

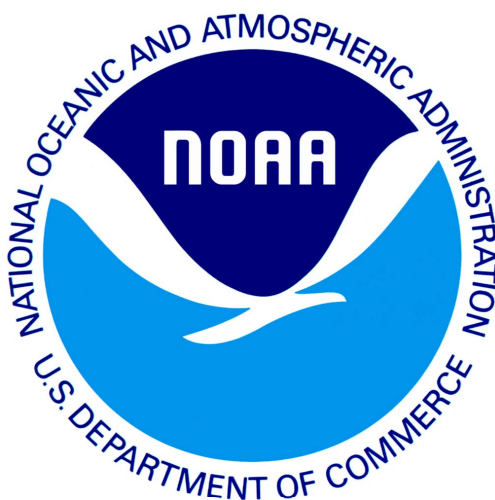
2026 Scallop Survey Short Report

Habcam/LRAUV

Prepared by:

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1 METHODS

Scallop abundance and biomass data from the Habcam/LRAUV surveys are highly spatially autocorrelated and zero-inflated (containing many zero values), reflecting the patchiness of scallop distributions and the continuous nature of the survey observations (Figure 1.1). Thus, a model-based estimation method, Regression Kriging (RK), was chosen to interpolate the transect data into unsurveyed areas to estimate regional total scallop abundance and biomass.

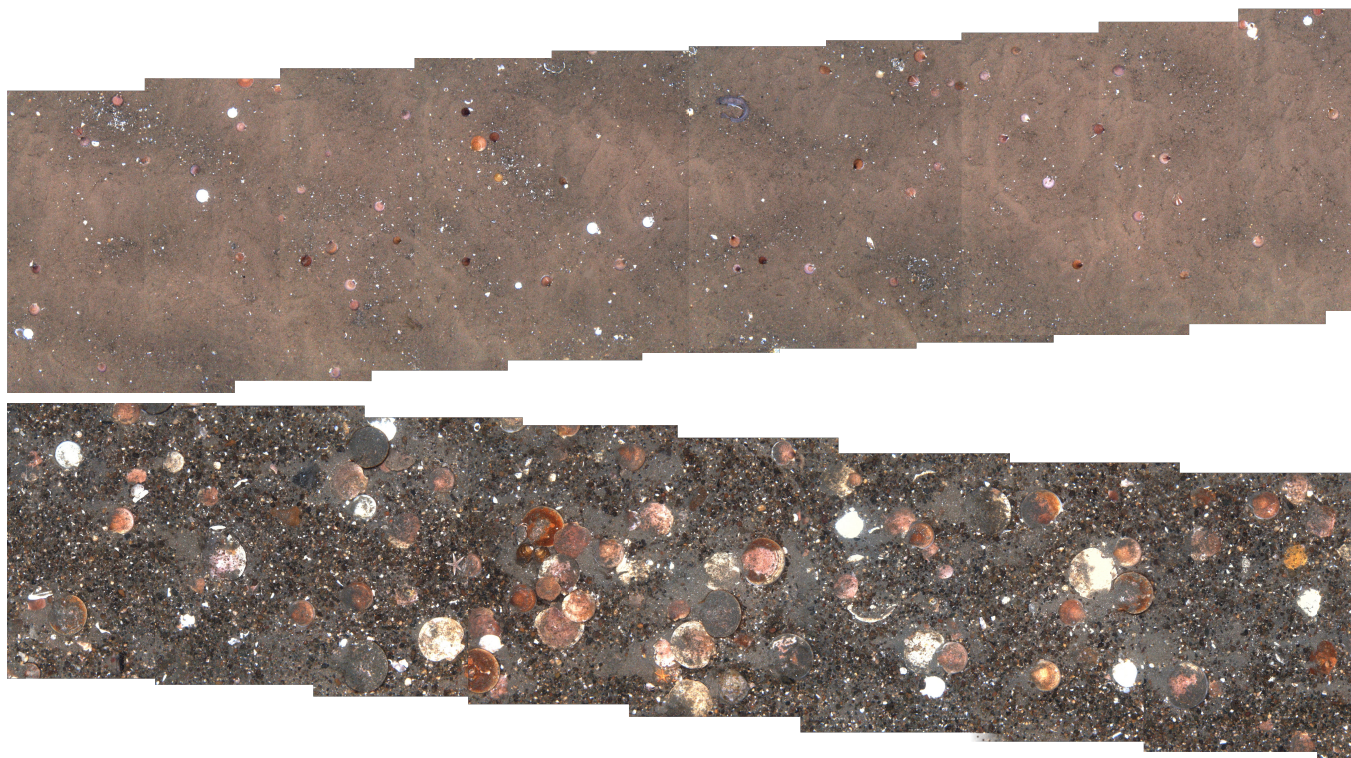


Figure 1.1. The mosaics of Habcam images collected in 2014 in CL2-South (top) and HAPC (bottom).

Kriging is one of the most widely used geostatistical methods for spatial interpolation. Ordinary Kriging (OK) is a standard version of the kriging methods, based on the assumption that spatial patterns remain consistent throughout the entire area (i.e., they are spatially stationary). RK extends OK to account for a potentially non-stationary global trend across the entire modeling region. This trend

is estimated using (generalized) regression models with external variables such as depth, after which OK is performed on the model residuals to estimate local-scale, spatially autocorrelated variability.

For the Habcam/LRAUV surveys, Generalized Additive Models (GAMs) were used as the RK regression models to allow for non-linear relationships between the data and the explanatory variables. To address the high degree of zero-inflation, a two-stage hurdle GAM was employed. The first stage models the probability of scallop presence using a quasi-binomial distribution, while the second stage estimates the conditional abundance or biomass (given that scallops are present) using a quasi-Poisson distribution.

In order to reduce the extent of the zero-inflation and the autocorrelation among nearby data points, the transect data were blocked into 750-meter segments along the tracks. Data within each segment were aggregated into a single data point, with its observation and position taken to be the averages in that segment, weighted by the variation in the field of view.

Latitude, longitude, and depth were used to model the scallop abundance and biomass in the hurdle GAMs. Depth is correlated with latitude and/or longitude in some of the areas. To prevent potential model instability caused by highly correlated predictors (collinearity), latitude and longitude were transformed into composite variables: latitude plus longitude, latitude plus half longitude, or half latitude plus longitude. GAM models with the different combinations of these covariates were tested (Table 1.1). The final GAM model was selected using the RMSE from a 10-fold cross-validation.

Table 1.1. List of GAMs tested in the 10-fold cross-validation.

s(Longitude, Latitude)+s(Depth)	s(Latitude, Depth)
s(Longitude, Depth)	s(LatPlusHalfLong, Depth)
s(HalfLatPlusLong, Depth)	s(LatPlusLong, Depth)
s(Latitude)+s(Depth)	s(Longitude)+s(Depth)
s(LatPlusHalfLong)+s(Depth)	s(HalfLatPlusLong)+s(Depth)
s(LatPlusLong)+s(Depth)	s(Latitude)+Depth

The spatial residuals obtained from the GAMs were used to estimate fine-scale spatial patterns using OK. Isotropic and a series of anisotropic (from 0 to 180 by 20 degrees) residual OK models, as well as different OK model configurations (spherical, exponential, Gaussian, and Matérn models), were tested. Isotropy and anisotropy refer to the variation of data being uniform in all directions (yielding round patches) or directionally dependent (yielding oval patches), respectively. For scallops, the shape of local patches varied by area, and thus, both isotropic and anisotropic OK models were evaluated. The final OK model was selected based on the RMSE calculated from a 10-fold cross-validation.

The Habcam/LRAUV data were interpolated onto 750-meter regular grids, corresponding to the 750-meter data segments. The total abundance and biomass of GAM+OK model estimates were calculated as:

$$\hat{T} = \sum_{i=1}^n (\hat{x}_i \hat{y}_i + \hat{z}_i), \quad (1.1)$$

where $\hat{x}_i$ is the probability of presence estimate, $\hat{y}_i$ is the estimate of abundance or biomass given that scallops are present, $\hat{z}_i$ is the kriged residual at location i , and n is the number of grids. By assuming that $\hat{x}$ and $\hat{y}$ are independent, the variance of the $\hat{T}$ was calculated as:

$$\begin{aligned} \text{Var}(\hat{T}) = \sum_{i=1}^n \text{E}^2(\hat{x}_i) \text{Var}(\hat{y}_i) + \text{E}^2(\hat{y}_i) \text{Var}(\hat{x}_i) + \text{Var}(\hat{x}_i) \text{Var}(\hat{y}_i) + \\ \sum_{i=1}^n \sum_{j=1}^n \text{Cov}(\hat{z}_i, \hat{z}_j) \end{aligned} \quad (1.2)$$

2 2026 SURVEY BIOMASS ESTIMATES

Table 2.1. Summary of 2026 Habcam/LRAUV model-based estimates for scallops larger than 40 mm shell height using the combined data from NEFSC and CFF. VIMS 2025 SH-MW equation was used to estimate meat weights for the scallops in NLS-South, whereas updated RT 2025 SH-MW equations were used for the rest of the SAMS areas. MeanWt is estimated using BmsMT/NumMill. #PerM² is estimated using NumMill/Area. The target annotation rate is 1:50 for NEFSC Habcam, 1:5 for NEFSC LRAUV, and 1:100 for CFF Habcam for 2026.

SAMS Area	NumMill	BmsMT	BmsMTSE	MeanWt	AvgSize	#PerM ²	#Annotated
Georges Bank							
CL1-Access	10	197	123	19	115.20	0.01	1942
CL1-Sliver	185	2375	906	12.80	96.30	0.23	3255
CL1-South	2	49	61	24.10	103.50	0.01	412
CL2-North	109	3633	74	33.40	114.70	0.25	2926
CL2-Access	181	1091	132	6	70.80	0.05	4896
CL2-Ext	107	1549	157	14.50	92	0.08	2537
NLS-North	50	734	423	14.60	100.70	0.05	1958
NLS-South	4250	31724	891	7.50	77.80	2.96	6571
NLS-West	15	286	39	18.50	70.40	0.01	4590
GSC	375	3821	1344	10.20	73.40	0.09	9737
GSC-HMA	12	465	518	38.90	115.20	0.04	423
NF	131	1762	79	13.50	81.20	0.07	6169
SF	690	8450	367	12.20	81.80	0.16	8096
Mid-Atlantic							
BI	34	371	22	11.10	70	0.04	1453
LI	322	6828	80	21.20	97.30	0.03	22114
NYB	305	4345	152	14.30	89.30	0.06	9270
MAB-Nearshore	0	0	0	4.80	43.70	0	7742
HCS	604	10217	162	16.90	99.30	0.15	15438
ET	450	7703	73	17.10	100.60	0.10	20999
DMV	14	83	9	5.80	61.70	0	6504

3 FIGURES OF SURVEY COVERAGE

The 2026 NEFSC Habcam/LRAUV survey date and areas covered are listed below:

- Habcam in Mid-Atlantic:
 - 5/11-19 in DMV, ET, HCS, and a mid-line through NYB and LI (Leg 1 - Bigelow)
- Habcam in Georges Bank:
 - 5/20-29 in NLS-West, CL1, NF, CL2-North, and GSC (Leg 2 - Bigelow)
- LRAUV in Mid-Atlantic:
 - 7/2-6 in Northern ET and Southern HCS (Polaris; Small Boat Launch out of Lewis, Delaware),
 - 7/2-6 in Inshore ET (Stella; Small Boat Launch out of Lewis, Delaware)

The center completed 879 nm and 717 nm of Habcam tracks in the Mid-Atlantic and Georges Bank, respectively, and 188 nm of LRAUV tracks in the Mid-Atlantic. About 5.67 million image pairs (97 thousand from LRAUV) were collected, and 102,053 images were manually annotated. Of all the images annotated with scallops, 87% (6924/7945) were QA/QC'd. The overall QA/QC rate is 9.6% (9813/102053). Fifty-two geostatistical models were constructed to produce spatial estimates of scallop counts, biomass, and recruitment for Georges Bank and the Mid-Atlantic for 2026.

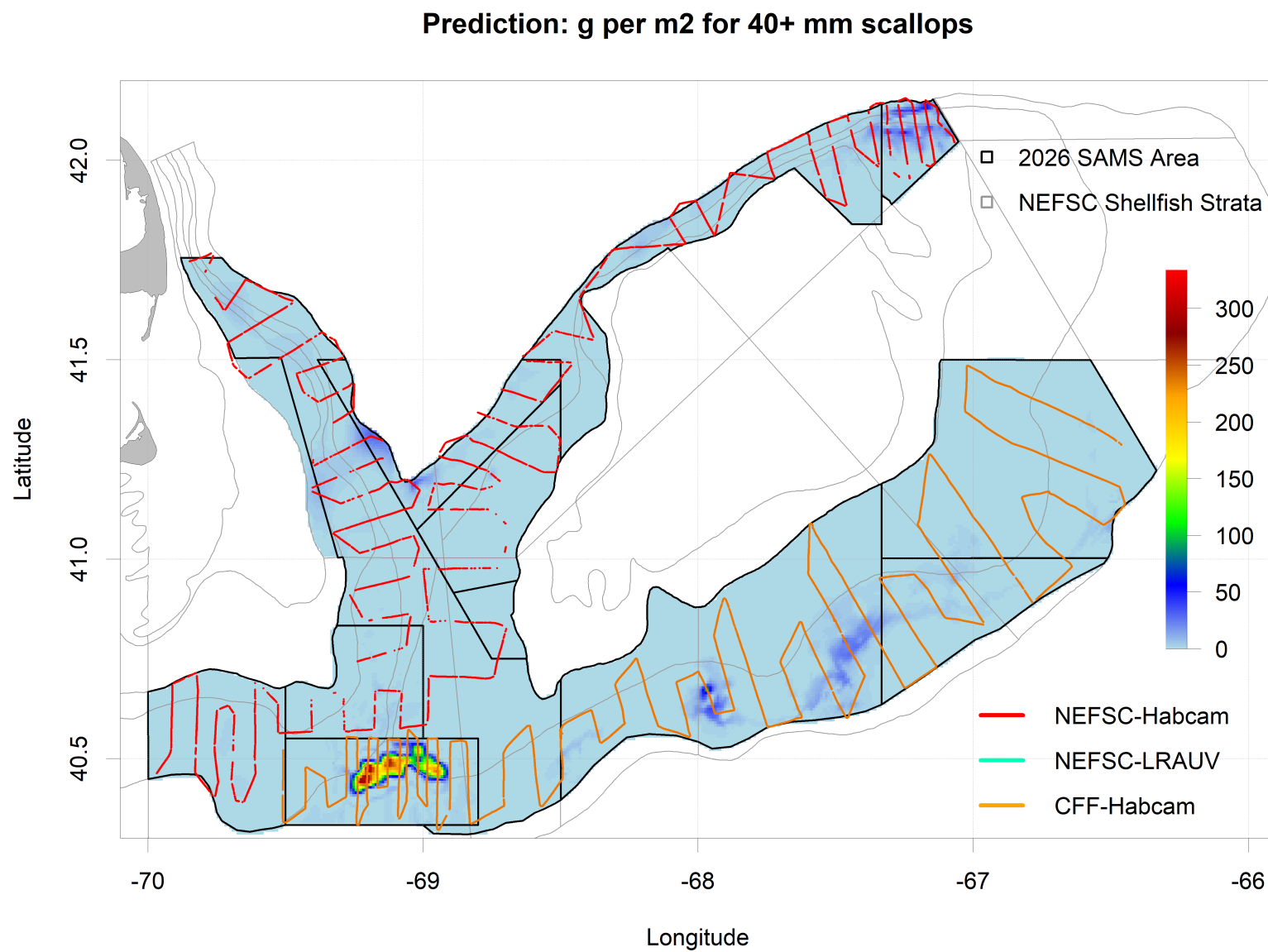


Figure 3.1. The 2026 Habcam survey tracks conducted by NEFSC and CFF, along with biomass estimates for 40+ mm scallops for Georges Bank.

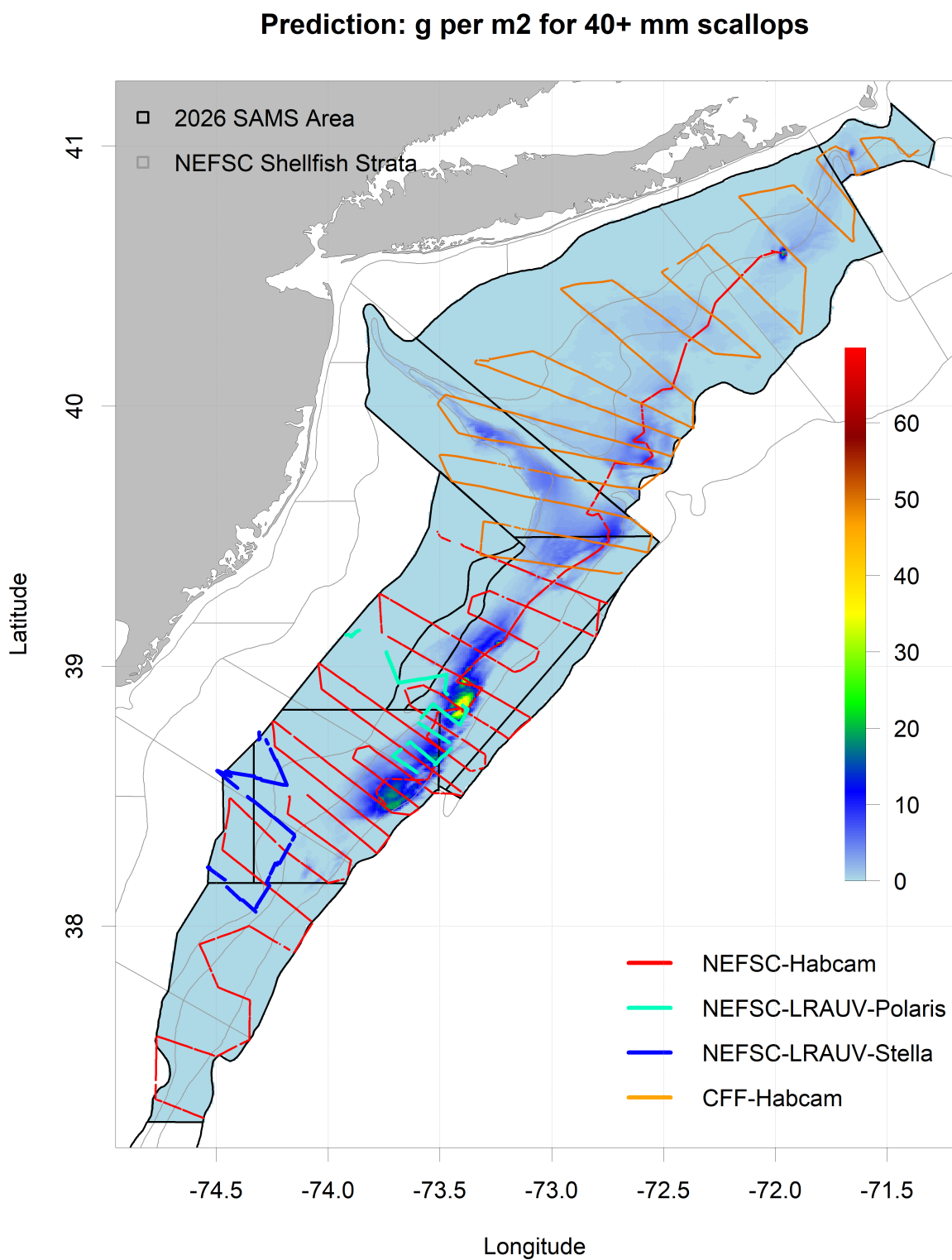


Figure 3.2. The 2026 Habcam/LRAUV survey tracks conducted by NEFSC and CFF, along with biomass estimates for 40+ mm scallops for Mid-Atlantic.

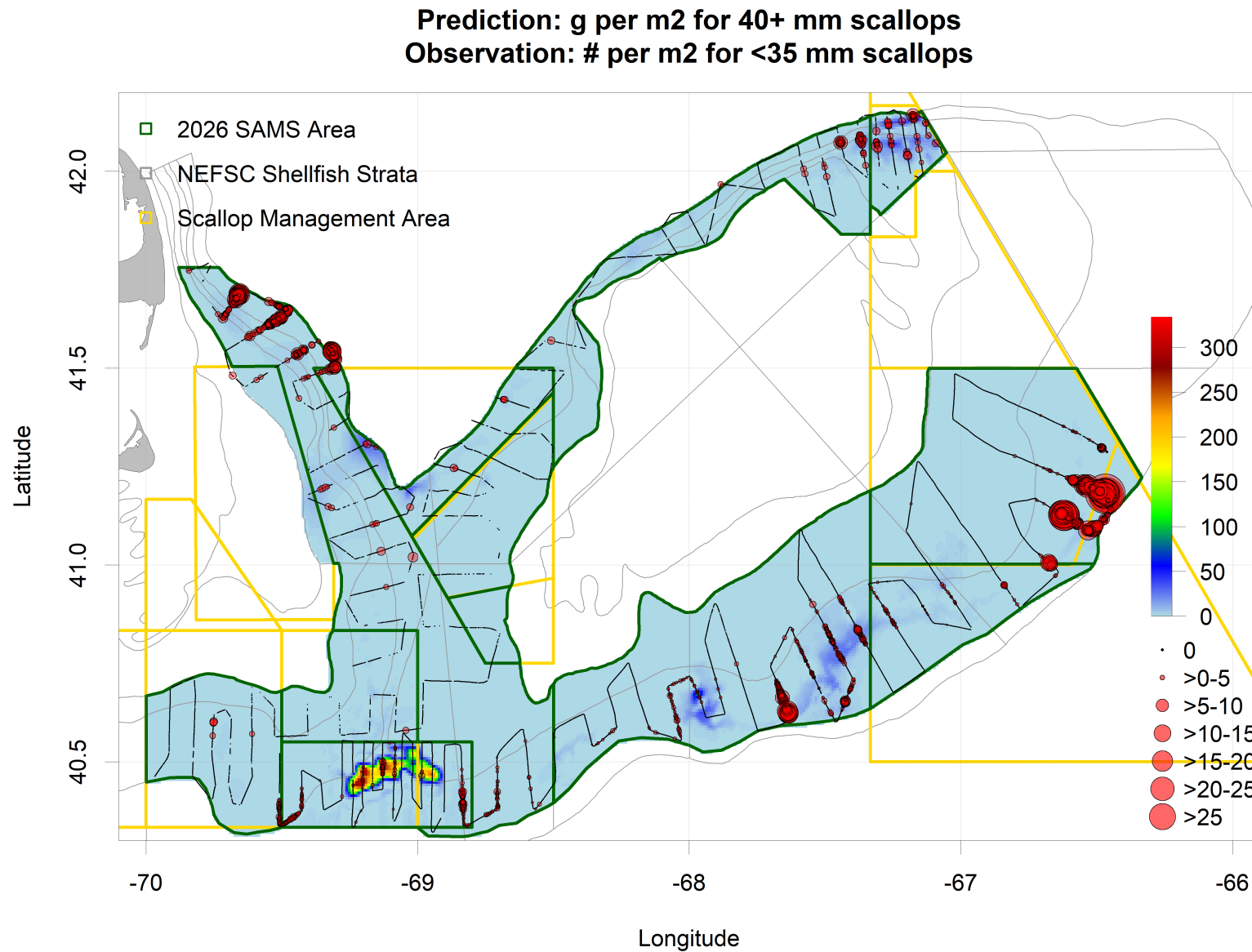


Figure 3.3. The number of <35 mm scallops observed on the 2026 NEFSC and CFF Habcam survey, along with biomass estimates for 40+ mm scallops for Georges Bank.

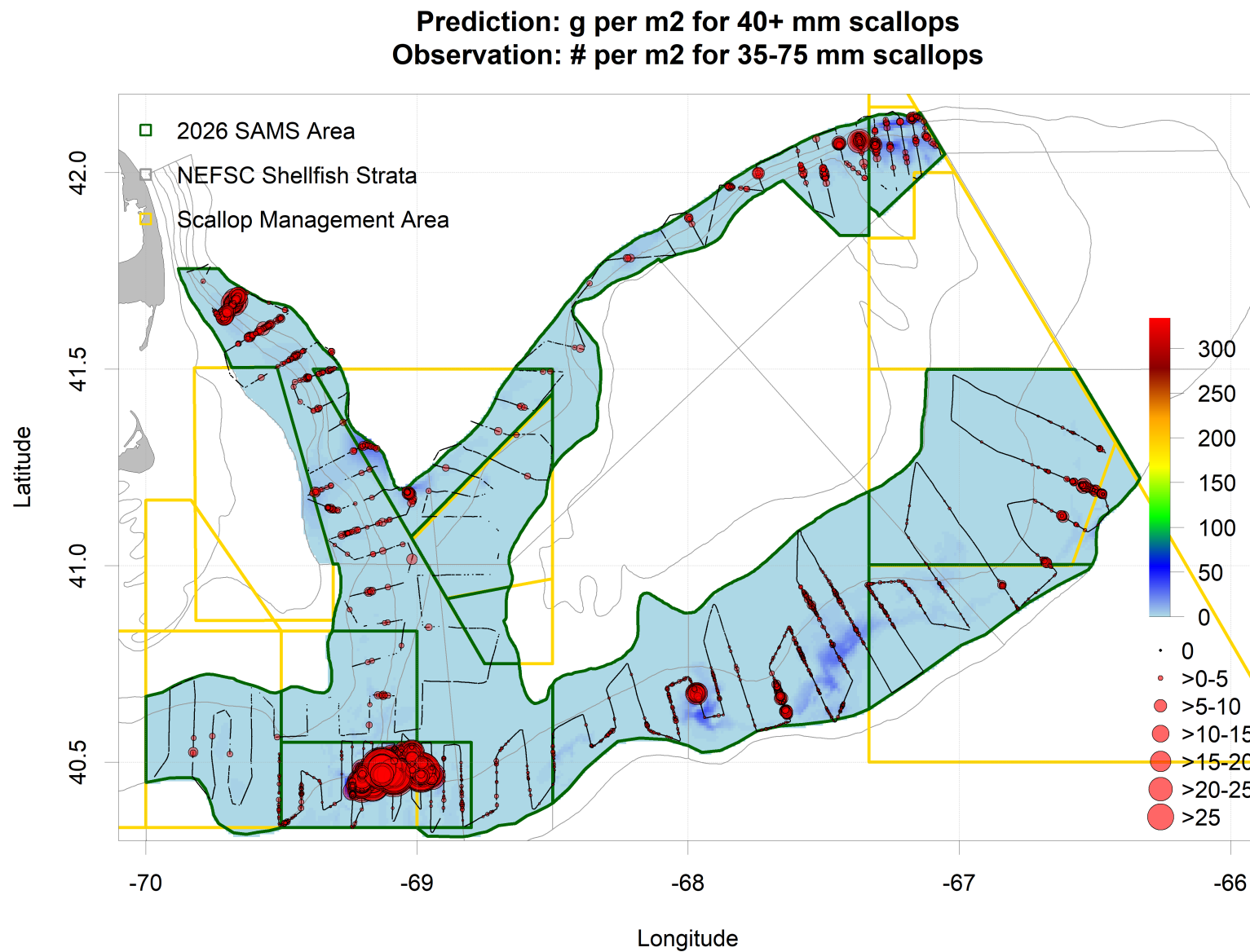


Figure 3.4. The number of 35-75 mm scallops observed on the 2026 NEFSC and CFF Habcam survey, along with biomass estimates for 40+ mm scallops for Georges Bank.

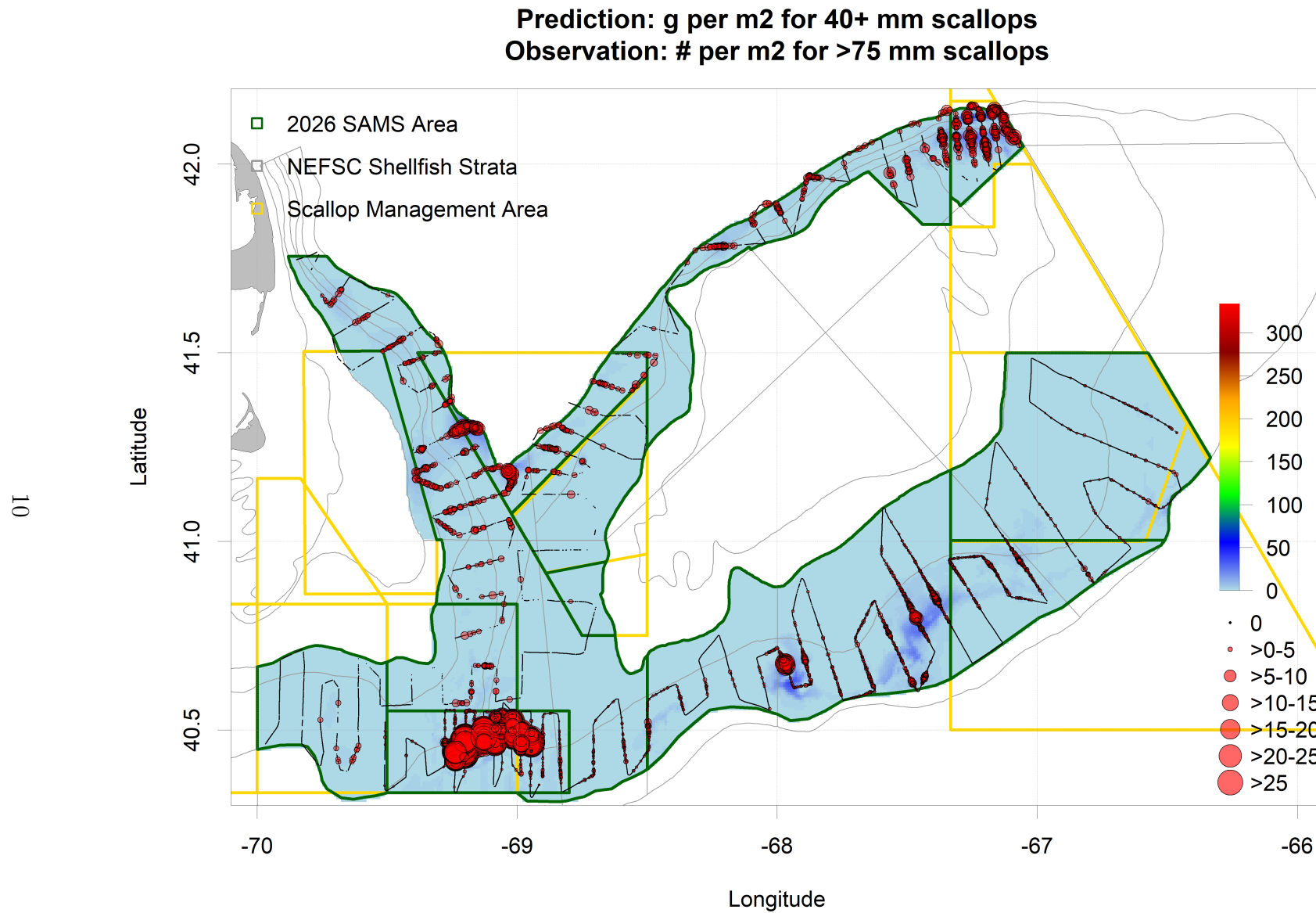


Figure 3.5. The number of >75 mm scallops observed on the 2026 NEFSC and CFF Habcam survey, along with biomass estimates for 40+ mm scallops for Georges Bank.

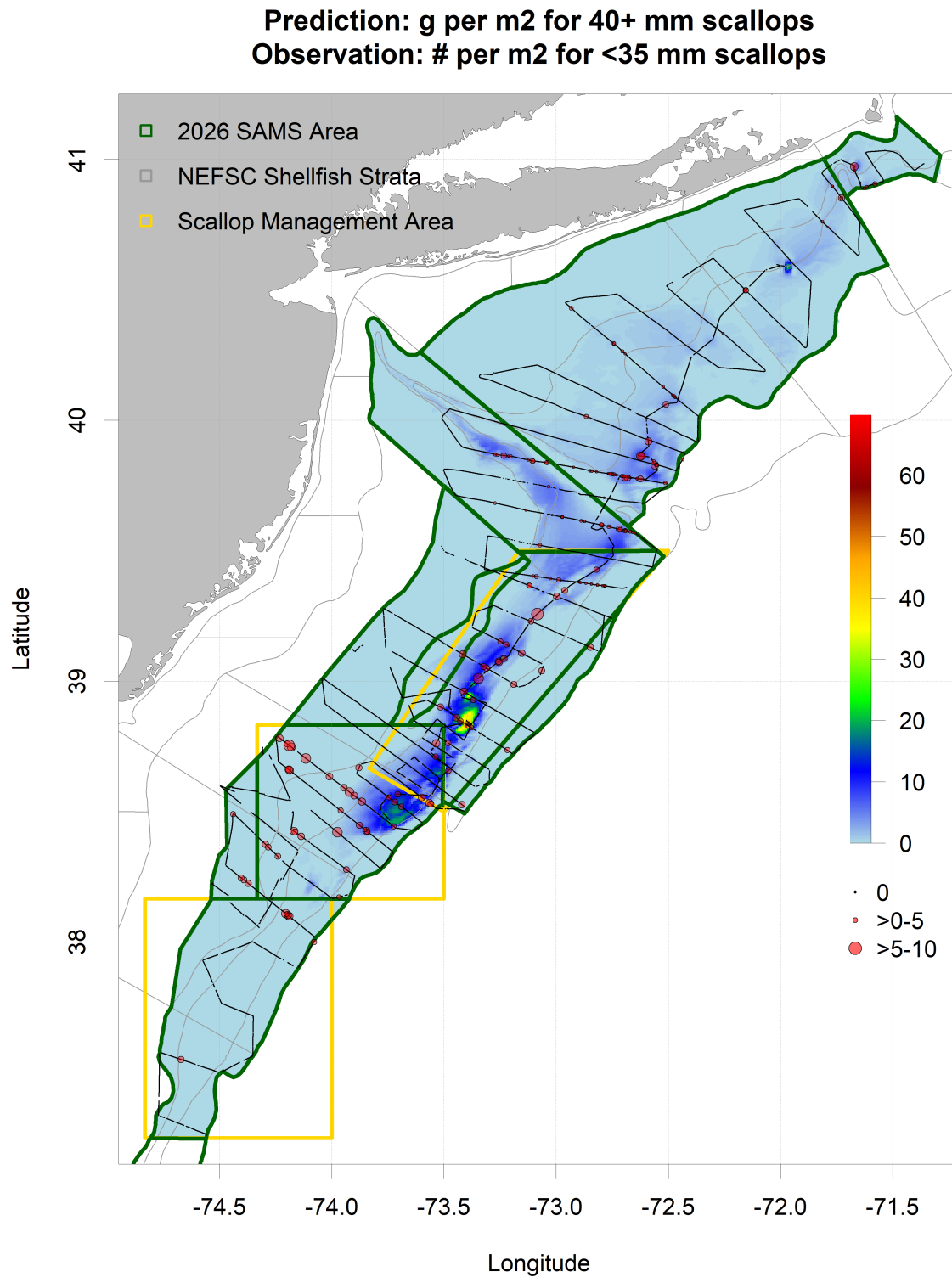


Figure 3.6. The number of <35 mm scallops observed on the 2026 NEFSC Habcam, NEFSC LRAUV, and CFF Habcam surveys, along with biomass estimates for 40+ mm scallops for Mid-Atlantic.

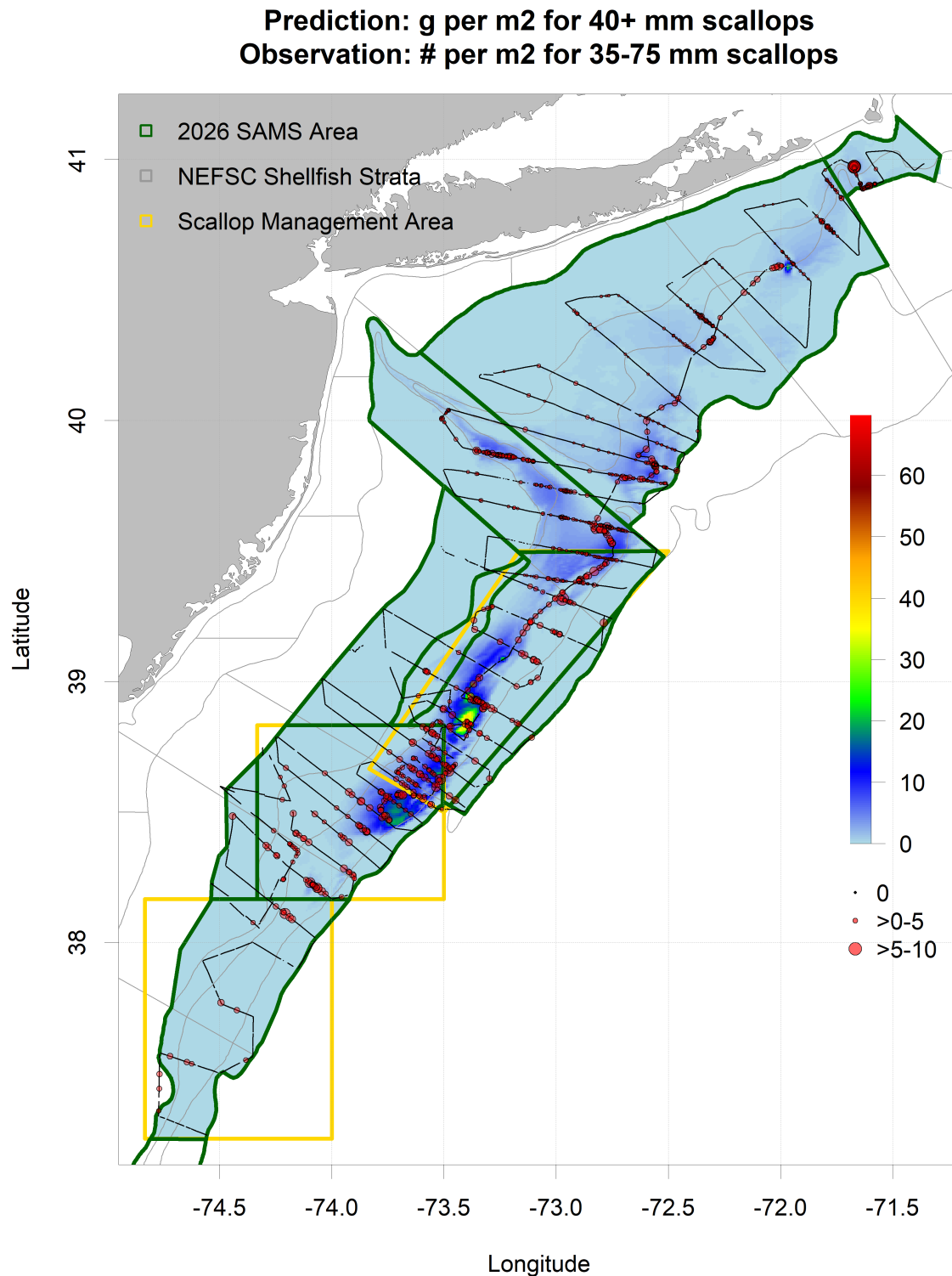


Figure 3.7. The number of 35-75 mm scallops observed on the 2026 NEFSC Habcam, NEFSC LRAUV, and CFF Habcam surveys, along with biomass estimates for 40+ mm scallops for Mid-Atlantic.

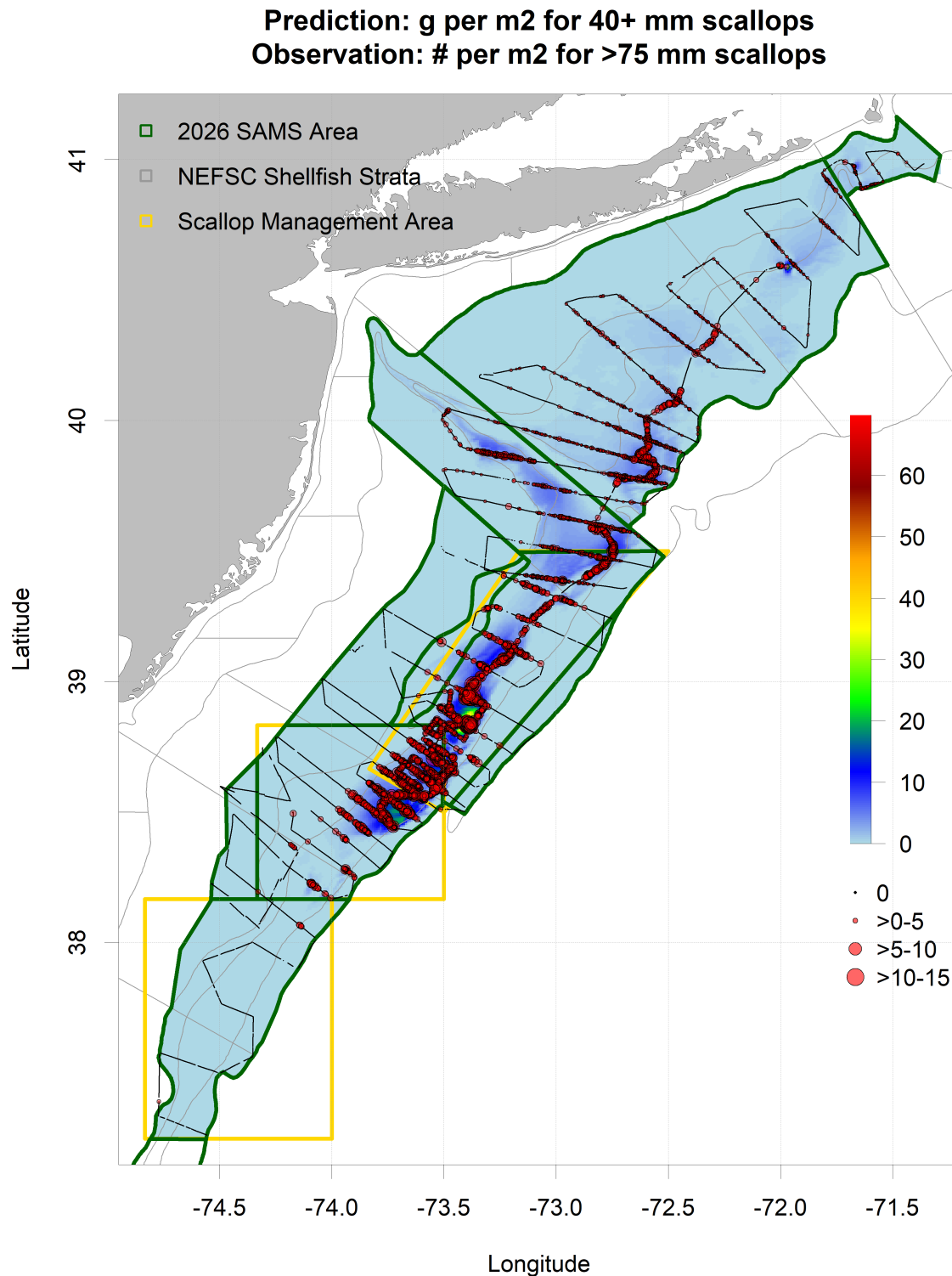


Figure 3.8. The number of >75 mm scallops observed on the 2026 NEFSC Habcam, NEFSC LRAUV, and CFF Habcam surveys, along with biomass estimates for 40+ mm scallops for Mid-Atlantic.

4 LENGTH FREQUENCY PLOTS BY SAMS AREA

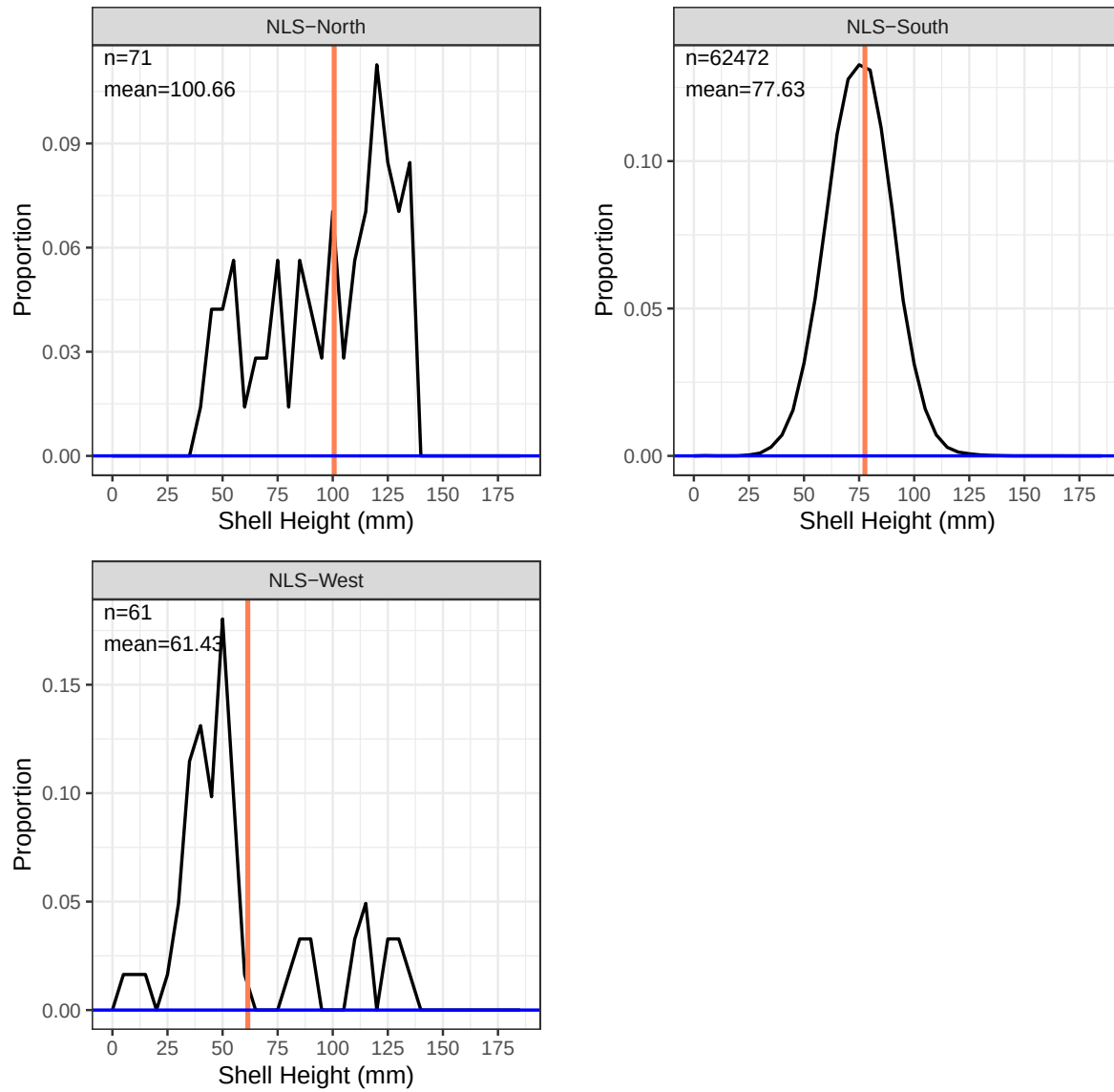


Figure 4.1. The 2026 size frequencies, mean shell height, and its sample size by SAMS area for 0+ mm scallops using combined data from NEFSC and CFF Habcam surveys for Georges Bank.

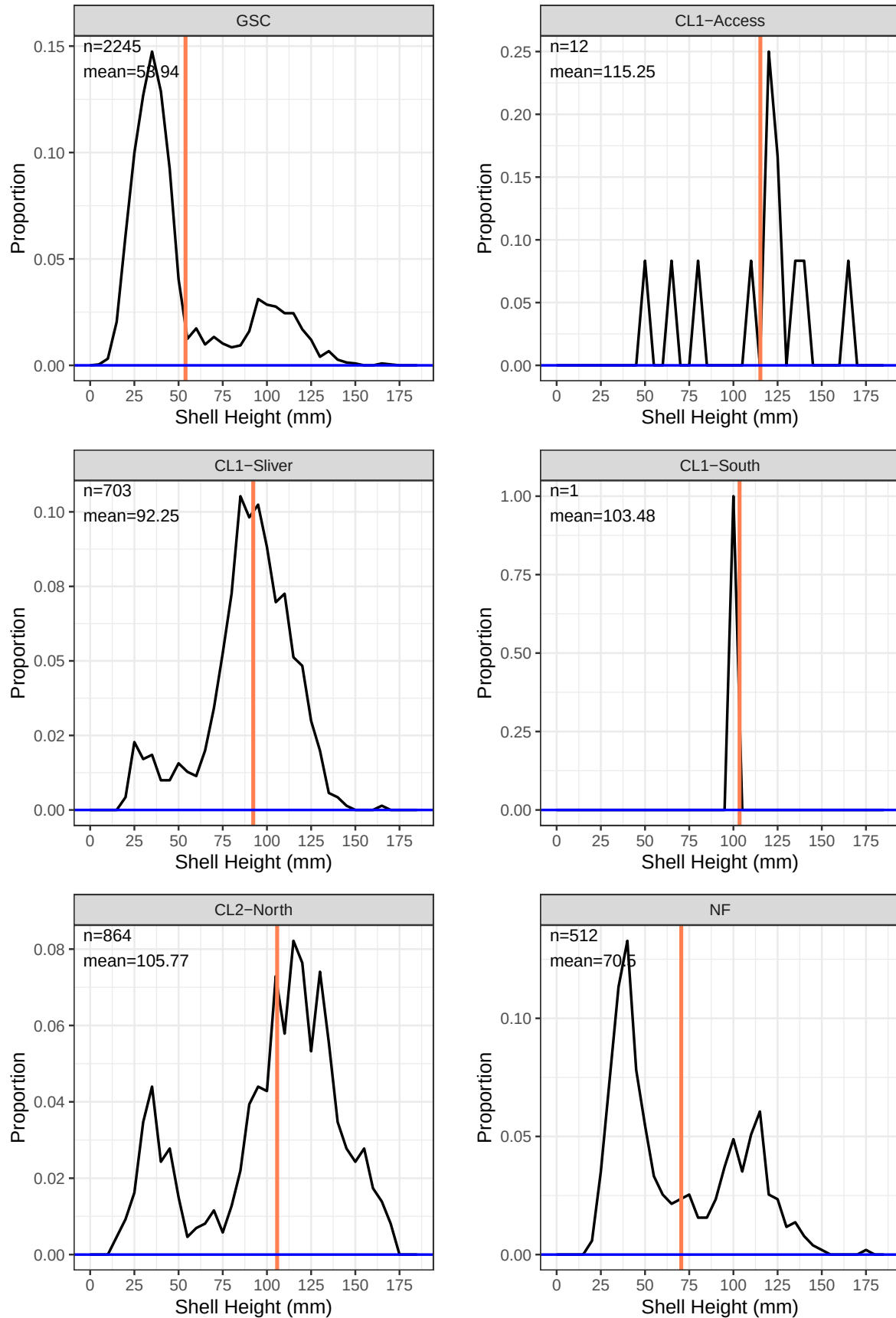


Figure 4.1. Continued.

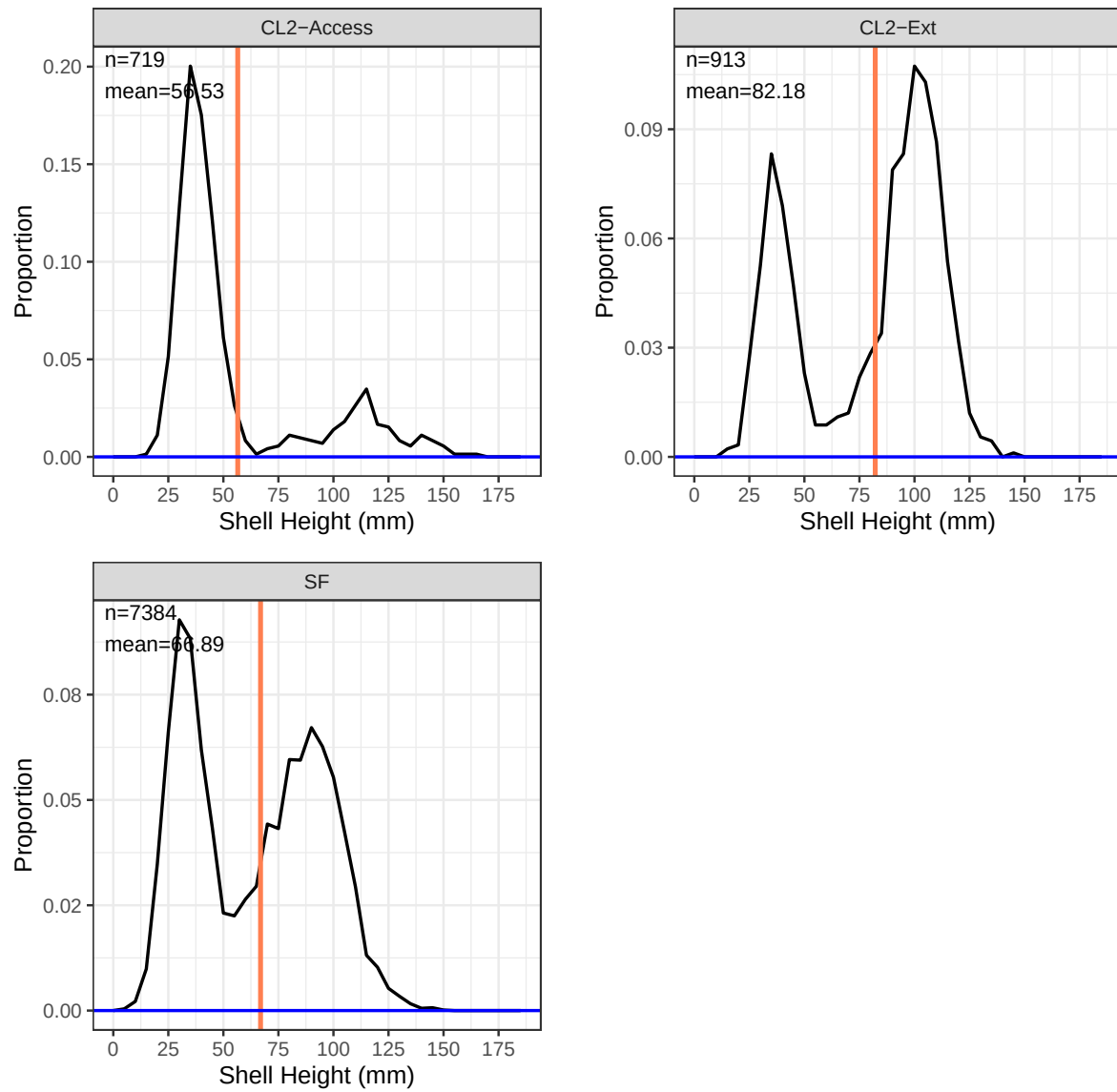


Figure 4.1. Continued.

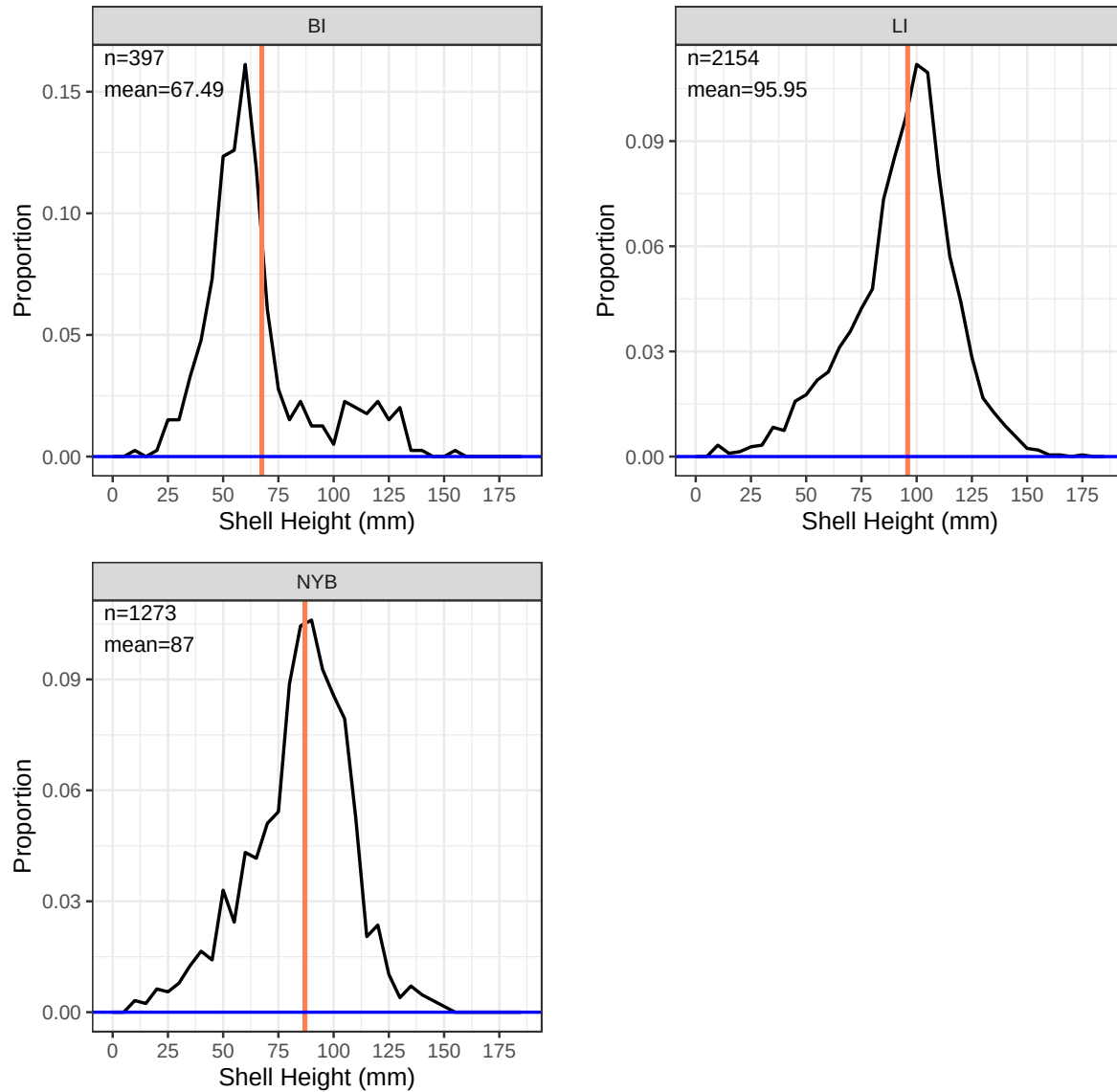


Figure 4.2. The 2026 size frequencies, mean shell height, and its sample size by SAMS area for 0+ mm scallops using combined data from NEFSC Habcam, NEFSC LRAUV, and CFF Habcam surveys for Mid-Atlantic.

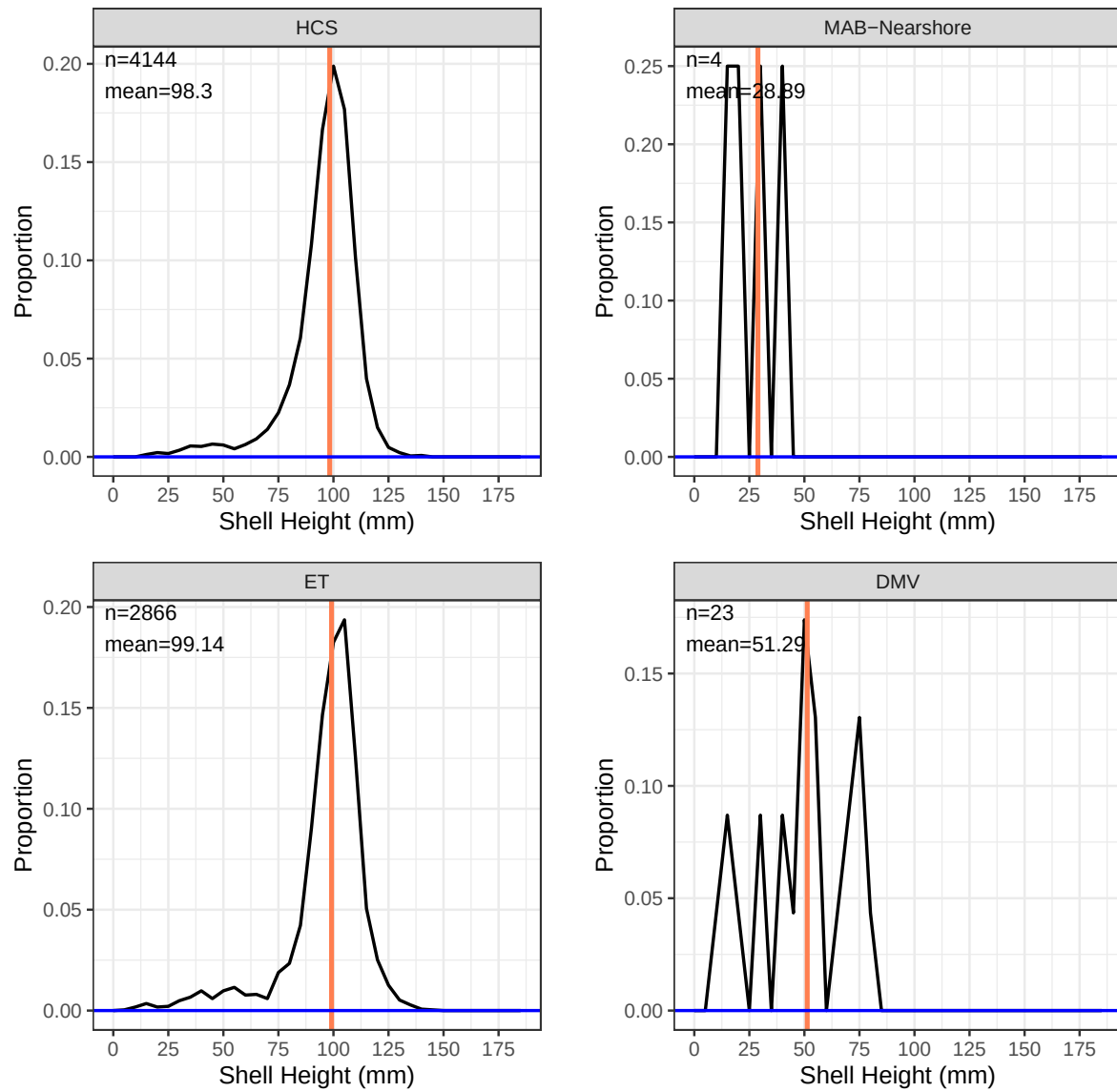


Figure 4.2. Continued.

5 EXPLOITABLE BIOMASS ESTIMATES FOR 2026 (CURRENT FY)

Table 5.1. Summary of 2026 Habcam/LRAUV model-based estimates for exploitable scallops using the combined NEFSC and CFF data. VIMS 2025 SH-MW equation was used to estimate meat weights for the scallops in NLS-South, whereas updated RT 2025 SH-MW equations were used for the rest of the SAMS areas. Yochum and DuPaul 4-inch ring selectivity was used for exploitable cutoff.

SAMS Area	ExNumMill	ExBmsMT	ExBmsMTSE	ExMeanWt
Georges Bank				
CL1-Access	8	180	112	23.9
CL1-Sliver	89	1517	579	17.1
CL1-South	1	30	38	24.1
CL2-North	79	3210	65	40.7
CL2-Access	48	828	100	17.3
CL2-Ext	51	1024	104	20
NLS-North	29	590	340	20.7
NLS-South	774	8996	253	11.6
NLS-West	4	195	26	54.8
GSC	106	2534	891	24
GSC-HMA	9	407	453	45.9
NF	47	1229	55	26.1
SF	208	4203	183	20.2
Mid-Atlantic				
BI	6	183	11	33
LI	163	4575	54	28
NYB	115	2347	82	20.4
MAB-Nearshore	0	0	0	4.8
HCS	329	6295	100	19.1
ET	261	5071	48	19.5
DMV	1	6	1	9

6 COMPARISON WITH PREVIOUS YEARS ESTIMATES

Table 6.1. Summary of 2025 and 2026 Habcam/LRAUV model-based estimates for scallops larger than 40 mm shell height using the combined data from NEFSC and CFF. Percent difference was calculated as (2026 - 2025)/2025.

SAMS Area	Abundance (mil.)			Biomass (mt)			Exp Bio (mt)		
	2025	2026	%Diff	2025	2026	%Diff	2025	2026	%Diff
Georges Bank									
CL1-Access	-	10	-	-	197	-	-	180	-
CL1-Sliver	-	185	-	-	2375	-	-	1517	-
CL1-South	-	2	-	-	49	-	-	30	-
CL2-North	-	109	-	-	3633	-	-	3210	-
CL2-Access	24	181	654.2	740	1091	47.4	656	828	26.2
CL2-Ext	78	107	37.2	1505	1549	2.9	963	1024	6.3
NLS-North	-	50	-	-	734	-	-	590	-
NLS-South	2046	4250	107.7	10379	31724	205.7	1431	8996	528.7
NLS-West	26	15	-42.3	631	286	-54.7	435	195	-55.2
GSC	-	375	-	-	3821	-	-	2534	-
GSC-HMA	-	12	-	-	465	-	-	407	-
NF	-	131	-	-	1762	-	-	1229	-
SF	461	690	49.7	5164	8450	63.6	1570	4203	167.7
Mid-Atlantic									
BI	12	34	183.3	196	371	89.3	109	183	67.9
LI	452	322	-28.8	5916	6828	15.4	3106	4575	47.3
NYB	223	305	36.8	2125	4345	104.5	905	2347	159.3
MAB-Nearshore	2	0	-100	11	0	-100	7	0	-100
HCS	-	604	-	-	10217	-	-	6295	-
ET	562	450	-19.9	6079	7703	26.7	2072	5071	144.7
DMV	-	14	-	-	83	-	-	6	-

7 SHELL-HEIGHT MEAT WEIGHT COMPARISONS

Table 7.1. Comparison of 2026 Habcam biomass estimates (40+ mm) using SH-MW equations from VIMS 2025 (original) and VIMS 2025-2026 (sensitivity) for NLS-South, and from updated RT 2025 (original) and updated 2026 (sensitivity) for Mid-Atlantic. Percent difference was calculated using biomass estimates (Sensitivity - Original)/(Original).

SAMS Area	Original		Sensitivity		%Diff
	BmsMT	BmsMTSE	BmsMT	BmsMTSE	
NLS-South	31724	891	31041	874	-2.2
BI	371	22	410	24	10.5
LI	6828	80	7033	84	3
NYB	4345	152	4823	49	11
MAB-Nearshore	0	0	1	1	260.7
HCS	10217	162	10808	254	5.8
ET	7703	73	8599	104	11.6
DMV	83	9	97	11	17.6

8 SPECIAL COMMENTS

8.1 2026 Habcam/LRAUV Survey Spatial Count Estimates For 40+ mm Scallops

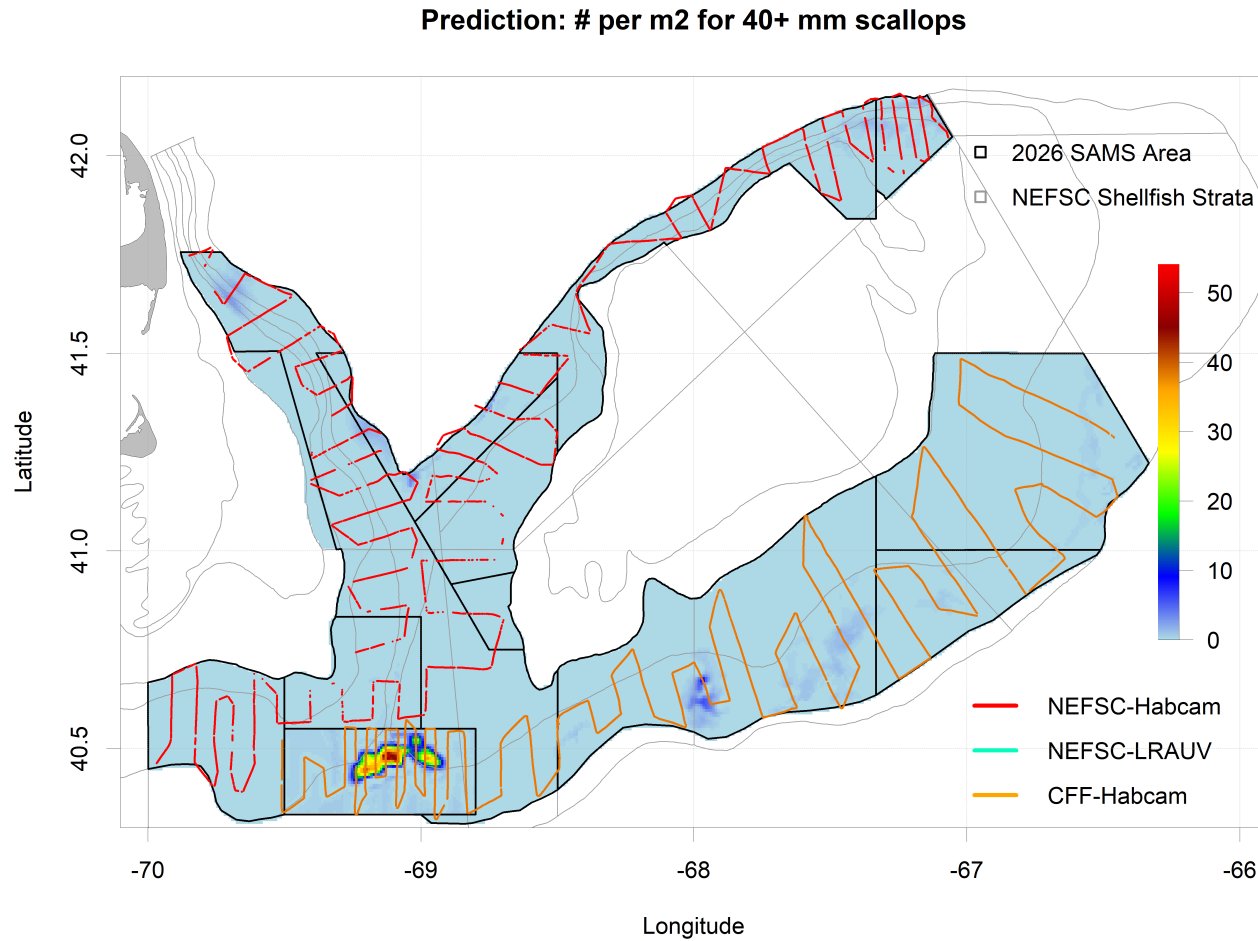


Figure 8.1 The 2026 Habcam survey tracks conducted by NEFSC and CFF, along with count estimates for 40+ mm scallops for Georges Bank.

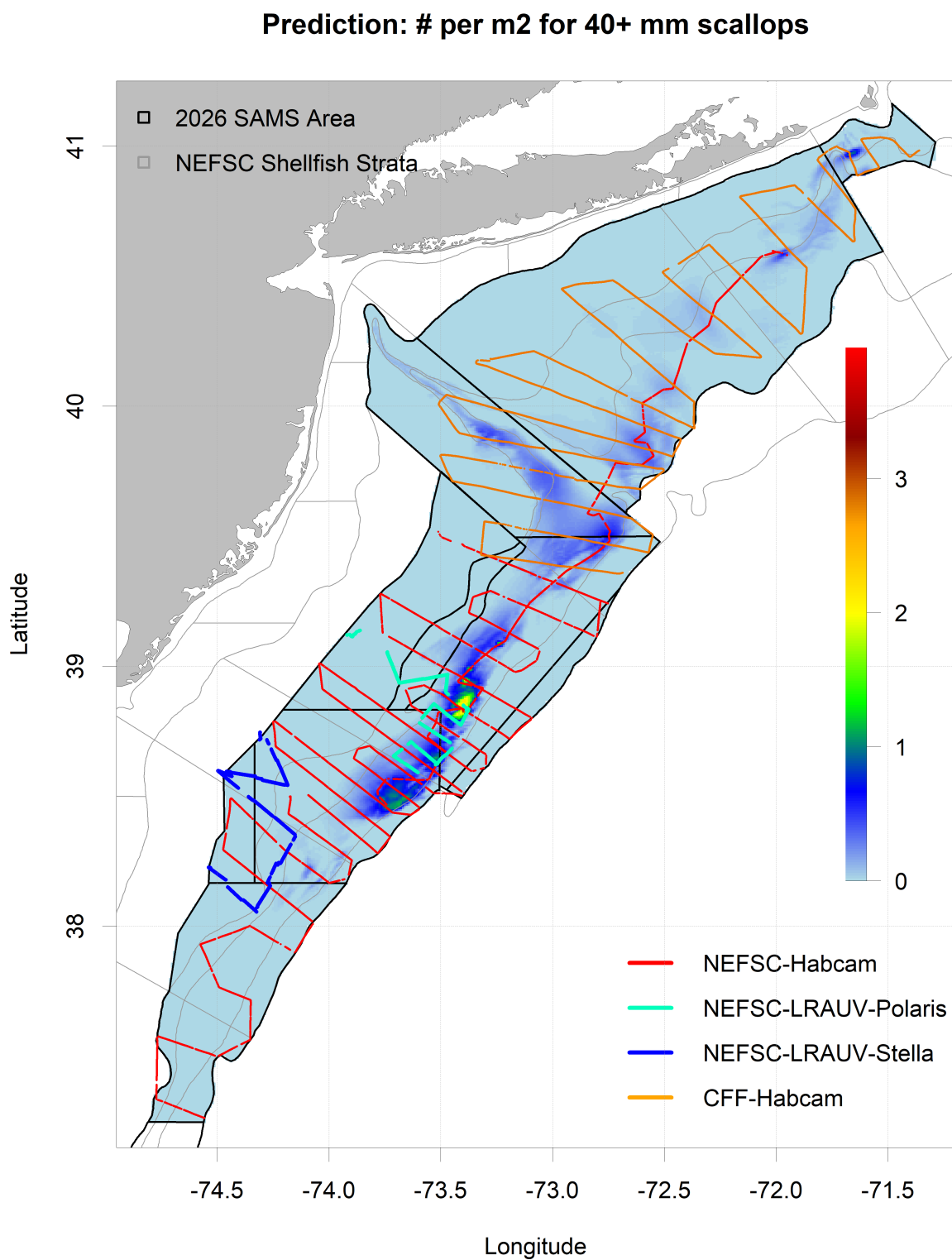


Figure 8.2. The 2026 Habcam/LRAUV survey tracks conducted by NEFSC and CFF, along with count estimates for 40+ mm scallops for Mid-Atlantic.

8.2 2026 Habcam/LRAUV Survey Spatial Count Estimates For 2-Year Old Recruits

The 2026 Habcam/LRAUV survey observed 2-year-old scallop recruits throughout the resource. Here, the definition of 2-year-old recruits (size range) varies by location, ranging from 30 mm to the shell height of one year's growth from 30 mm at that location. The spatial counts of the 2-year-old scallop recruits were estimated using the same geostatistical method as the 40+ mm scallops, and are listed below (Table 9.1; Figures 9.3 and 9.4).

Table 8.1. Summary of 2026 Habcam/LRAUV count estimates for 2-year old recruits using the combined NEFSC and CFF data.

SAMS Area	NumMill	NumMillSE	#PerM ²
Georges Bank			
CL1-Access	0	1	0
CL1-Sliver	25	10	0.03
CL1-South	0	2	0
CL2-North	31	3	0.07
CL2-Access	5860	28	1.63
CL2-Ext	170	5	0.12
NLS-North	11	8	0.01
NLS-South	4694	70	3.27
NLS-West	15	1	0.01
GSC	595	6	0.15
GSC-HMA	2	0	0.01
NF	117	8	0.06
SF	1291	13	0.31
Mid-Atlantic			
BI	25	3	0.03
LI	76	4	0.01
NYB	87	1	0.02
MAB-Nearshore	7	0	0
HCS	54	1	0.01
ET	54	1	0.01
DMV	13	1	0

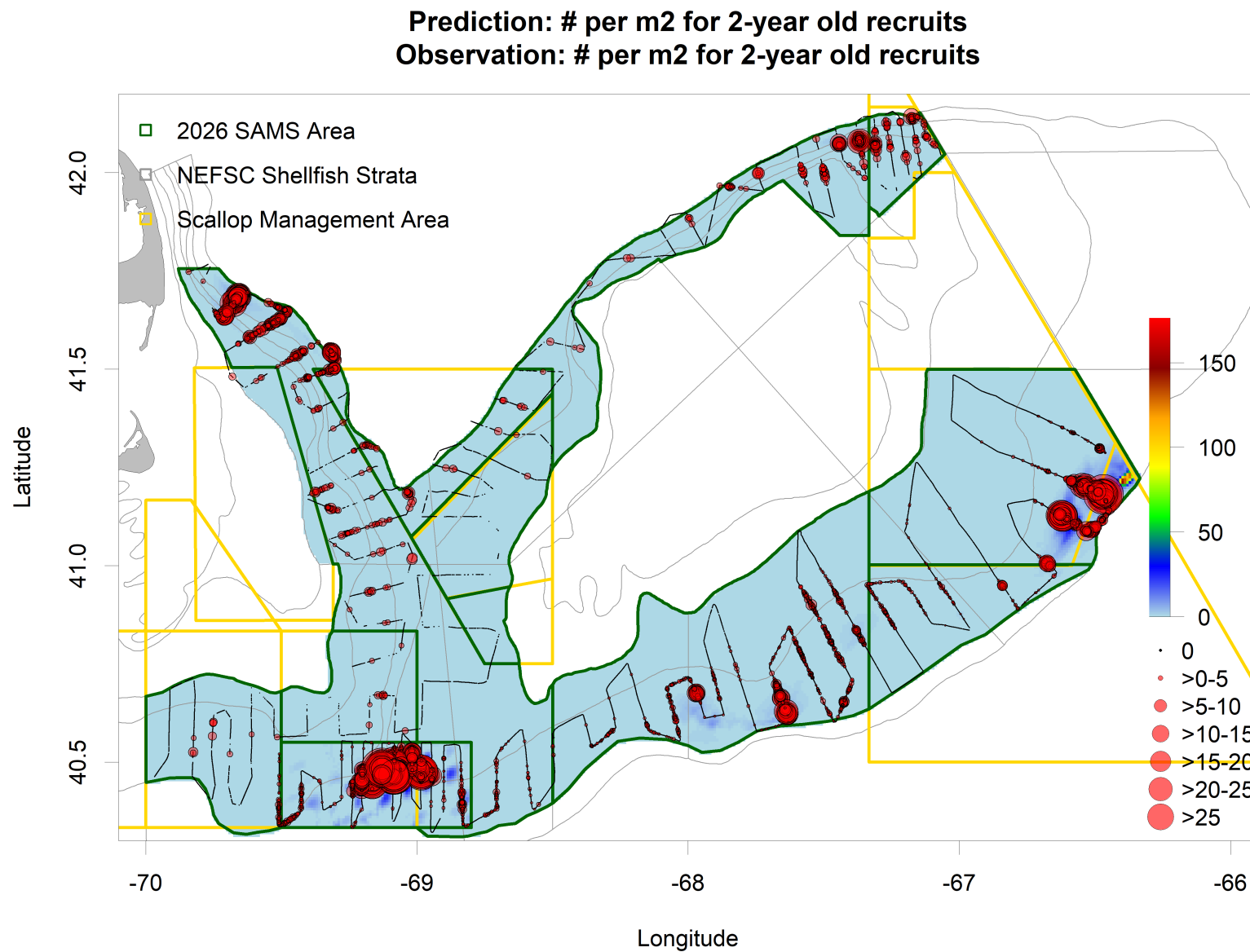


Figure 8.3. The number of 2-year old recruits observed on the 2026 NEFSC and CFF Habcam surveys, along with count estimates for the recruits for Georges Bank.

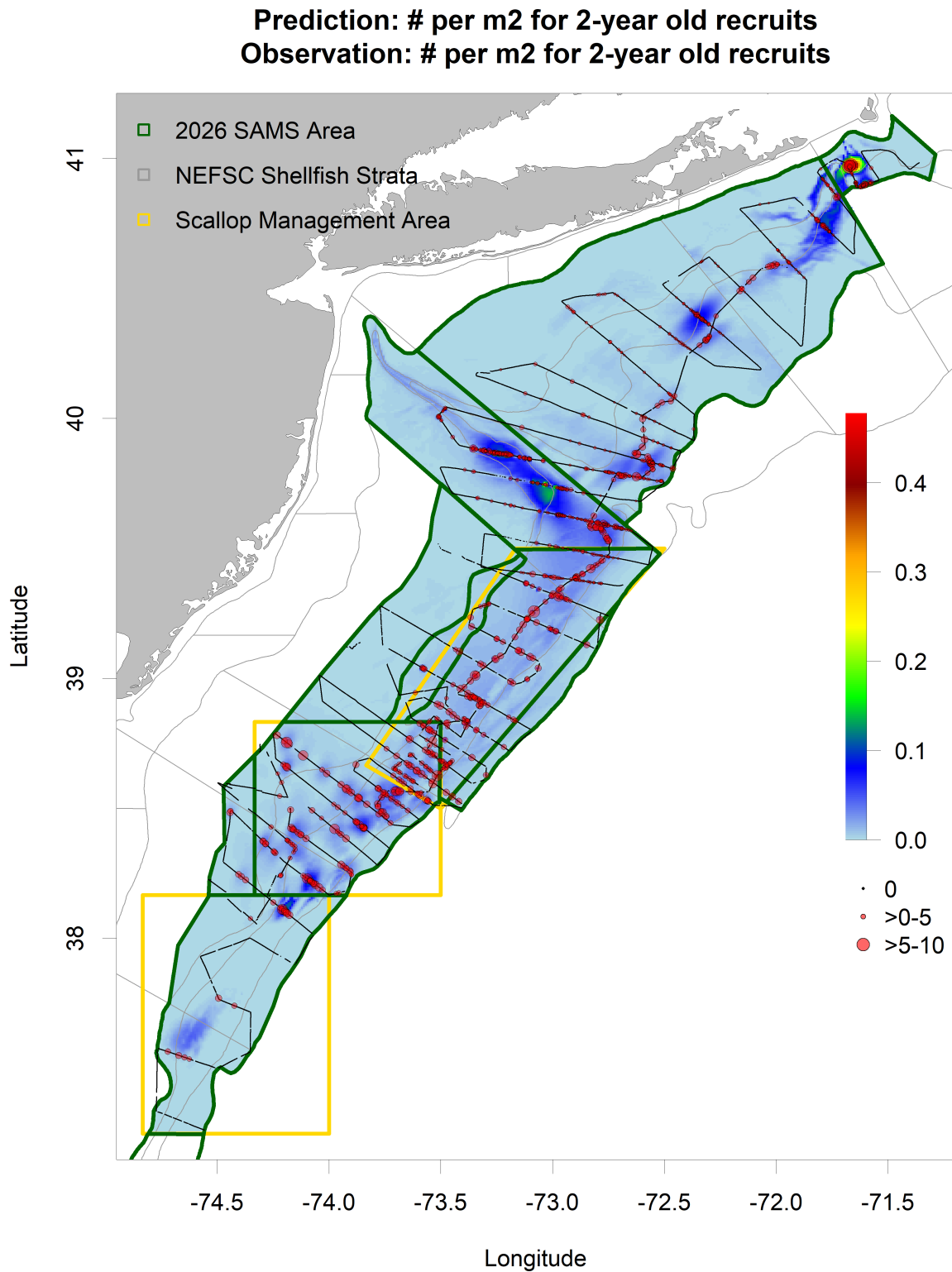


Figure 8.4. The number of 2-year old recruits observed on the 2026 NEFSC Habcam, NEFSC LRAUV, and CFF Habcam surveys, along with count estimates for the recruits for Mid-Atlantic.

8.3 2026 Habcam/LRAUV Survey Clapper Ratio

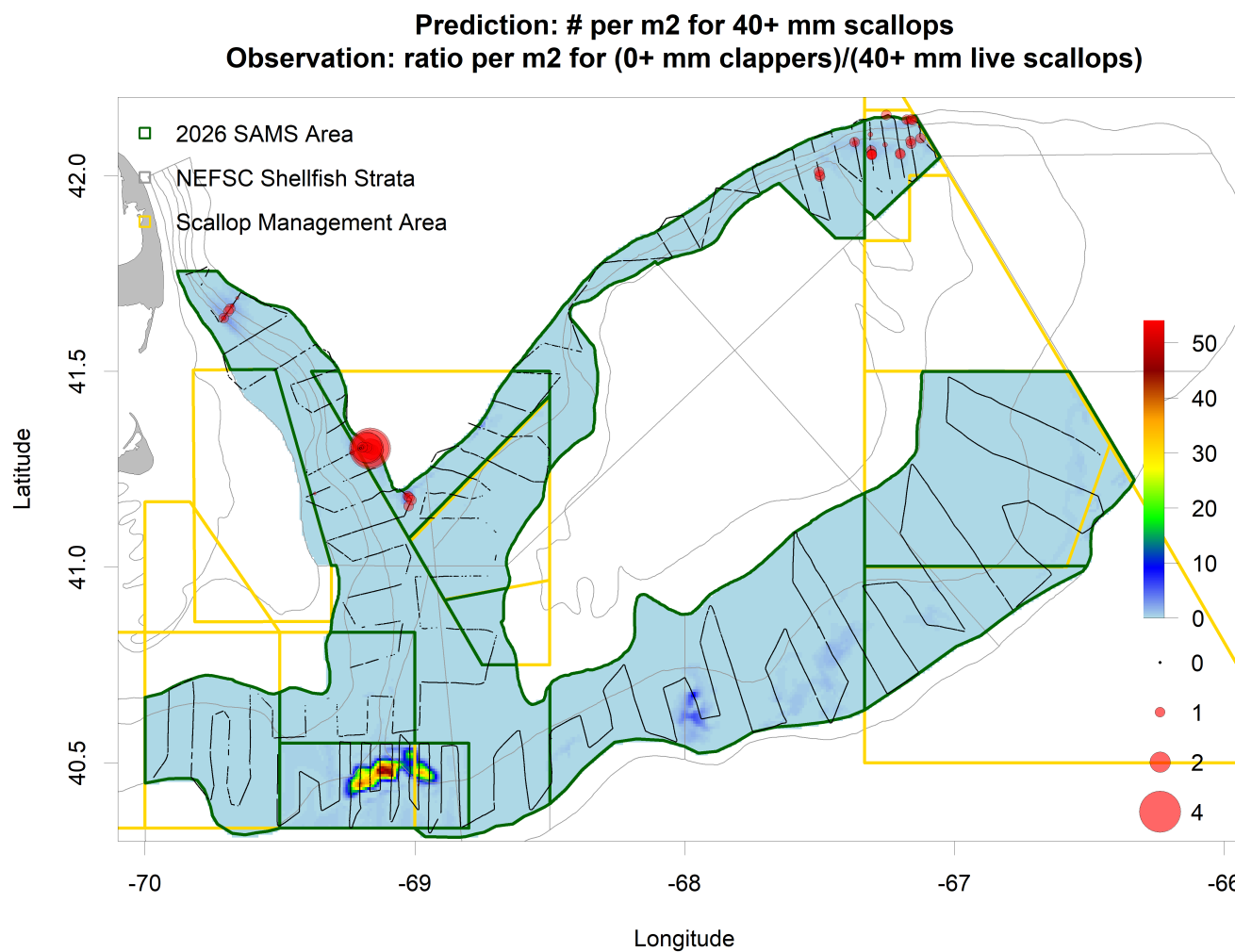


Figure 8.5. The ratio of clapper (0+ mm) versus live scallops (40+ mm) observed on the 2026 NEFSC and CFF Habcam surveys, along with count estimates for 40+ mm scallops for Georges Bank.

Prediction: # per m2 for 40+ mm scallops
Observation: ratio per m2 for (0+ mm clappers)/(40+ mm live scallops)

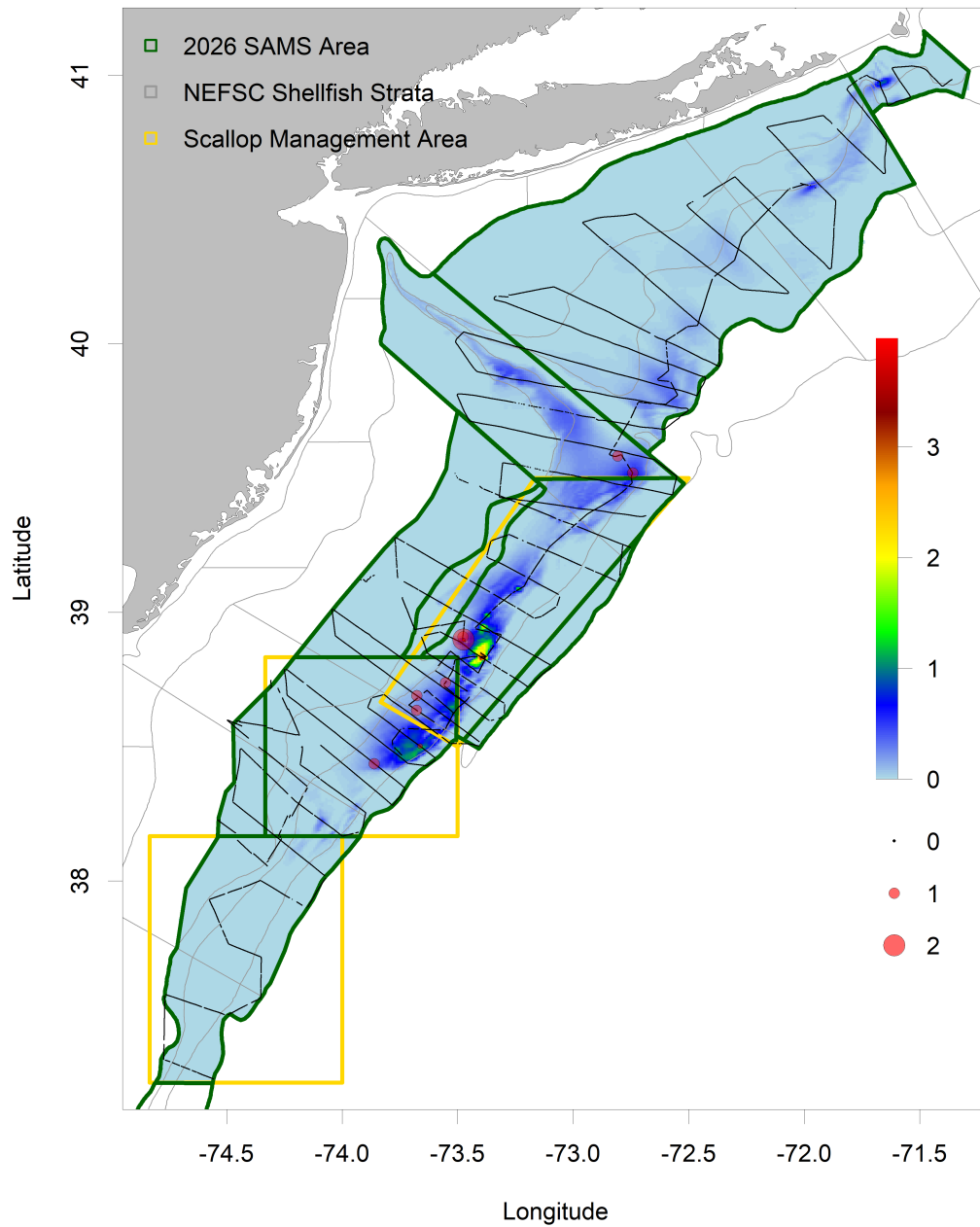


Figure 8.6. The ratio of clapper (0+ mm) versus live scallops (40+ mm) observed on the 2026 NEFSC and CFF Habcam surveys, along with count estimates for 40+ mm scallops for Mid-Atlantic.

8.4 2026 Habcam/LRAUV Survey Design-Based Estimates For 40+ mm Scallops

Table 8.2. Summary of 2026 Habcam/LRAUV design-based estimates (stratified mean by image) for scallops larger than 40 mm shell height using the combined NEFSC and CFF data. VIMS 2025 SH-MW equation was used to estimate meat weights for the scallops in NLS-South, whereas updated RT 2025 SH-MW equations were used for the rest of the SAMS areas MeanWt is estimated using BmsMT/NumMill.

SAMS Area	NumMill	BmsMT	BmsMTSE	MeanWt
Georges Bank				
CL1-Access	11	399	139	34.7
CL1-Sliver	242	3542	241	14.6
CL1-South	1	14	14	24.8
CL2-North	144	4490	243	31.2
CL2-Access	118	1013	84	8.6
CL2-Ext	108	1572	89	14.5
NLS-North	33	785	133	24
NLS-South	5170	39838	1183	7.7
NLS-West	9	157	45	18.1
GSC	577	5245	296	9.1
GSC-HMA	12	400	108	33.7
NF	145	2171	181	14.9
SF	735	8663	431	11.8
Mid-Atlantic				
BI	64	558	65	8.7
LI	470	8132	277	17.3
NYB	326	4560	221	14
MAB-Nearshore	1	1	1	1.6
HCS	907	15184	382	16.7
ET	661	11333	271	17.2
DMV	17	76	21	4.4