpoint.

Table 1: The four stock definitions presented in the 2015 benchmark stock assessment and overfished, overfishing status for sub-regions based on the ASAP model and peer-reviewed methods.

Options for Stock Unit Definitions	MA	RI	CT	NY	NJ	DE	MD	VA	NC
A. Three Region (Assessment Preferred)	Overfished Overfishing			Overfished Not Overfishing		Overfished Not Overfishing			
B. Three Region (Highly Regarded Alternative)	Overfished Overfishing		Overfished Overfishing			Overfished Not Overfishing			
C. Two Region	Overfished Overfishing				Overfished Overfishing				
D. Coastwide (status quo)	Overfished Overfishing								

¹ ASMFC Tautog 2015 Benchmark Stock Assessment and Peer Review Reports (February 2015)
http://www.asafc.org/uploads/file//54eccd8cTautogStockAssessment_PeerReviewReport_Feb2015.pdf

DEFINING TAUTOG STOCK REGIONS

The TC considered all available biological and fisheries data, as well as management concerns when determining the regional definitions to assess. Based on the analyses of biological and fisheries information, the TC determined the “coastwide” stock unit is inappropriate. Appropriate region designations must compromise tautog’s limited home range with available data and political boundaries. With these considerations in mind, the TC determined a three-region approach would provide the best balance between a smaller geographical scale and data richness. The TC recognizes the proposed three region breakdowns likely contain distinct sub-stocks, but believes this regional structure reduces the risk of overfishing individual sub-stocks and provides a better stock assessment than the coastwide structure currently used.

The TC considered two different three-region breakdowns, one that placed CT with MA and RI, and one that put CT and NY with NJ. DE, MD, VA, and NC formed the third region in both alternatives. NY and NJ share a fishery in the NY Bight area, making it difficult to separate landings. Given that biological evidence suggests CT and NY fish from Long Island Sound are more similar to MA and RI fish than to NJ fish, the TC believed CT would have a higher degree of connectivity with MA and RI than with NJ. As a result, the TC favored the Southern New England (MA-CT), NY-NJ, and DelMarVa (DE-NC) breakdown when completing the assessment report. During deliberations, the TC expressed concern this “preferred” regionalization splits Long Island Sound (LIS) into two stocks while the data sets contain both CT and NY fish. Therefore, a “highly regarded” alternate regional breakdown was also developed that placed CT with the NY-NJ region so that the data sets and regional breakdown matched.

Although a two region breakdown (MA-NY and NJ-NC) and a coastwide model were also considered, the TC determined the finer geographic scale provided by the three-region approach provided a better assessment of stock status and management advice than the two region or coastwide models. It is important to note the stock assessment presented both the “preferred” three-region and the alternate “highly regarded” three-region definitions – both supported for management use by the TC and Peer Review Panel.

Biological information included age and length data collected by each state (used to infer growth rates), natural mortality based on estimators from scientific literature, and migration behaviors based on tagging studies conducted by state programs. It is important to note data availability vary by region; northern states have more data from early in the time-series, when more older, larger fish were present in the samples. The southern states lack data from fishery-independent sources and thus have limited samples of the youngest, smallest fish. In addition, NY samples come from both LIS and the Atlantic Ocean (about half from each area), making the distinctions between NY and NJ growth rates less certain (i.e. data may be confounded). Further examination of growth rate differences should be explored using data that are more representative of the full size-age structure of the population.

- **Growth curves** per state and regions were developed using length-weight data (Table 2). Results suggest tautog from Southern New England and NY waters have significantly lower maximum sizes than fish from NJ to VA. Growth constants generally decreased along the north-to-south gradient, while maximum sizes were higher in the southern portion of the range than the northern portion of the range. This suggests a clear regional difference in tautog growth and size.

Table 2. Estimates of maximum sizes and growth constants by state and regional units.

State	Maximum Size Estimates (cm)	Growth Constant
MA	61.68	0.118
RI	60.25	0.140
CT	59.11	0.171
NY	60.45	0.123
NJ	80.66	0.052
DE	76.03	0.060
MD	78.23	0.085
VA	74.67	0.065

Regional Unit	States	Maximum Size Estimates (cm)	Growth Constant
3-Region	MA-RI-CT	57.36	0.186
	NY-NJ	66.36	0.090
	DE-MD-VA	71.25	0.090
2-Region	MA-RI-CT-NY	57.58	0.176
	NJ-DE-MD-VA	82.74	0.051
Coastwide	All States	64.38	0.101

- **Length-at-Age:** The examination of mean length-at-age identified significant differences in lengths between regions, particularly the northern and southern states.
- **Natural mortality (M)** was calculated for regional stock units (Table 3). The area-specific estimates showed higher rates of M in the northern regions than southern. However, the higher estimates of M for the northern regions came from the estimators that rely on growth parameters, while estimators that rely on longevity data were more similar across all regions.

Table 3. Average natural mortality rates by region.

Regional Stock Unit		Average Natural Mortality
Three Region (Assessment Preferred)	SNE (MA-RI-CT)	0.24
	NY-NJ	0.15
	DelMarVa	0.16
Two Region	Northern (MA-NY_	0.23
	Southern (NJ-NC)	0.12
Coastwide	MA through NC	0.16

- **Migration behavior** was inferred from tagging data, which indicated tautog have strong site fidelity and move only short distances longitudinally, if at all, during seasonal migrations. This is strong evidence for managing tautog at a finer regional scale, further justification the current coastwide stock unit is not appropriate based on the limited home range of this reef species.

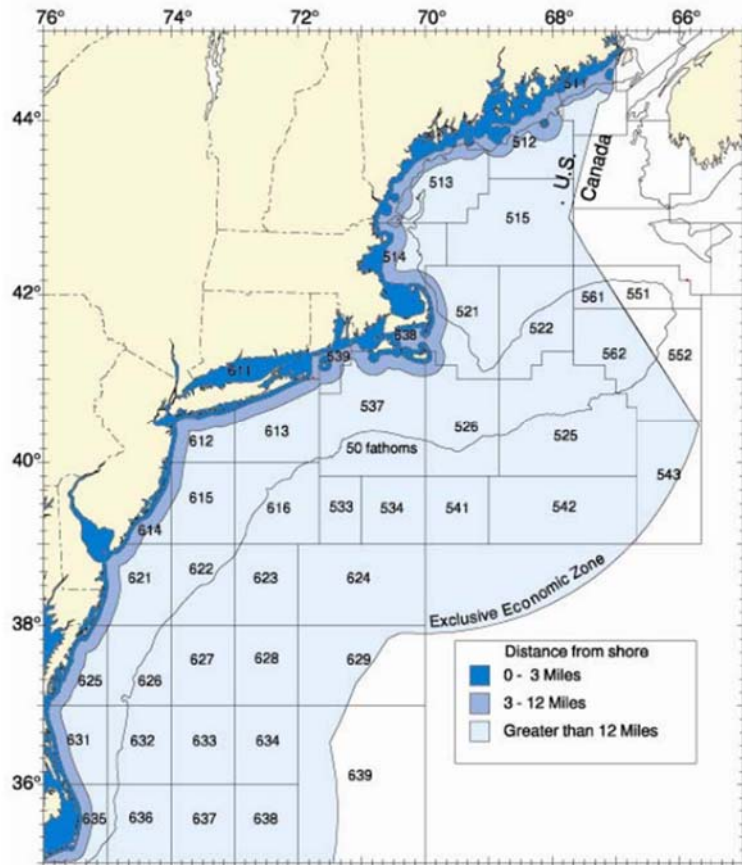
In summary, the biological data suggest a broad pattern of differences in growth between the north and the south, with little movement of adult fish. The TC used fishery-dependent data to refine the regional structure.

Fishery-dependent data included recreational and commercial trip data from vessel trip reports. Fishery catch and effort information from NMFS Fishing Vessel Trip Reports (VTR) was evaluated by NMFS statistical areas to identify state-specific fishery characteristics (Figure 1). VTR data are provided by a subset of the fishery that are required to report, which in some states includes only fishers with a federal license, therefore may not be fully representative of the entire tautog fishery. However, they provide a finer scale breakdown of area fished than the broad angler-reported categories from MRIP.

Results based on fishing effort reported in the stock assessment indicate that:

- Angler effort from MA to CT remain primarily within local sounds and bays
- Angler effort from DE to VA remain south of Delaware Bay
- Fisheries in NY and NJ range from LIS to Delaware Bay, with significant overlap in ocean waters of NMFS statistical areas 612 and 613 (approximately Manasquan River, NJ to Montauk, NY (Table 4).

Figure 1. NMFS statistical areas.



Similar results were produced when the analysis used catch rather than effort (Tables 4A and B). The patterns of fishing effort inferred from VTR data suggested NJ and NY are fishing on the same fish in the ocean south of Long Island, and NY and CT are fishing on the same fish in LIS, although CT and NJ have minimal overlap. Given the overlap of fishing effort between NY and NJ in ocean waters, the TC chose to include NY and NJ in the same region. NY and CT fishing effort also overlaps significantly in LIS, which is why the TC also strongly endorsed the inclusion of CT in the NY-NJ region, and preferred the three-region breakdown over separating NY and NJ into northern and southern regions.

Table 4A. Proportion of commercial catch by statistical area and state from VTR records. Red, bolded numbers indicate areas that account for more than 10% of a state’s catch.

	MA	RI	CT	NY	NJ	DE	MD	VA	TOTAL
514	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
537	0.04	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.01
538	0.72	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.08
539	0.01	0.80	0.01	0.01	0.00	0.00	0.00	0.00	0.09
611	0.00	0.07	0.94	0.40	0.00	0.00	0.00	0.00	0.18
612	0.00	0.00	0.01	0.48	0.62	0.00	0.00	0.01	0.38
613	0.00	0.00	0.03	0.10	0.00	0.00	0.00	0.00	0.04
614	0.00	0.00	0.00	0.00	0.14	0.00	0.01	0.00	0.04
615	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.01
621	0.00	0.00	0.00	0.00	0.20	0.97	0.67	0.15	0.09
625	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.67	0.03
626	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.03	0.01

Table 4B. Proportion of recreational catch by statistical area and state from VTR records. Red, bolded numbers indicate areas that account for more than 10% of a state’s catch.

	MA	RI	CT	NY	NJ	DE	MD	VA	TOTAL
514	0.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
537	0.01	0.03	0.00	0.01	0.00	0.00	0.00	0.00	0.00
538	0.65	0.04	0.00	0.05	0.00	0.00	0.00	0.00	0.03
539	0.00	0.83	0.00	0.01	0.00	0.00	0.00	0.00	0.06
611	0.00	0.04	0.99	0.29	0.00	0.00	0.00	0.00	0.10
612	0.00	0.00	0.00	0.60	0.52	0.00	0.00	0.00	0.45
613	0.00	0.00	0.00	0.04	0.01	0.00	0.00	0.01	0.01
614	0.00	0.00	0.00	0.00	0.23	0.00	0.19	0.00	0.14
621	0.00	0.00	0.00	0.00	0.17	0.99	0.73	0.01	0.15
625	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.45	0.00
626	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.02	0.00

An analysis of MRIP data by area fished was conducted after the assessment at a Commissioner’s request. Data from RI through NJ were evaluated by summarizing the harvest and catch data into various categories including ‘State’, ‘Site’, ‘Fishing Area’, and ‘Distance From shore’ from 2004-2014. This analysis showed a similar pattern to the VTR data, with RI catch coming primarily from Narragansett Bay, CT catch coming primarily from LIS, NJ catch coming primarily from open water, and most NY catch being split between Long Island Sound (~57%) and open water (~35%) (Table 5).

Table 5: Proportion of recreational catch by area fished and state from MRIP data. Red, bolded numbers indicate areas that account for more than 10% of a state’s catch.

	RI	RIWest*	CT	NY	NJ	Total
Open Water	0.25	0.91	0.01	0.35	0.72	0.36
Sound	0.01	0.04	0.01	0.02	0.00	0.01
River	0.00	0.00	0.00	0.00	0.00	0.00
Bay	0.00	0.00	0.00	0.04	0.14	0.05
Other	0.00	0.05	0.00	0.01	0.10	0.03
Narragansett Bay	0.73	0.00	0.00	0.00	0.00	0.13
Long Island Sound	0.00	0.00	0.98	0.57	0.00	0.41
Hudson Estuary	0.00	0.00	0.00	0.01	0.00	0.00
Delaware Bay	0.00	0.00	0.00	0.00	0.03	0.01

*Rhode Island harvest occurring west of Point Judith Harbor accounts for approximately 6% of total RI harvest.

While the prior VTR analysis showed the majority (60%) of the NY recreational catch coming from offshore, thereby emphasizing the shared fishery resource between NY and NJ, VTR data do not characterize the entire fishery. For a species like tautog, which is primarily a recreational fishery, MRIP data must also be considered. Analysis of MRIP data showed the majority (57%) of NY recreational catch coming from LIS, thereby emphasizing the shared fishery resource between NY and CT. This additional information was not available for peer review, but should be considered when evaluating the demarcations of the regions.

Peer Review Panel Comments

The Peer Review Panel down-weighted the biological information in assessing regional determinations because they found the regional differences could be driven as much by data availability as biological factors. The Panel approved the finer regional scale of the assessment, stating region-level ASAP stock assessment models provided the best available scientific foundation for management, but did not endorse one regional breakdown over another. Based on information presented in the assessment, the Panel concluded either three-region breakdown would be suitable for management, meaning one three-region breakdown is not “preferred” over another.

Additional analyses by the TC showing the substantial overlap in fisheries between CT and NY in LIS and the minimal overlap in fisheries between CT and RI are also justification for considering the three-region alternative including CT in a region with NY and NJ as being

comparable to the three-region option that places CT in the region with RI and MA. The TC agrees either three-region definitions can be used for management.

REFERENCE POINTS AND STOCK STATUS

This section of the memo provides the reference points presented in the stock assessment report and includes additional reference points calculated using consistent methods for each regional stock unit as requested by the Board. Because longer data time series exist for states in the northern range, the stock assessment used different methods to calculate reference points for regions. **Maximum sustainable yield (MSY) based reference points** were estimated from ASAP, which uses a combination of spawning potential ratio (SPR), yield-per-recruit (YPR), and the stock-recruitment relationship to calculate the SSB_{MSY} and F_{MSY} . $75\% F_{MSY}$ was calculated by projecting the population forward assuming the same stock-recruitment (S-R) relationship and finding the fishing mortality (F) that maintains the population at $75\% SSB_{MSY}$. $SSB X\%$ was calculated by projecting the population forward while fishing at $F X\% SPR$ with recruitment randomly drawn from the observed historical recruitment.

MSY-based reference points were proposed for the SNE region due to the longer time-series of data. The assessment proposed **SPR based reference points** for NY-NJ and DelMarVa regions because of the shorter time-series of the data. The DelMarVa S-R curve fitted by the model resulted in unrealistic parameters (e.g., steepness equal to one). The S-R curve for the NY-NJ region provided more reasonable parameter estimates, but since the data used in the assessment did not include the peak of exploitation at the beginning of the recreational time-series and the curve was sensitive to assumptions about population levels at the beginning of the time-series, the TC chose to use SPR reference points for the NY-NJ region.

Based on the assessment's proposed regional stock units and reference points, the resulting overfished and overfishing status for each of the regional stock units are listed below.

Table 6A. Stock assessment preferred three region stock definition

Stock Region	SSB Target	SSB Threshold	SSB 2013	F Target	F Threshold	F 3-year Ave	Stock Status
SNE (MA-RI-CT)	3,883	2,912	1,814	0.15	0.20	0.48	Overfished Experiencing Overfishing
New York – New Jersey	3,570	2,640	2,202	0.17	0.26	0.24	Overfished Not Experiencing Overfishing
DelMarVa	2,090	1,580	1,532	0.16	0.24	0.16	Overfished Not Experiencing Overfishing

Table 6B. Alternative three region stock definition

Stock Region	SSB Target	SSB Threshold	SSB 2013	F Target	F Threshold	F 3-year Ave	Stock Status
SNE (MA-RI)	2,633	1,975	1,612	0.16	0.19	0.38	Overfished Experiencing Overfishing
CT – NJ	5,160	3,920	2,359	0.17	0.24	0.34	Overfished Experiencing Overfishing
DelMarVa	2,090	1,580	1,532	0.16	0.24	0.16	Overfished Not Experiencing Overfishing

Table 6C. Two region stock definition

Stock Region	SSB Target	SSB Threshold	SSB 2013	F Target	F Threshold	F 3-year Ave	Stock Status
North	7,277	5,458	3,447	0.14	0.18	0.36	Overfished Experiencing Overfishing
South	4,037	3,028	1,254	0.18	0.15	0.33	Overfished Experiencing Overfishing

Table 6D. Coastwide stock definition

Stock Region	SSB Target	SSB Threshold	SSB 2013	F Target	F Threshold	F 3-year Ave	Stock Status
Coastwide	20,612	15,459	4,882	0.10	0.13	0.30	Overfished Experiencing Overfishing

For comparison, a full suite of biological reference point (BRP) options was calculated for all four regions as tasked by the Board (Table 7). This included MSY-based reference points and SPR-based reference points. MSY-based reference points are generally preferred when they are considered reliable, because they address stock productivity by taking into account the relationship between SSB and future recruitment, whereas SPR-based reference points do not.

The TC recognizes there still could be a significant uncertainty in S-R data for the New England region. Because of this, F_{MSY} reference point may change in the future as a result of a future assessment. However, this is the best scientific information available at this point. F_{MSY} development for the NJ-NY and DelMarVa regions will require additional S-R data accumulation with sufficient contrast in stock size. It is also important to note F-based reference point values by region are not exactly comparable due to the differences in age-specific selectivity. Tautog are fully recruited to the fishery at an older age in the New England area, due to the larger minimum size. As a result, more younger fish can contribute to the spawning population before being harvested, resulting in a higher F reference point.

For the Southern New England and MA-RI regions, where a longer time-series of stock-recruitment data is available, the MSY-based target reference points (F_{MSY} and SSB_{MSY}) were closer to $F_{50\%SPR}$ than the $F_{40\%}$ target proposed for the other regions. If the stock recruitment relationships in NY -NJ and DelMarVa areas are similar to the parameters estimated for the New England area the $F_{30\%}$ and $F_{40\%}$ may exceed the F_{MSY} for those areas as well.

Table 7. Spawning stock biomass and fishing mortality based on a range of reference points, by regional stock unit. The bolded reference points were used to determine overfished and overfishing status in the assessment (Table 6A-D).

		Region							
		SNE	NY-NJ	MARI	CT-NY-NJ	DMV	North	South	Coastwide
SSB	SSB _{msy}	3,883	4,616	2,633	4,695	885	7,277	4,037	20,612
	75% SSB _{msy}	2,912	3,462	1,975	3,521	664	5,458	3,028	15,459
	SSB 30%	2,310	2,640	1,390	3,920	1,580	3,840	3,730	6,710
	SSB 35%	2,715	3,120	1,630	4,610	1,870	4,405	4,255	8,050
	SSB 40%	3,090	3,575	1,930	5,160	2,090	5,145	4,760	9,240
	SSB 50%	3,940	4,570	2,490	6,430	2,610	6,475	5,915	11,675
F	F _{msy}	0.15	0.18	0.16	0.19	0.50	0.14	0.15	0.10
	F 75% _{msy}	0.20	0.21	0.19	0.25	0.71	0.18	0.18	0.13
	F 30%	0.44	0.26	0.56	0.24	0.24	0.42	0.23	0.34
	F 35%	0.33	0.21	0.42	0.19	0.19	0.33	0.19	0.26
	F 40%	0.26	0.17	0.31	0.17	0.16	0.25	0.16	0.21
	F 50%	0.16	0.11	0.19	0.11	0.11	0.16	0.11	0.14

Conclusion

The Tautog TC determined a three region approach would provide the best balance between a smaller geographical scale and data richness/reliability. The TC considers both three-region breakdowns to be reasonable from a scientific standpoint, and recommends the Board chose a regional structure based on management considerations. However, the alternate, “highly regarded” three-region breakdown avoids the mismatch of data source created by the “assessment preferred” three-region breakdown.

The TC notes LIS presents a unique challenge to regional management for this species. It is possible that the population within the Sound represents a sub-stock that has only a small overlap of recruitment with the surrounding area (ex. western RI waters). There is currently a genetic study taking place that may help inform this assumption. In recent years, harvest from LIS has accounted for 29% of coastwide landings. For these reasons, the TC acknowledges managing LIS as a discrete area may be appropriate. Fishery-independent data exist for LIS, all of CT’s sampling comes from the Sound, and most of NY’s fishery-independent surveys for tautog (or include tautog data) come from the Sound. However, there are challenges with properly partitioning the fishery-dependent data and harvest estimates for LIS, especially for NY’s harvest. These challenges prohibited exploration of assessing LIS as its own region for the current benchmark assessment but the TC recognizes the value in exploring this option in the future.