VIMS Nantucket Lightship SHMW Analysis

August 19, 2019

Methods

Shell height meat weight relationships (SHMW) were estimated for the Nantucket Lightship (NL) survey by SAMS area with VIMS survey data. SHMW relationships were developed using only the 2019 survey data and a combined dataset from survey data for 2016-19.

SHMW models were developed with forward selection and variables were retained in the model if the AIC was reduced three or more units. Variables were added to the model based on individual model AIC values. 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 model. 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 of a tow), SAMS Area (retained in all models), latitude (beginning latitude of a tow) and an interaction term of shell height and depth. Year was included in the combined data model to test for a year effect, and was not significant. Tables provided below include the SHMW models with parameters and AIC by SAMS area. Parameter estimates for the preferred model and predicted SHMW relationships are also provided.

2019 total biomass for the VIMS NL survey was estimated with the SARC 65 GB SHMW parameters, the VIMS combined 2016-18 parameter estimates, and the VIMS combined 2016-19. A comparison of biomass estimates is provided below. Dredge efficiency issues persist in high density area in the South_Deep SAMS area.

Table 1. SHMW models for the 2019 VIMS NL survey data. Bold variables indicate significance. Model in red was selected as the preferred model. * indicates an interaction term.

Model	Parameters	K	AICc	Delta_AICc
nl3	~ 1 + **shell height + latitude** + depth + **SAMS Area**	10	12,527.89	0.00
nl2	~ 1 + **shell height + latitude + SAMS Area**	9	12,529.01	1.12
nl4	~ 1 + **shell height** + depth + **SAMS Area**	9	12,533.81	5.92
nl5	~ 1 + shell height * depth + **SAMS Area**	10	12,534.60	6.71
nl1	~ 1 + **shell height** + **SAMS Area**	8	12,535.11	7.22

Table 2. Parameter estimates for model nl2 from Table 1.

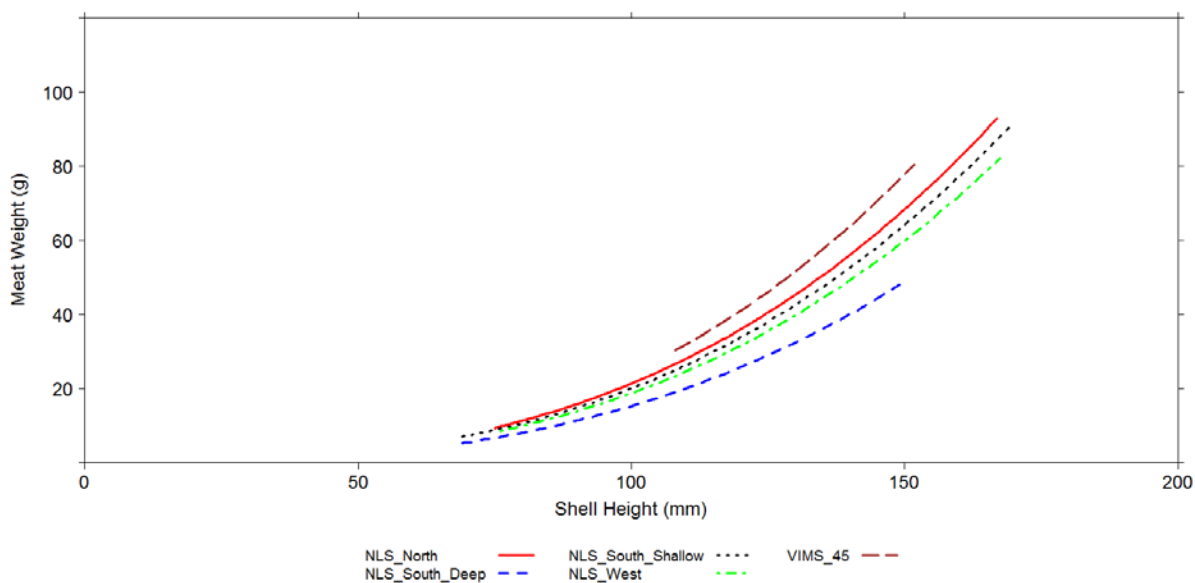| Parameter	Parameter Estimate
Intercept	-37.844
ln shell height	2.868
latitude	0.681
NLS_South_Deep	-0.170
NLS_South_Shallow	0.076
NLS_West	-0.034
VIMS_45	0.087

Figure 1. Predicted SHMW relationships by SAMS Area for the NL using model nl2 from Table2.

Table 3. SHMW models for the 2016-19 VIMS NL survey data. Bold variables indicate significance. Model in red was selected as the preferred model. * indicates an interaction term.

Model	Parameters	K	AICc	Delta_AICc
nl6	~ 1 + shell height * depth **+ latitude + SAMS Area**	11	34,269.59	0.00
nl3	~ 1 + **shell height + depth + latitude + SAMS Area**	10	34,269.99	0.40
nl2	~ 1 + **shell height + depth + SAMS Area**	9	34,272.49	2.90
nl4	~ 1 + **shell height + latitude + SAMS Area**	9	34,311.62	42.03
nl5	~ 1 + **shell height * depth + SAMS Area**	10	34,314.18	44.59
nl1	~ 1 + **shell height + SAMS Area**	8	34,319.07	49.48

Table 4. Parameter estimates for model nl3 from Table 3. <mark>Use this TABLE, these are correct.</mark>

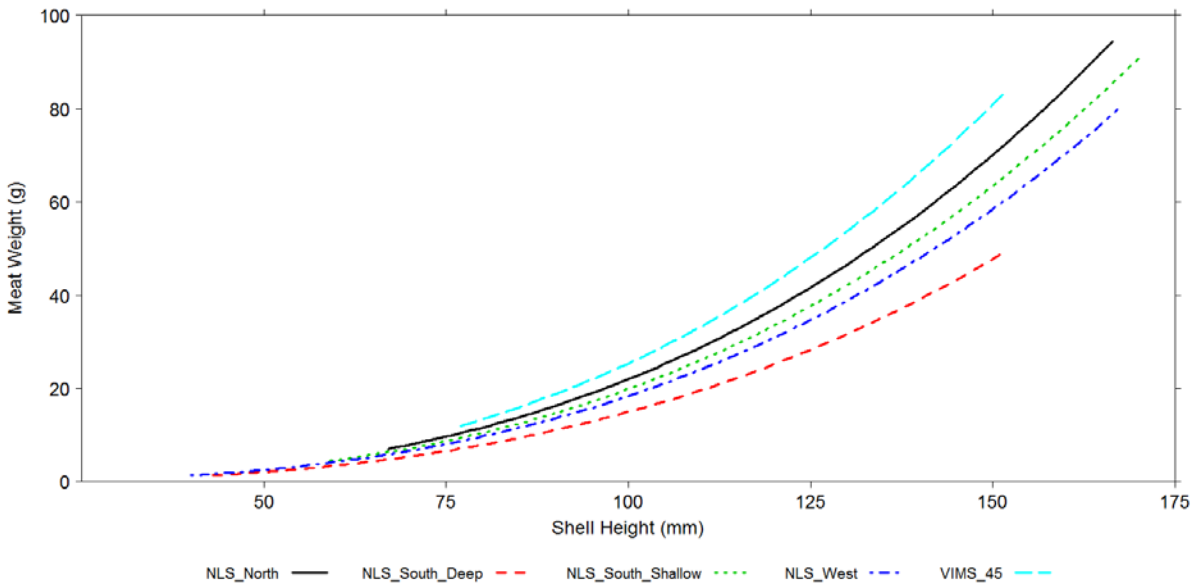| Parameter	Parameter Estimate
Intercept	-50.333
ln shell height	2.862
Latitude	1.007
ln depth	-0.169
NLS_South_Deep	-0.127
NLS_South_Shallow	0.095
NLS_West	-0.049
VIMS_45	-0.027

Figure 2. Predicted SHMW relationships by SAMS Area for the NL using model nl3 from Table4.

Table 5. Total biomass estimates (mt) for the NL using SARC 65 parameter estimates, VIMS 2016-18 parameter estimates and VIMS 2016-19 for the current SAMS areas. Dredge efficiency issues persist in high density area in the South_Deep SAMS Area.

SAMS Area	Total Biomass (mt) - SARC 65	Total Biomass (mt) - VIMS 2016-18	Total Biomass (mt) - VIMS 2016-19
NLS_North	3,613.91	3,251.00	3,368.23
NLS_South_Deep	11,955.05	12,596.00	11,897.84
NLS_South_Shallow	2,402.17	1,408.00	1,721.06
NLS_West	4,732.83	3,214	3,276.12
VIMS_45	90.47	80.00	82.58

Discussion

SHMW relationships in the NL continue to show a similar trend across years. The South_Deep SAMS Area continues to have a lower meat weight at shell height compared to the other SAMS areas. This SAMS Area is significantly different from the reference case, NLS_North SAMS Area, for the 2019 analysis and the combined analysis.

Biomass estimates were comparable between the different SHMW parameters used for estimation. This result is likely from having updated data included in the SARC 65 estimates and having the South_Shallow scallops in a separate SHMW analysis for SARC 65.