VIMS Dredge Survey Mid-Atlantic New Closed Area SHMW Analysis

Sally Roman

August 2, 2022

Methods

Shell height meat weight relationships (SHMW) were estimated for the Mid-Atlantic (MAB) survey to compare biomass estimates for the new NYB-Closure SAMS Area/access area. SHMW relationships were developed using a combined dataset from 2015 - 2022.

Station-level data from the 2015 - 2021 surveys were reassigned to 2022 SAMS Areas for analysis. VIMS' protocols dictate that at every station with scallop catch, up to 15 scallop that encompass the length distribution of scallops at a given station are sampled to collect data on meat weight, gonad weight, meat quality, sex, maturity stage, and disease prevalence. The shell height is taken for each scallop assessed, and then the adductor muscle and gonad are carefully removed. The adductor muscle and gonad are weighed with a Marel M2200 motion compensating scale.

SHMW mixed effect models were developed with forward selection and variables were retained in the model if the AIC was reduced three or more units. SAMS Area was included in all models to estimate the SAMS Area effect. The model with the lowest AIC was selected as the preferred model and used to predict SHMW relationships by SAMS Area. If models were within three units of each other, a likelihood ratio test was used to test for significant differences between models. If there was no significant difference between the models, the more parsimonious model was selected as the preferred model. Variables considered were: ln shell height, ln depth (average depth for a station), SAMS Area (retained in all models), latitude (beginning latitude of a station), and an interaction term of shell height and depth. A Tukey's honestly significant difference post-hoc test was run to test for differences between SAMS Area means for all combinations of SAMS Areas. Tables provided below include the SHMW models with parameters and AIC values. Parameter estimates for the preferred model and predicted SHMW relationships are also provided. Predicted SHMW curves estimated from the VIMS preferred model were compared to those using the SARC 65 parameters. Biomass estimates for the new NYB-Closure SAMS Area/access area were also estimated with the VIMS and SARC 65 equations.

Results

Table 1 provides the number of scallops assessed and number of stations included in the analysis. The preferred model included an interaction of shell height and depth and SAMS Area as fixed effects (Table 2). Parameter estimates are provided in Table 3. Several SAMS Areas, including the new NYB-Closure area were significantly different from the reference level (BI SAMS Areas). Post-hoc comparisons indicated the NYB-Closure Area was significantly different from all other SAMS Areas except the LI SAMS Area = (p-value = 0.11) and the MAB Nearshore SAMS Area (p-value = 0.63). Predicted SHMW curves are provided in Figure 1 and a comparison of SHMW curves with the SARC 65 and VIMS equations is in Figure 2. The NYB-Closure SHMW curve is in the middle of all the predicted SHMW curves (Figure 1). The VIMS SHMW curve and the SARC 65 Access Area curve are similar for scallops ranging in size from 50 mm to approximately 125 mm (Figure 2). The two curves diverge at approximately 125 mm, with the VIMS curve predicting a high meat weight at length relative to the SARC 65 curves for scallops larger than

125 mm. Total biomass estimates are in Table 4. Biomass increased by 597 mt, for a relative difference of 7%, using the VIMS equation compared to the SARC 65 equation.

Table 1. Number of scallops assessed and number of stations included in the SHMW analysis by year.

Year	Number of Scallops	Number of Stations
2015	4,935	436
2016	5,534	408
2017	5,750	417
2018	5,398	380
2019	5,489	375
2020	4,762	377
2021	4,843	376
2022	4,813	380
Total	41,524	3,149

Table 2. SHMW models for the 2015 - 2022 VIMS MAB survey data. Model in bold was selected as the preferred model. The number of parameters (K), AIC, ΔAIC, AIC weight, and Deviance explained are also included.

Model	Parameters	K	AIC	ΔAIC	AIC Weight	Deviance Explained
mab2	Shell Height*Depth, SAMS Area, Latitude	15	247,983	-	0.66	78
mab1	**Shell Height*Depth, SAMS Area**	**14**	**247,985**	**1.36**	**0.34**	**78**
mab3	Shell Height, Depth, SAMS Area	15	248,207	223.65	0	77.88
mab4	Shell Height, Depth, SAMS Area, Latitude	14	248,224	240.65	0	77.88
mab5	Shell Height, SAMS Area, Latitude	13	248,299	315.99	0	77.89
mab6	Shell Height, SAMS Area	12	248,316	332.59	0	77.89
mabnull	Intercept	3	314,401	66,417.63	0	

Table 3. Parameter estimates for model mab1 from Table 2.

Parameter	Estimate	P-value
Intercept	-18.36	<0.001
Shell Height	4.76	<0.001
Depth	2.08	<0.001
DMV	-0.12	<0.001
ET	0.015	0.57
HCS	0.04	0.16
LI	0.07	0.01
MAB_Nearshore	0.07	0.03
NYB	0.04	0.13
NYB Closure	0.10	0.02
VIR	-0.25	<0.001
Shell Height*Depth	-0.49	<0.001

Table 4. Total biomass (mt) estimates for the NYB-Closure area estimated with the SARC 65 and VIMS SHMW equations.

SAMS Area	Total Biomass (mt)	
	SARC 65	VIMS 2015 - 2022
NYB-Closure	8,029	8,626

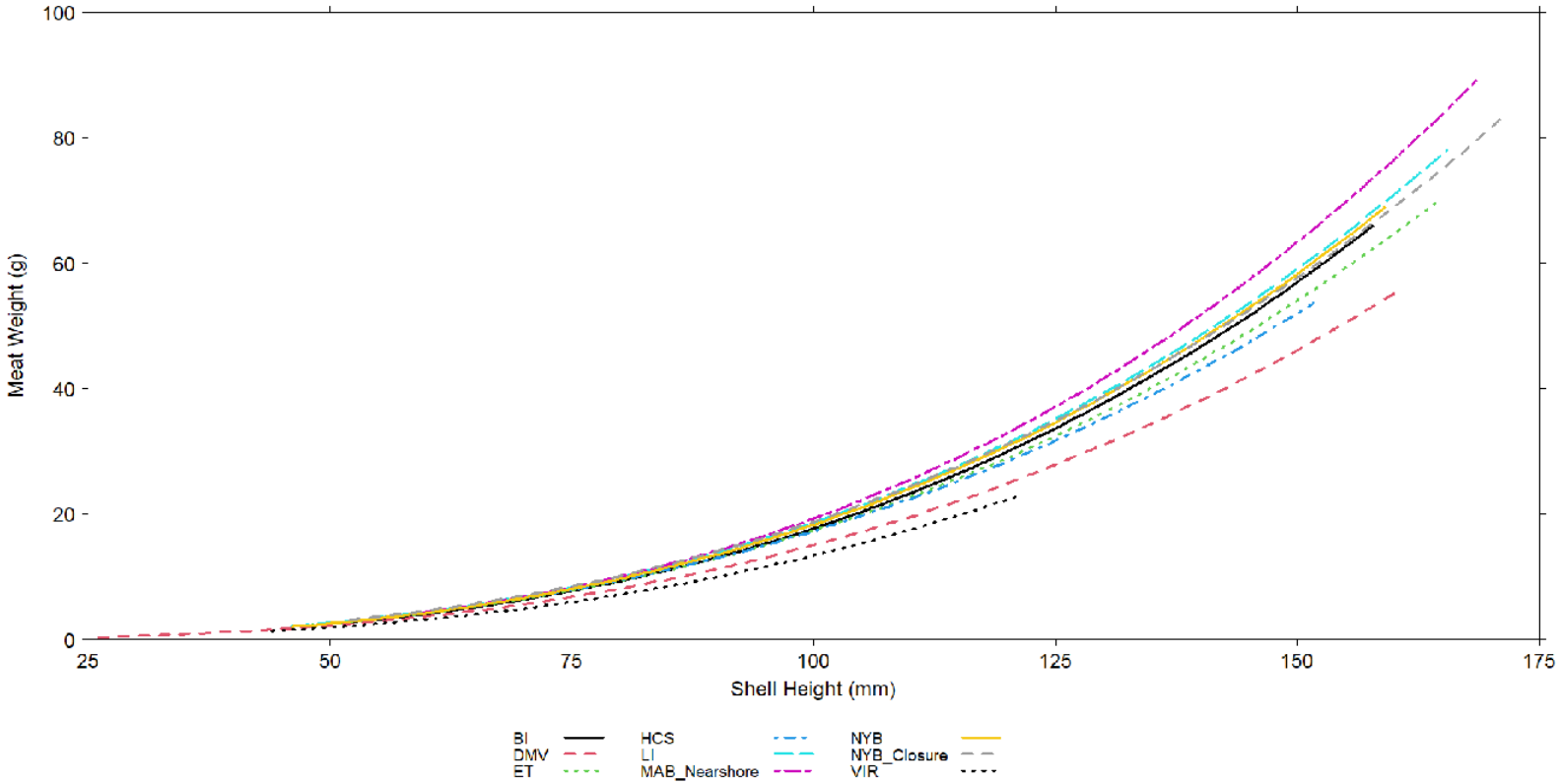

Figure 1. Predicted SHMW relationships by SAMS Area using model mab1 from Table2.

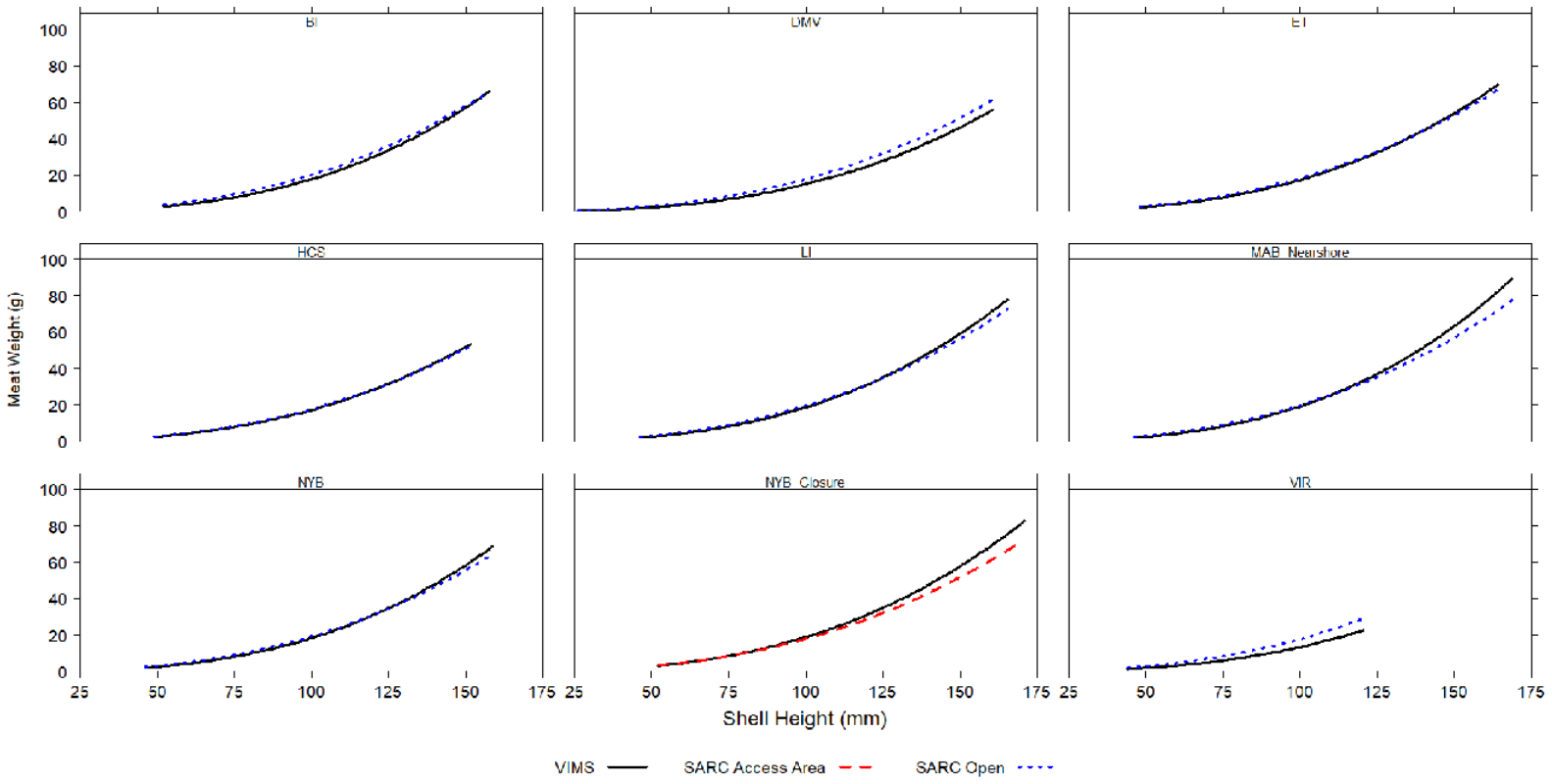

Figure 2. Predicted SHMW relationships by SAMS Area using the SARC 65 and VIMS equations.