Atlantic States Marine Fisheries Commission

American Lobster
Addendum XXVII Plan Development Team Call and Webinar

Wednesday, December 15, 2021
10:30 AM - 12:00 PM

DRAFT AGENDA

Webinar: https://global.gotomeeting.com/join/289862029
You can also dial in using your phone.
United States: +1 (408) 650-3123;
Access Code: 289-862-029

1.	**Welcome & Review of the Agenda** *(C. Starks)*	10:30 a.m.
2.	**Review TC Advice on Vent Sizes** *(K. Reardon)*	10:35 a.m.
3.	**Make Recommendations for Vent Sizes** *(C. Starks)*	10:50 a.m.
4.	**Review Draft Addendum Document** *(C. Starks)* • Resolve remaining questions/edits • Discuss Area 3 split options	10:50 p.m.
5.	**Next Steps** *(C. Starks)* • Full PDT review of Draft Addendum document	11:50 p.m.
6.	**Adjourn**	12:00 p.m.

Atlantic States Marine Fisheries Commission

1050 N. Highland Street • Suite 200A-N • Arlington, VA 22201
703.842.0740 • 703.842.0741 (fax) • www.asmfc.org

MEMORANDUM

TO: American Lobster Plan Development Team

FROM: American Lobster Technical Committee

DATE: December 14, 2021

SUBJECT: Technical Committee Recommendations for Proposed Vent Sizes for Draft Addendum XXVII Options

Background

The Plan Development Team (PDT) has been working on the development of Draft Addendum XXVII since February 2021 when the Board reinitiated work on the addendum. As recommended by the TC and PDT after considering recent abundance survey indices, the Board modified the goal of the addendum to the following:

"Given persistent low settlement indices and recent decreases in recruit indices, the addendum should consider a trigger mechanism such that, upon reaching the trigger, measures would be automatically implemented to increase the overall protection of spawning stock biomass of the Gulf of Maine/Georges Bank (GOM/GBK) stock."

The PDT has developed draft management options to be considered for public comment, which include options that would modify the minimum and maximum gauge sizes of Lobster Conservation and Management Areas (LCMAs) within the stock. The current biological management measures include escape vent size requirements, which are intended to release the majority of sublegal-sized lobsters to reduce handling stress and increase fishing efficiency. The Plan Development Team (PDT) requested the Technical Committee (TC) develop recommendations for escape vent sizes to be considered alongside the proposed changes in minimum gauge size. The TC's discussions and recommendations are summarized below.

Summary of Technical Committee Discussion

Below are the key recommendations arising from the TC analysis and discussion. Specifically, the TC recommended sizes for one rectangular or two circular escape vents that should be considered alongside the proposed changes to the minimum gauge size in LCMA 1. LCMA 1 is the only area for which a change to the minimum gauge size is proposed under this addendum, therefore the TC does not recommend changes to the vent sizes for other areas within the GOM/GBK stock.

The TC discussed selecting appropriate vent sizes to be implemented alongside the minimum gauge sizes proposed. The TC noted that previous and current sets of measures in other LCMAs could be used as precedent for choosing vent sizes for LCMA 1. Those candidate vent sizes and the associated selectivities were determined by multiple past research efforts, but none of the projects tested all of the vent sizes in a single study (Nulk 1978, Krouse unpublished, Estrella & Glenn 2006). Particularly relevant is the study by Estrella and Glenn (2006) that characterized the selectivity of the SNE escape vent sizes corresponding with potential increases in minimum legal size for American lobster. This study was conducted in raceways with lobsters of various sizes being placed in unbaited traps with closed parlor heads and different experimental vent sizes, and a bait plume introduced upstream of the traps to elicit escape attempts. Thus, the study attempted to quantify the mechanical selectivity (i.e., which lobsters can physically escape) when a lobster is incentivized to leave a trap. Therefore, the results likely overestimate the actual probability that a lobster will escape a trap. Additionally, these results reflect the outcome from a single interaction of a lobster with a trap, not the cumulative probability of being retained over the course of a fishing year, which further suggests that these estimated retention rates would over-estimate the impact of changing vent sizes on actual annual landings and conservation benefit in the first year of implementation.

Characterizing the selectivity of vent sizes is challenging because of variability around lobster sex-specific morphometrics (carapace width, height, and abdomen width) and maturity. The work by Estrella and Glenn (2006) estimated the selectivity for each experimental vent size tested, which did not allow for estimation of selectivity for untested vent sizes and did not account for different selectivities between sexes due to sexual dimorphism. Thus, the TC revisited the original raceway data from the Estrella and Glenn (2006) study to develop a statistical model that modeled vent size as a continuous variable, allowing for estimation of selectivity for the current LMA 1 rectangular vent ($1\ ^{15}/_{16}$” x 5 ¾ “) with sex-specific selectivities. The cohort retention rate is based on the molt increment models from the GOM/GBK 2015 assessment and represents the mean retention rate of all lobsters predicted to recruit into the fishery in a given year. This analysis provides rough estimates of minimum size and cohort retention rates for all vent size option for relative comparisons. Table 1 provides the estimated retention rates of lobsters at the specified minimum gauge size for the current vent sizes in LCMA 1, as well as potential future gauge size changes combined with the proposed vent sizes. Table 2 provides the estimated cohort retention rates. Both these tables are based on the enclosed updated analysis by the TC. Retention curves for both vent types are also available in the enclosed report.

The draft addendum as proposed would consider modifying the minimum gauge size in LCMA 1 to $3\ ^{5}/_{16}$” (84 mm) and/or $3\ ^{3}/_{8}$ ” (86 mm). These minimum gauge sizes have been implemented previously in LCMA 6 and 2, when there was a series of changes which incrementally increased the minimum gauge size from $3\ ^{1}/_{4}$” to $3\ ^{3}/_{8}$”. During this series of gauge changes the vent sizes were held at status quo at $1^{15}/_{16}$ x $5^{3}/_{4}$” (rectangular) or $2\ ^{7}/_{16}$” (circular) until the final increase to the minimum size was implemented. When the gauge size was changed to $3\ ^{3}/_{8}$”, the vent sizes were then changed to 2 x $5^{3}/_{4}$” (rectangular) and $2\ ^{5}/_{8}$” (circular). The TC agreed it could be appropriate to implement a consistent approach to what was implemented in Southern New England LCMAs.

Vent Size Recommendations

The TC recommends the PDT include a rectangular vent size of 2 x $5^{3}/_{4}$” and a circular vent size of $2\ ^{5}/_{8}$” in the draft addendum options to modify the gauge size in LCMA 1. These are the vent sizes that are currently required for the Southern New England Stock Areas (LCMA 2, 4, 5 and 6).

The proposed options in Draft Addendum XXVII include incremental changes to the minimum size in LCMA 1 such that the minimum size could increase once from the current size of $3\ ^{1}/_{4}$” (83 mm) to $3\ ^{5}/_{16}$” (84 mm), and then again from $3\ ^{5}/_{16}$” to $3\ ^{3}/_{8}$ ” (86 mm). However, the TC recommends that the addendum consider a change to the vent sizes at only one of these gauge size changes. Given that, the recommended vent sizes could be implemented alongside the first change to the minimum size, or the second. The TC agreed that implementing the increased vent size at the first change to minimum gauge size would be more consistent with the addendum goal of protecting spawning stock biomass, since a larger percentage of <86mm CL legal-sized lobsters may be able to escape from the new vent size. Additionally fishers would benefit due to reduced handling of undersize lobsters. Implementing the larger vent size at the later gauge change (to $3\ ^{3}/_{8}$” gauge) could delay some of the burden on industry related to the requirement to change out vents immediately and the costs associated with less efficient traps if the 2 x $5^{3}/_{4}$" vent size were combined with the 3 $^{5}/_{16}$" minimum gauge size.

Table 1. Retention rates at potential minimum legal sizes for proposed vent size changes

Minimum Gauge Sizes Considered	**Rect. Vent Size**	**Circ. Vent Size**	**Rect. % retention at gauge**	**Circ. % retention at gauge**
LCMA 1 status quo: 3 $^{1}/_{4}$" (83 mm)	$1^{15}/_{16}$ x $5^{3}/_{4}$"	2 $^{7}/_{16}$"	**47%**	**67%**
1^{st} proposed change (later vent change): 3 $^{5}/_{16}$" (84 mm)	$1^{15}/_{16}$ x $5^{3}/_{4}$" *(current GOM vent)*	2 $^{7}/_{16}$" *(current GOM vent)*	63%	78%
1^{st} proposed change (earlier vent change): 3 $^{5}/_{16}$" (84 mm)	2 x $5^{3}/_{4}$" *(current SNE vent)*	2 $^{5}/_{8}$" *(current SNE vent)*	38%	36%
Final proposed change: 3 $^{3}/_{8}$ " (86 mm)	2 x $5^{3}/_{4}$" *(current SNE vent)*	2 $^{5}/_{8}$" *(current SNE vent)*	53%	50%

Table 2. Retention rates for recruiting cohort for proposed vent size changes

Minimum Gauge Sizes Considered	**Rect. Vent Size**	**Circ. Vent Size**	**Rect. % retention for cohort**	**Circ. % retention for cohort**
LCMA 1 status quo: 3 $^{1}/_{4}$" (83 mm)	$1^{15}/_{16}$ x $5^{3}/_{4}$"	2 $^{7}/_{16}$"	86%	92%
1^{st} proposed change (later vent change): 3 $^{5}/_{16}$" (84 mm)	$1^{15}/_{16}$ x $5^{3}/_{4}$" *(current GOM vent)*	2 $^{7}/_{16}$" *(current GOM vent)*	91%	95%
1^{st} proposed change (earlier vent change): 3 $^{5}/_{16}$" (84 mm)	2 x $5^{3}/_{4}$" *(current SNE vent)*	2 $^{5}/_{8}$" *(current SNE vent)*	82%	79%
2^{nd} proposed change: 3 $^{3}/_{8}$ " (86 mm)	2 x $5^{3}/_{4}$" *(current SNE vent)*	2 $^{5}/_{8}$" *(current SNE vent)*	88%	86%

Literature Cited

Estrella, B.T., and R.P. Glenn. 2006. Lobster trap escape vent selectivity. MA Division of Marine Fisheries Technical Report TR-27, 15pp. https://www.mass.gov/files/documents/2016/08/ri/tr-27-lobster-trap-escape-vent-selectivity.pdf

Nulk, V. E. 1978. The effects of different escape vents on the selectivity of lobster traps. Marine Fisheries Review 40(5): 50–58. https://spo.nmfs.noaa.gov/sites/default/files/pdf-content/MFR/mfr405-6/mfr405-64.pdf

Krouse, J. 1988. Unpublished data. Maine Department of Marine Resources Annual Report: Gear Selectivity Study. Pages 17-19, 55-59.

Updated selectivity estimates for alternative minimum legal sizes and vent sizes.

Provided to the ASFMC PDT by Burton Shank

Nov 22, 2021

To assist the ASMFC PDT with management recommendations, I updated vent selectivity estimates from Estrella end Glenn (2006) with new statistical models that allow for better stabilization of selectivity curves and estimation of unobserved selectivity curves.

Modeling and Calculations:

To estimate unobserved selectivity curves, it was desirable to identify statistical models that treated vent size as a continuous variable across experimental treatments (four rectangular and four circular vents) rather than estimating a retention curve independently for each vent size. The approach of treating vent size as a continuous variable has a couple benefits. First, it allows the estimation of selectivity for untested vent sizes. Second, it effectively uses the observations across treatments to stabilize retention estimates, potentially decreasing estimation error. In the case of the retained statistical models below, the various vent sizes inform how L50 changes with vent size but all observations inform the estimation of the steepness of the retention curve. However, this is caveated on finding a model that adequately describes the shape of the relationship between vent size and retention rates. Examination of various alternative models (i.e. estimating vent size as categorical variables or with a GAM smoother) found non-linear responses of increasing vent size with the 2 1/16" rectangular vent producing markedly higher retention than expected. However, excluding the data from this experimental treatment resulted in the removal of the non-linear vent size effect with the remaining seven treatments describing a remarkably linear effect (Figure 1). Thus, we excluded the data from the 2 1/16" vent from further analysis, given that it would be appropriate to return to this data set when time permits to better understand why this treatment returns unexpected results.

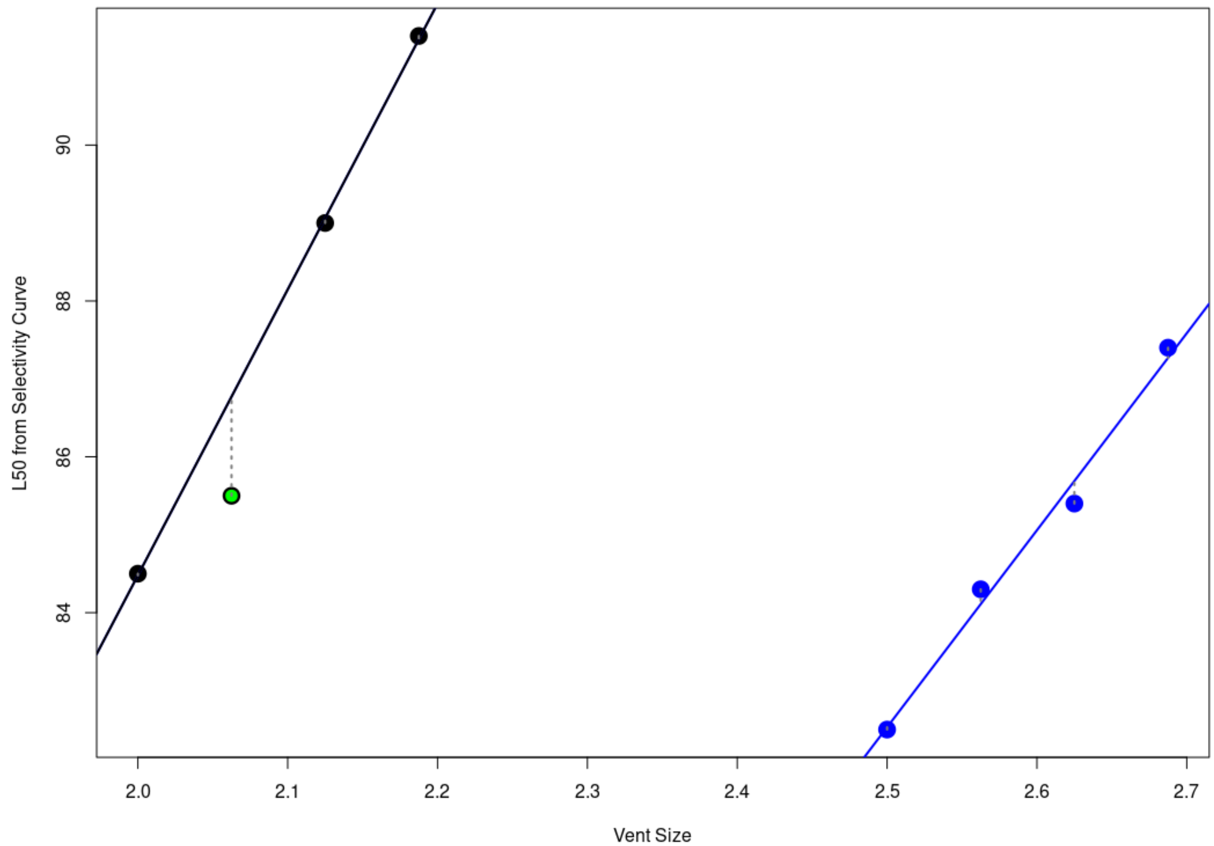

Figure 1. L50 (carapace length at which 50% of lobsters are retained) from alternative selectivity models. Points are resulting L50 estimates where each vent size was estimated independently for rectangular (black) and circular (blue) vents. The solid line shows L50 estimates from a model with vent size as a continuous linear variable. The dotted gray line indicates the errors between the two models. The green marker denotes the 2 1/16” rectangular vent that was omitted from the final model.

Also, examination of candidate models revealed males and females had different selectivities with males having lower retention rates than females (Figure 2). However, this effect was only evident for rectangular vents, not circular vents. We conclude that this is reasonable due to increasing sexual dimorphism as lobsters reach maturity with females developing proportionately wider carapaces than males of similar size. This effect is less noticeable for circular vents as retention rates may be more of a function of claw sizes or other morphometric trait that are not sexually dimorphic at the sizes tested. Thus, it was more appropriate to produce separate, relatively simple models for the two vent shapes, omitting the effect of sex from the circular vent model, rather than find a single, stable model that adequately described both rectangular and circular vents. The final models selected were:

$$Retention_{(Rectangular)} \sim CarapaceLength * Sex + VentSize$$

$$Retention_{(Circular)} \sim CarapaceLength + VentSize$$

Based on these models, I calculated the predicted retention rate for each combination of proposed minimum legal size (MLS) and vent size. Note that these retention rates are presumably biased low compared to a lobster trap fishing in the field. **If retention in a trap was a purely mechanical process**

(i.e. any lobster that is physically capable of fitting through a vent will always escape) and that lobsters have a similar level of incentive to escape a trap as in the Estrella and Glenn (2006) study, I expect these estimates could be representative of actual retention rates under normal fishing operations. However, other factors presumably also contribute to the probability that a lobster will not escape, as evinced by the occasional observations of very small lobsters in vented traps. This would result in higher retention rates than reported below.

The percent retained (retention rate) at a specified carapace length (minimum legal sizes (MLS) proposed in the Addendum) can be estimated based on the results of the modelling. Because this estimate of retention rate only represents the retention rate of a lobster at that exactMLS and is not representative of all legal-sized lobsters recruiting to the fishery, I also calculated the predicted retention rate of all lobsters in a recruiting cohort (i.e. the mean retention rate of all lobsters predicted to recruit into the fishery in a given year). To get the retention rate across a recruiting cohort, I used the molt increment models developed for the GOM / GBK 2015 stock assessment (unchanged in 2020) to get sex-specific molt increments associated with each minimum legal size. **Please note that, while this value is more representative of the impact of various combinations of legal size and vent size on catch, these values should still be considered conservative (i.e. actual retention rates are probably higher) because this analysis assumes any lobsters that escape from a trap once will not be caught in subsequent encounters with traps and lost to the fishery until they grow to a larger size.**

Rectangular vents:

The model predicts that females will be retained at higher rates than males for legal size lobsters (Figure 2) with similar retention rates around 82mm. The higher estimated retention for males below this size may be an artifact of model assumptions and less data support for these smaller sizes. L50 (carapace length at which 50% of lobsters are retained) estimates for 1 15/16” high vents are 82.7 and 83.1mm for females and males respectively with L50 estimates for 2” vents at 84.8 and 86.1mm respectively for females and males.

Retention rate for lobsters at the different proposed minimum legal sizes ranged from 24% for the 2” vents and status quo MLS to 76% for the 1 15/16” vent and 3 3/8” MLS (Table1), with respective cohort retention rates of 74% and 95%.

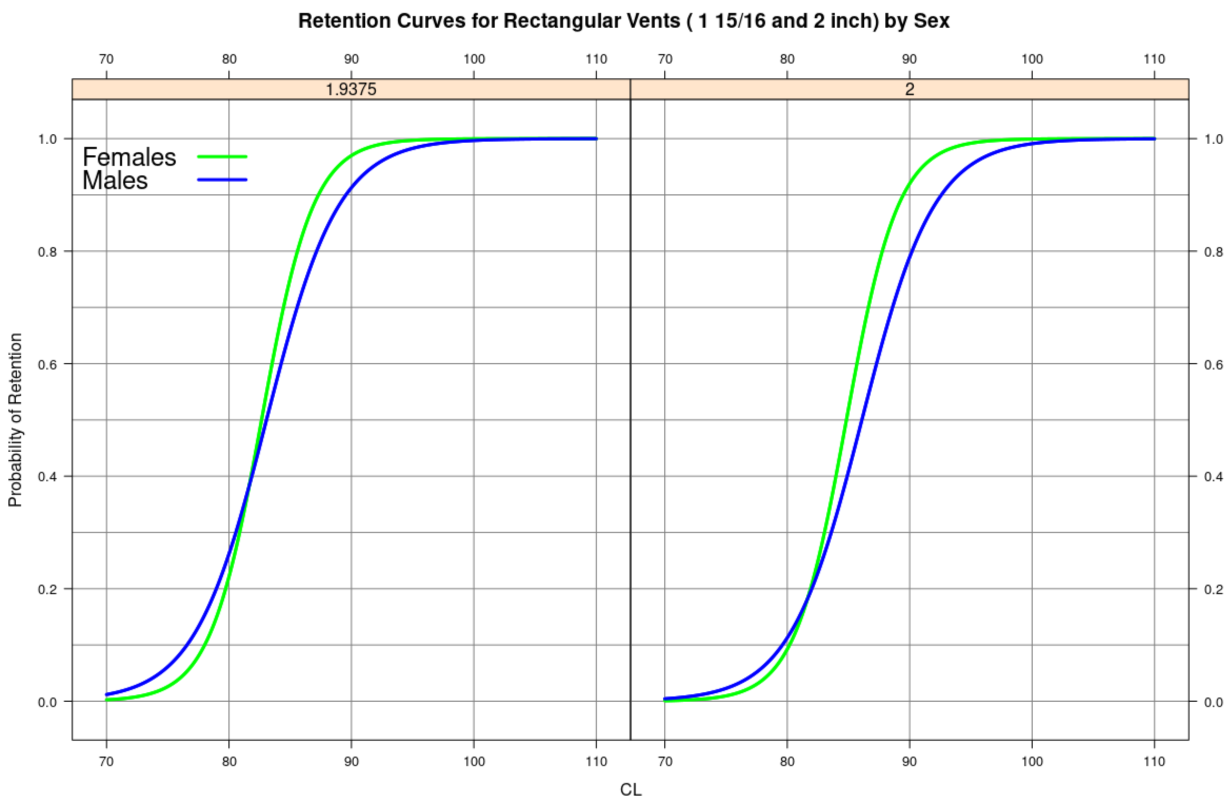

Figure 2. Sex-specific retention curves for 1 15/16” (left) and 2” (right) rectangular vents.

Table 1. Retention rates (proportion retained) at minimum legal size and retention rate of a recruiting cohort for females, males, and combined sexes with rectangular vents.

	proportion Retained @ MinLegalSize		proportion Cohort Retention	
MinLegalSize	1 15/16" Rect Vent	2" Rect Vent	1 15/16" Rect Vent	2" Rect Vent
status quo: 3 1/4” (83mm)	0.49 / 0.46 / 0.47	0.25 / 0.23 / 0.24	0.88 / 0.84 / 0.86	0.77 / 0.7 / 0.74
3 5/16” (84 mm)	0.66 / 0.59 / 0.63	0.41 / 0.34 / 0.38	0.93 / 0.89 / 0.91	0.86 / 0.79 / 0.82
3 3/8 ” (86 mm)	0.81 / 0.71 / 0.76	0.6 / 0.47 / 0.53	0.96 / 0.93 / 0.95	0.92 / 0.85 / 0.88

Circular Vents:

Sex-specific retention curves were not found to be necessary for circular vent selectivities. The L50 estimates for 2 7/16” and 2 5/8” vents are 80.6mm and 85.7mm respectively (Figure 3).

Retention rate for lobsters at minimum legal size ranged from 25% for the 2 7/16” vents and status quo MLS to 86% for the 2 5/8” vent and 3 3/8” MLS (Table2), with respective cohort retention rates of 71% and 97%.

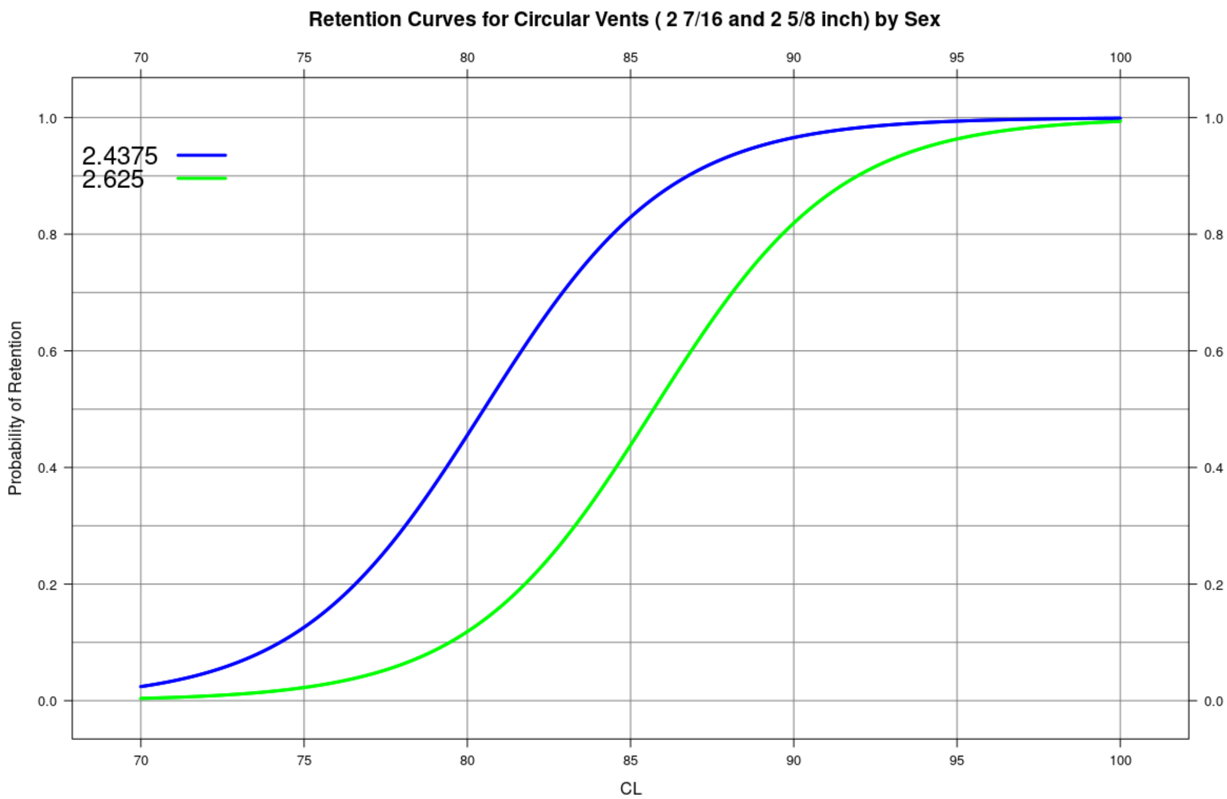

Figure 3. Model-estimated retention curves (probability of retention) for circular vent sizes 2 7/16 (2.4375) and 2 5/8 (2.65). Sexes combined.

Table 3. Retention rates at minimum legal size (sexes combined) and retention rate of a recruiting cohort for combined sexes with circular vents.

	proportionn retained @ MinLegalSize		proportion Cohort Retention	
MinLegalSize	2 7/16" Circ Vent	2 5/8" Circ Vent	2 7/16" Circ Vent	2 5/8" Circ Vent
status quo: 3 1/4” (83mm)	0.67	0.25	0.92	0.71
3 5/16” (84 mm)	0.78	0.36	0.95	0.79
3 3/8 ” (86 mm)	0.86	0.5	0.97	0.86