An Assessment of Sea Scallop Abundance and Distribution in the Mid-Atlantic Bight, Nantucket Lightship, Great South Channel, Closed Area I and Closed Area II

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Zoom Meeting

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Preliminary – PDT use only.

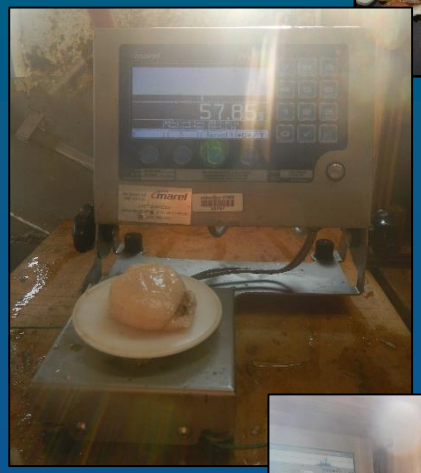
2020 VIMS-Industry Cooperative Surveys

Primary Objectives

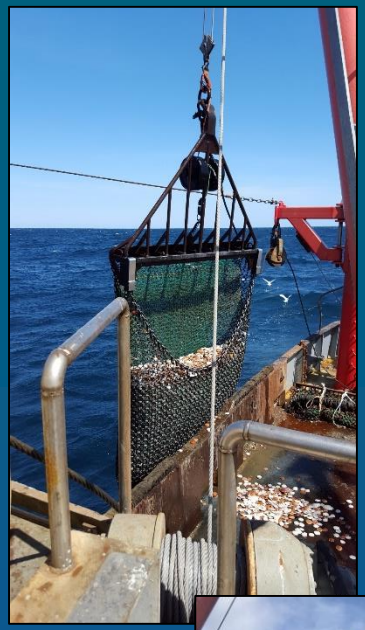
- Assess the abundance & distribution of scallops in survey domains by SAMS Areas
- Estimate total & exploitable biomass

Secondary Objectives

- Gear performance
  - Selectivity of commercial gear
- Scallop Biology & Product Quality
  - Assess marketability, growth, disease & SHMW
- Finfish Bycatch
- Scallop Predators



2020 VIMS-Industry Cooperative Surveys



- Sampling design
  - Stratified random design
    - NMFS shellfish strata
    - SAMS Areas included in survey domains
  - Station Allocation
    - Hybrid approach – stratum area & prior year catch data (biomass & number)
- Tow a survey dredge & commercial dredge simultaneously
  - Survey dredge – 8 ft in width, 2 in rings & 1.5 in diamond mesh liner
  - Rock Chains in strata 49-52 in GSC
  - Commercial dredge – varies by vessel and area
  - Survey dredge performance monitored

Biomass Estimation

- **Biomass calculated using swept area method (Cochran, 1997)**
- **Area swept per tow (a_s)**
  - **Navigational info**
  - **Tilt sensor**
- **Catch weight per tow (C_h)**
  - **Expanded length frequencies ≥ 40 mm**
  - **SHMW relationships from SARC 65 or determined by PDT**
  - **Selectivity (Roman and Rudders, 2019)**
- **Efficiency (E_s)**
  - **Values from Miller et al. (2018) for survey dredge:**
    - **.40 in soft bottom**
    - **.13 NLS South Deep**
    - **.27 in Strata 49-52 in GSC**
  - **Commercial Dredge = .65**

Stratified mean biomass per tow in stratum and SAMS Area

$$\bar{C}_{h,s} = \frac{1}{n_h}\sum_{i=1}^{h} C_{i,h,s}$$

$$Var(\bar{C}_{h,s}) = \frac{1}{n_h(n_h-1)}\sum_{i=1}^{n_h}\left(C_{i,h,s} - \bar{C}_{h,s}\right)^2$$

Stratified mean biomass per tow in SAMS Area

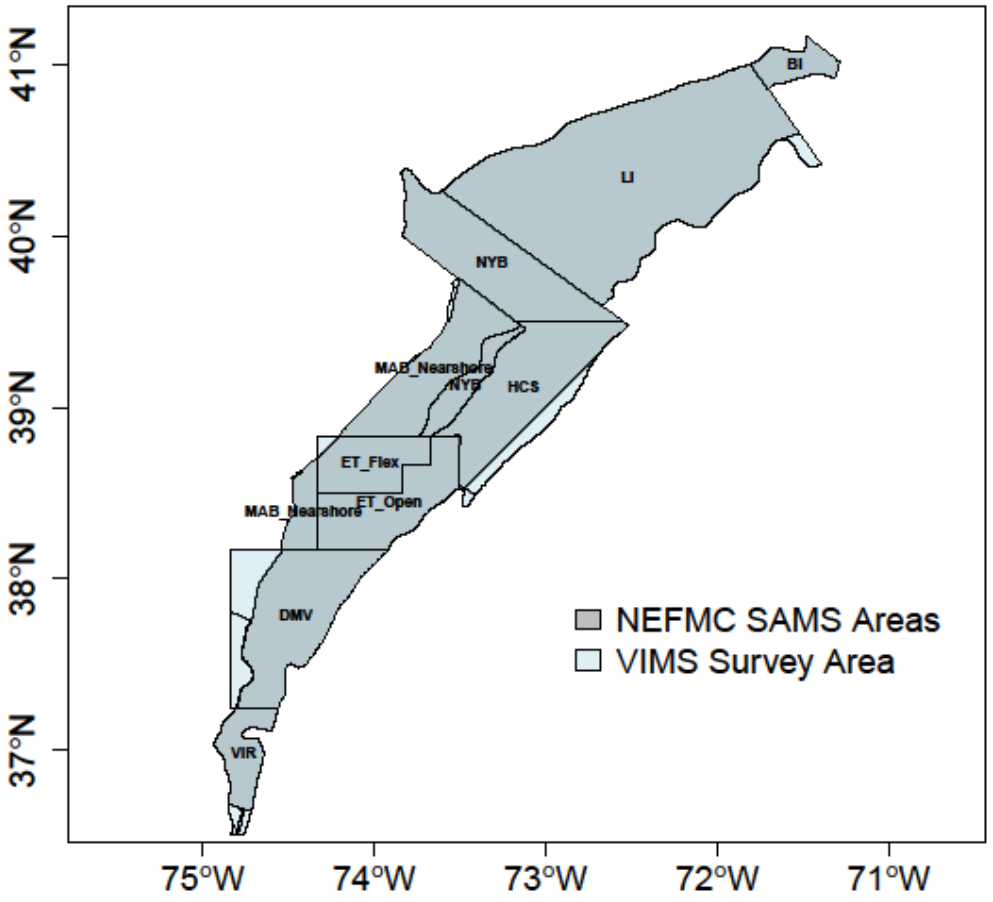
$$\bar{C}_s = \sum_{h=1}^{L} W_h \cdot \bar{C}_{h,s}$$

$$Var(\bar{C}_s) = \sum_{h=1}^{L} W_h^2 \cdot Var(\bar{C}_h)$$

Total biomass in SAMS Area

$$\widehat{B_s} = \left(\frac{\left(\frac{\bar{C}_s}{\bar{a}_s}\right)}{E_s}\right) A_s \qquad Var(\widehat{B_s}) = Var(\bar{C}_s) \cdot \left(\frac{A_s}{\bar{a}_s}\right)^2$$

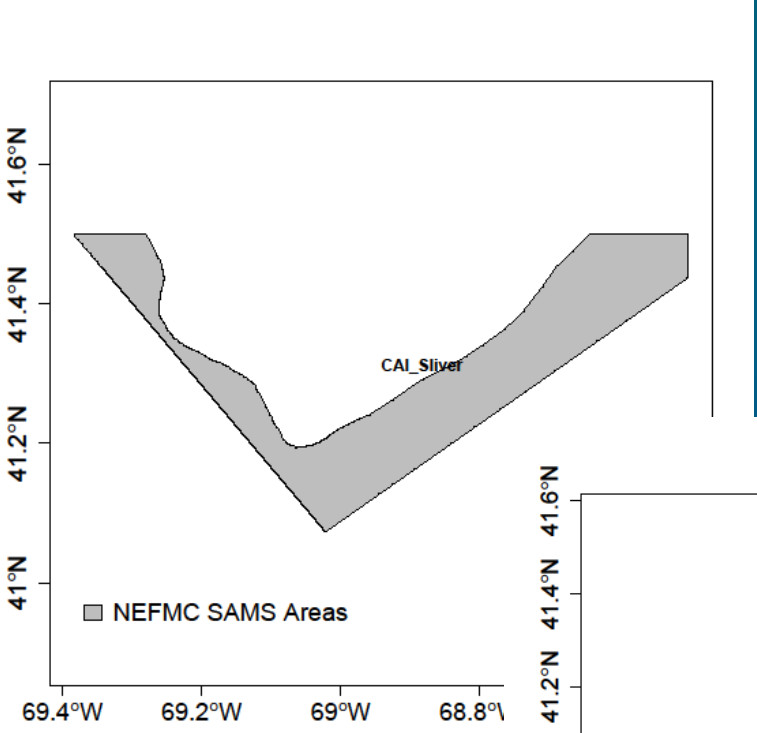
2020 SAMS Areas

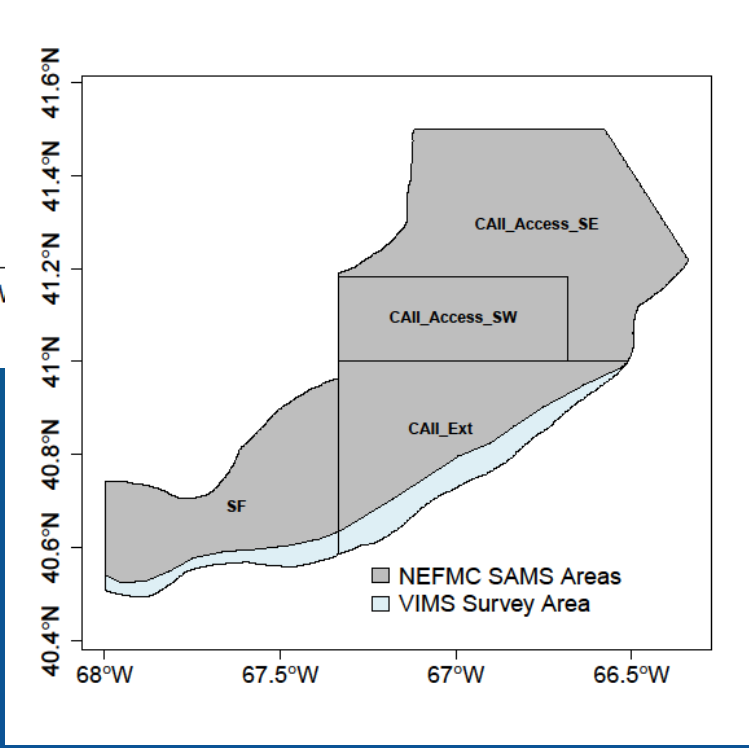


MAB Survey

- 9 SAMS Areas
- Survey outside of SAMS Areas
- Stations are included in the closest SAMS Area

2020 SAMS Areas





CAI & CAII Survey

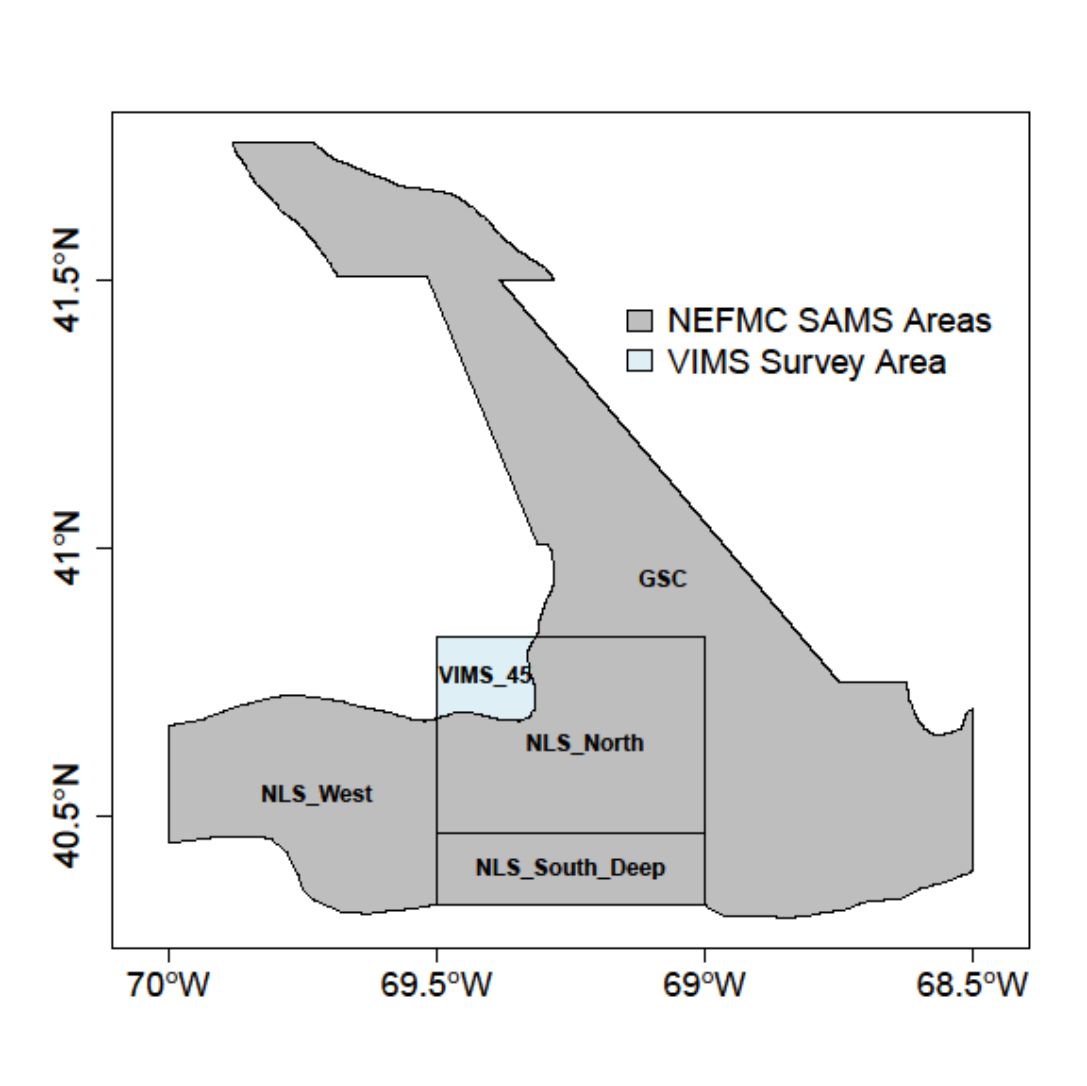
- CAI - 1 SAMS Areas
- CAII - 4 SAMS Areas

- CAII Access Area split into 2 SAMS Areas this year

- Survey outside of SAMS Areas

- Stations are included in the closest SAMS Area

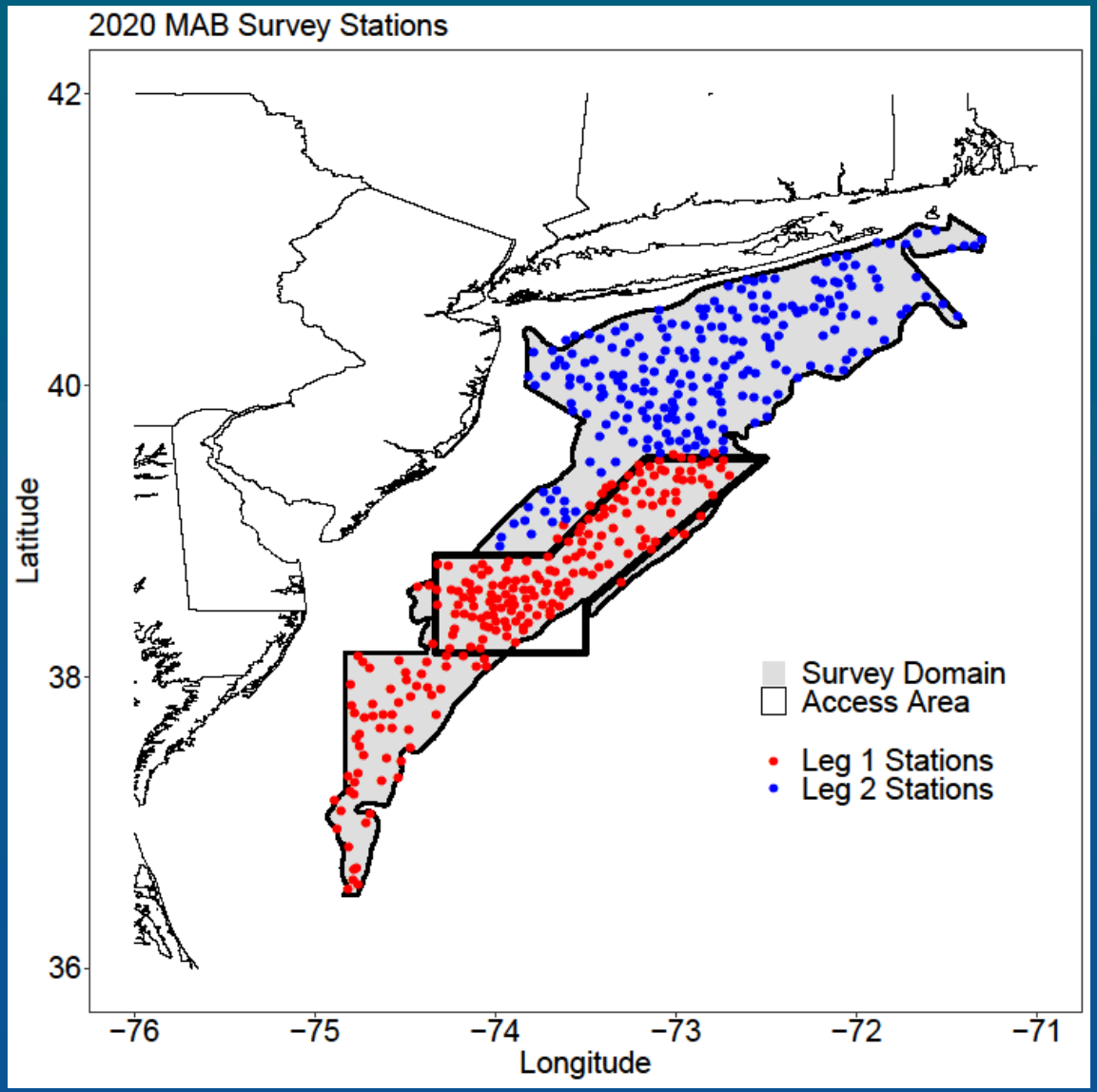
2020 SAMS Areas



NL & GSC Survey

- 4 SAMS Areas
- Survey outside of SAMS Areas
- Separate "SAMS Area" biomass estimated for VIMS_45

2020 MAB Survey



First Leg

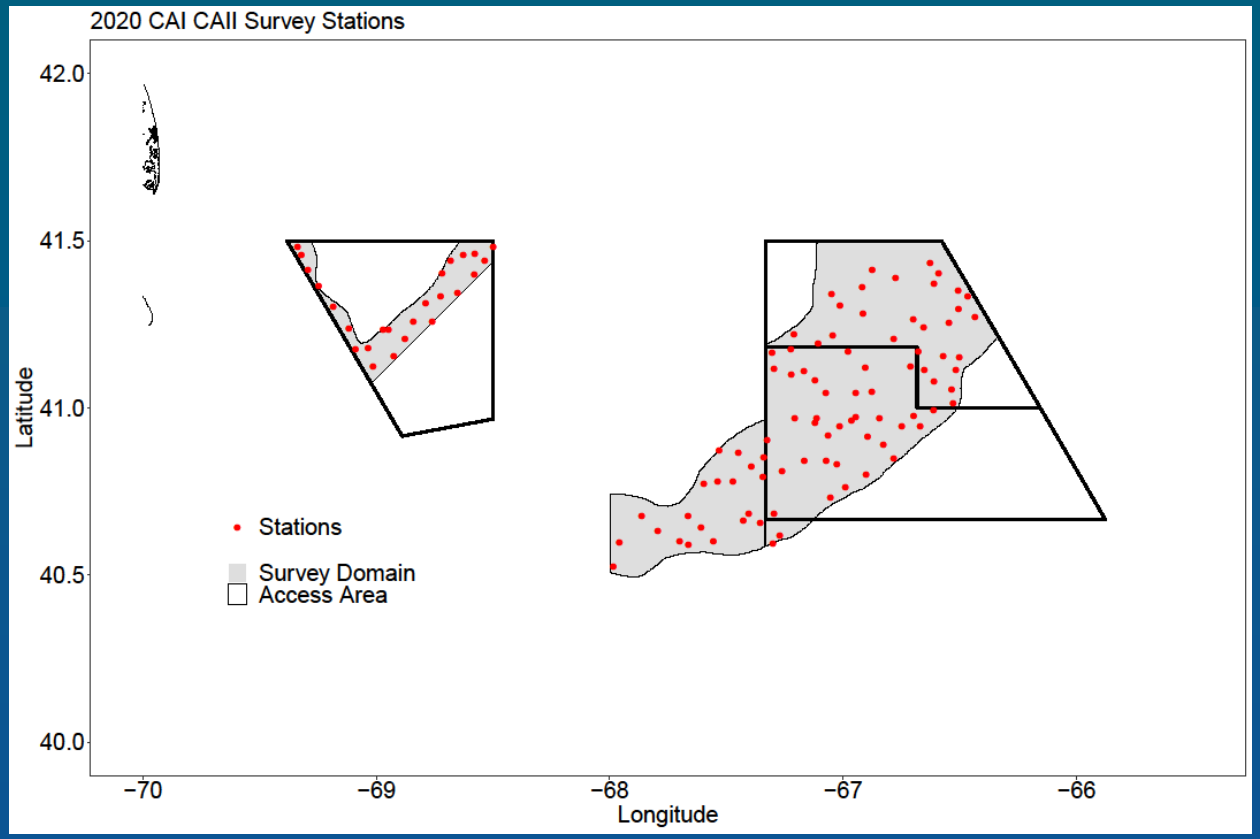
- **F/V Carolina Capes II**
  - **7/10 – 7/20/2020**

Second Leg

- **F/V Italian Princess**
  - **7/30 – 8/11/2020**

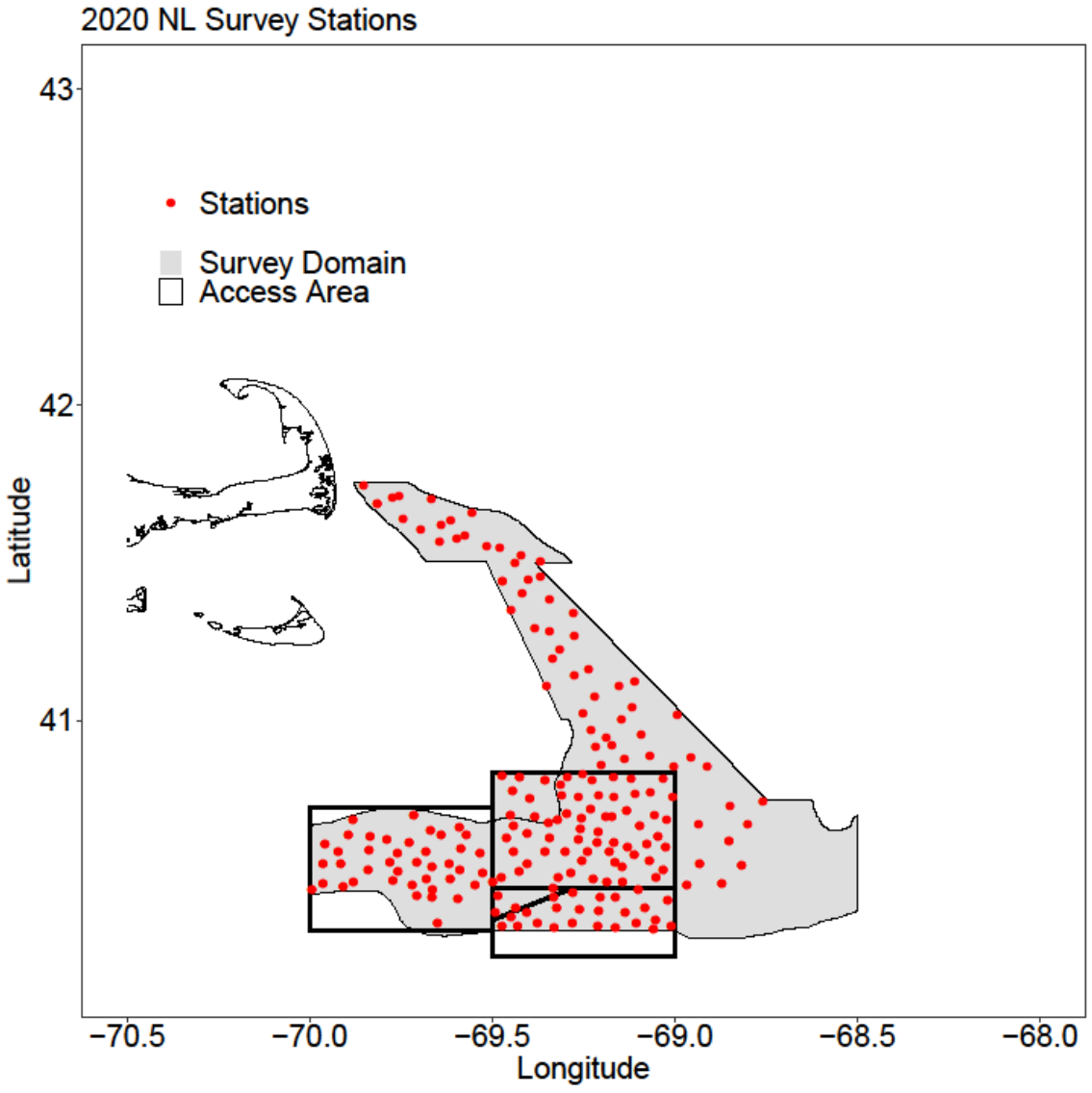
- **Completed 450 Stations**

2020 CAI & CAII Survey



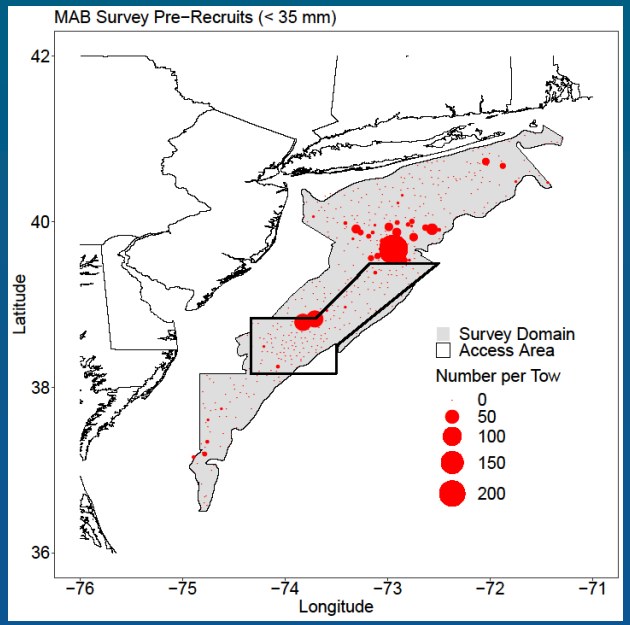
- F/V Pyxis
- 8/24 – 8/31/2020
- 125 Stations planned
- Completed 111 stations
- Dropped 14 stations in the northern portion of the CAII Access SE SAMS Area due to lobster gear

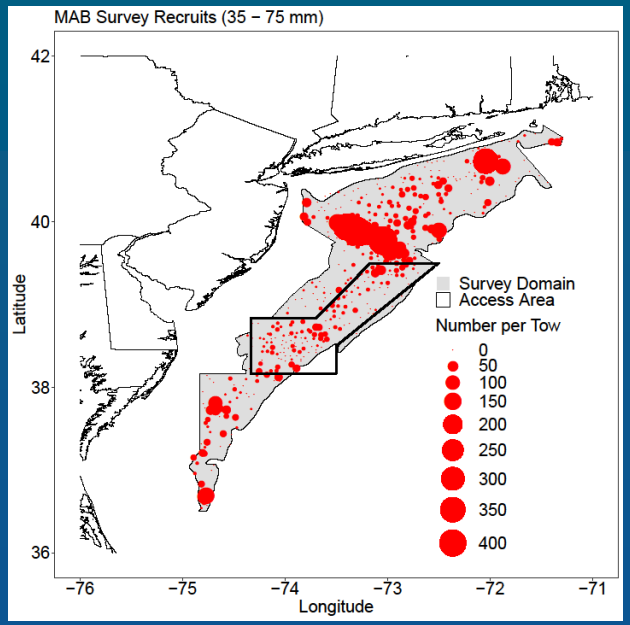
2020 NL & GSC Survey

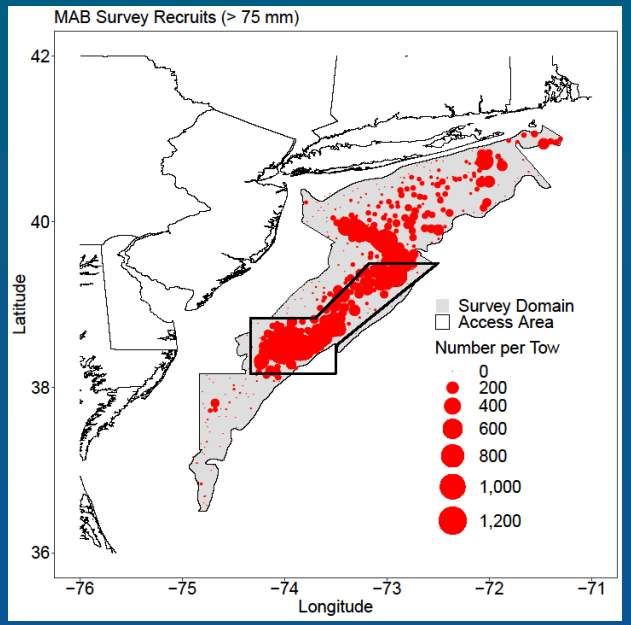


- F/V Celtic
- 9/1 – 9/8/2020
- Completed 195 stations with the survey dredge
- 119 stations completed with commercial dredge – excludes majority of GSC & northern portion of the North SAMS Area

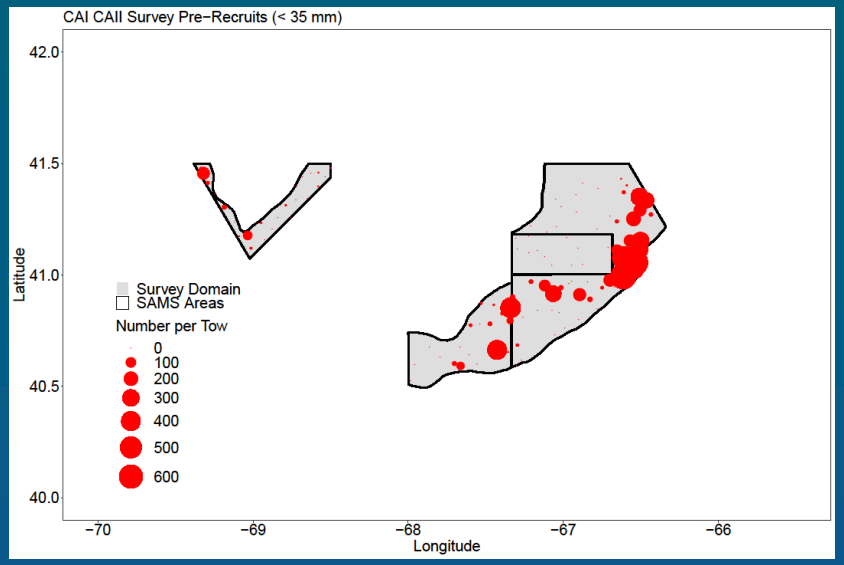
2020 MAB Survey
Scallop Distribution – Number per Tow

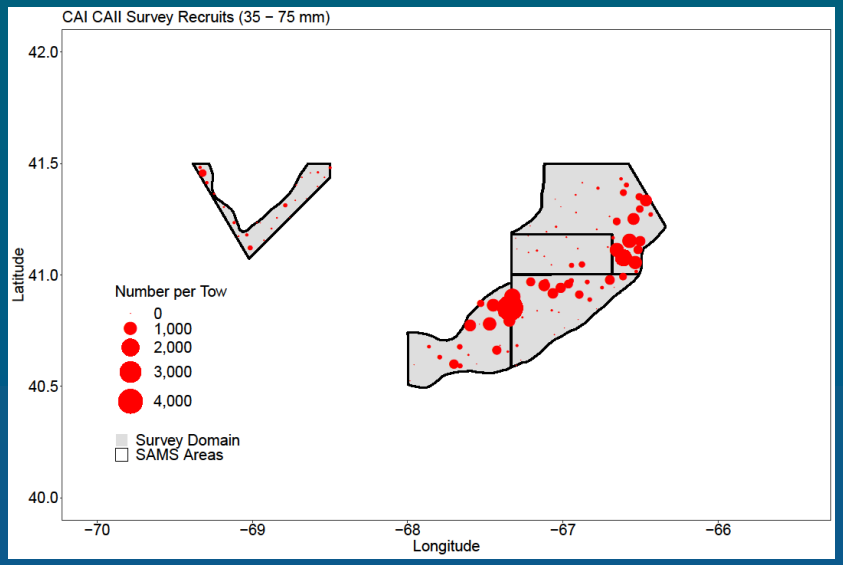


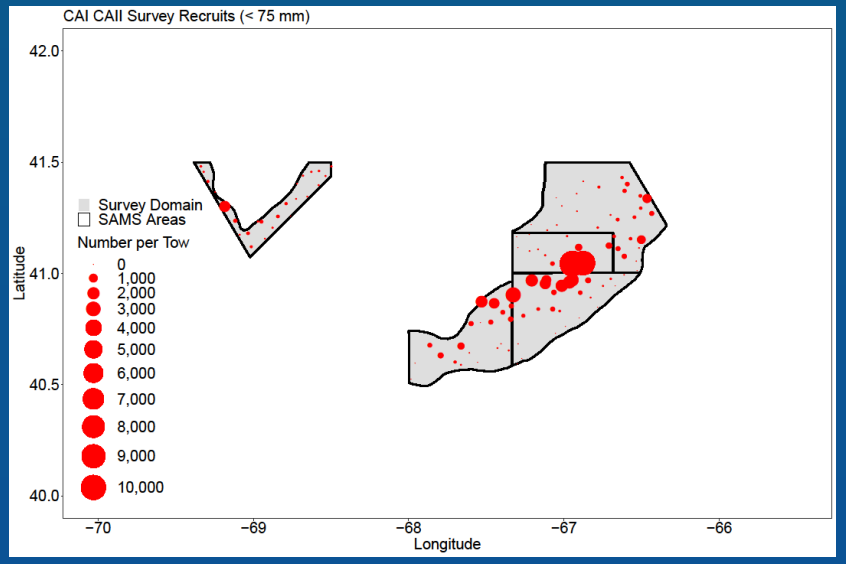




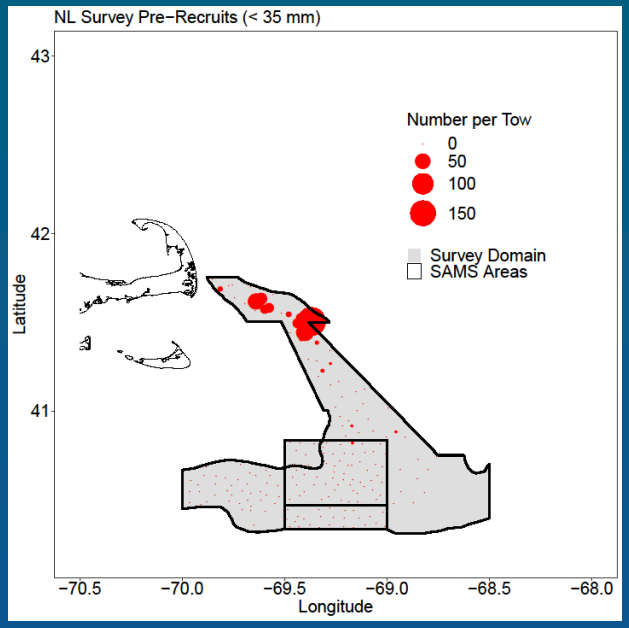
2020 CA I & CAII Survey
Scallop Distribution – Number per Tow

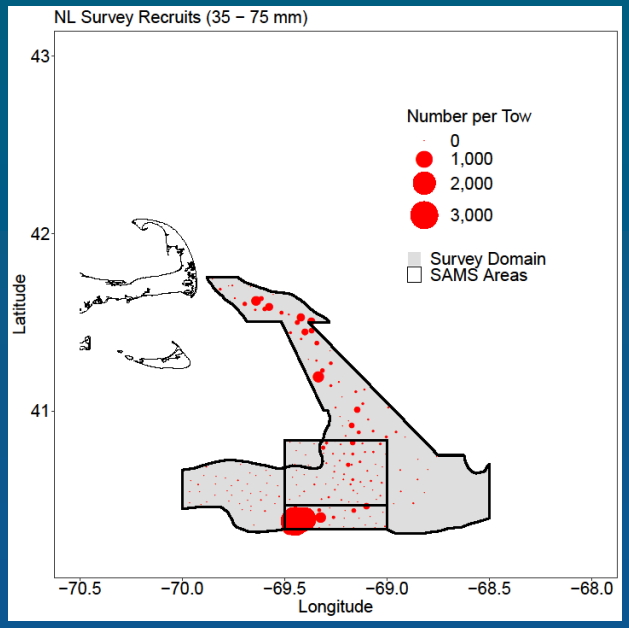


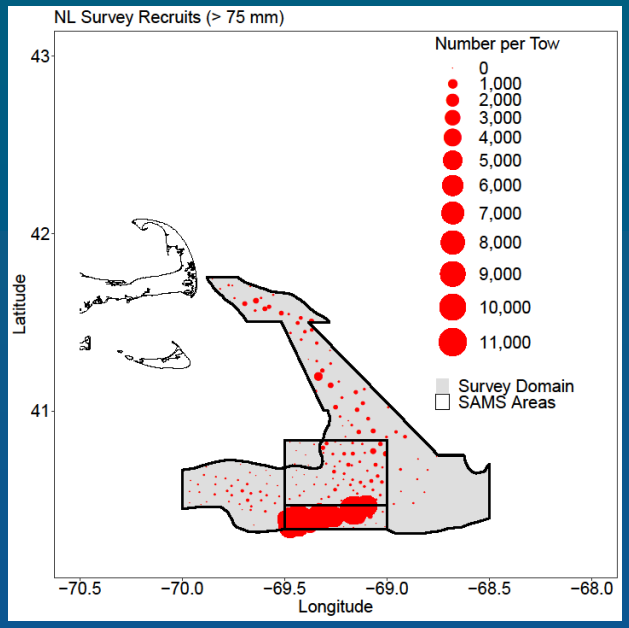




2020 NL & GSC Survey
Scallop Distribution – Number per Tow





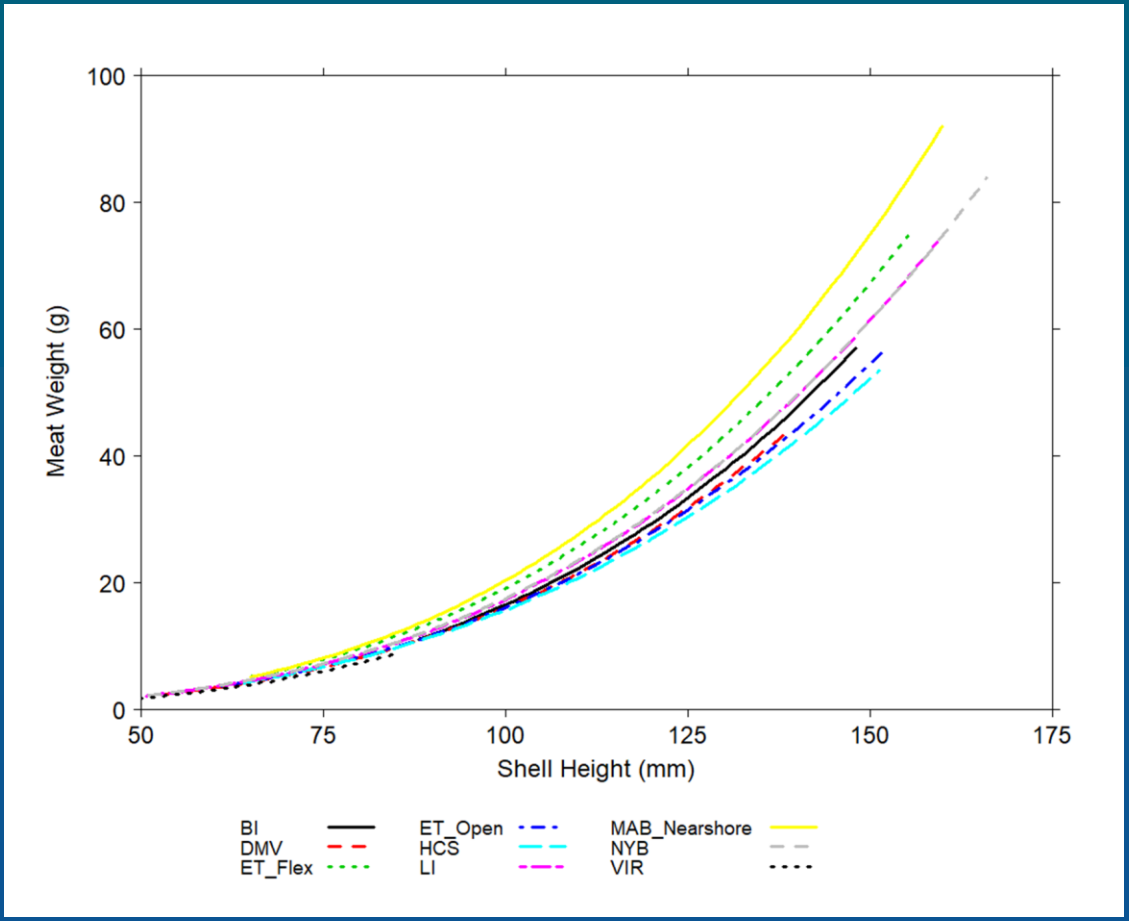


Number per tow shown calculated with reduced q = .13 for South Deep SAMS Area

SHMW Relationship

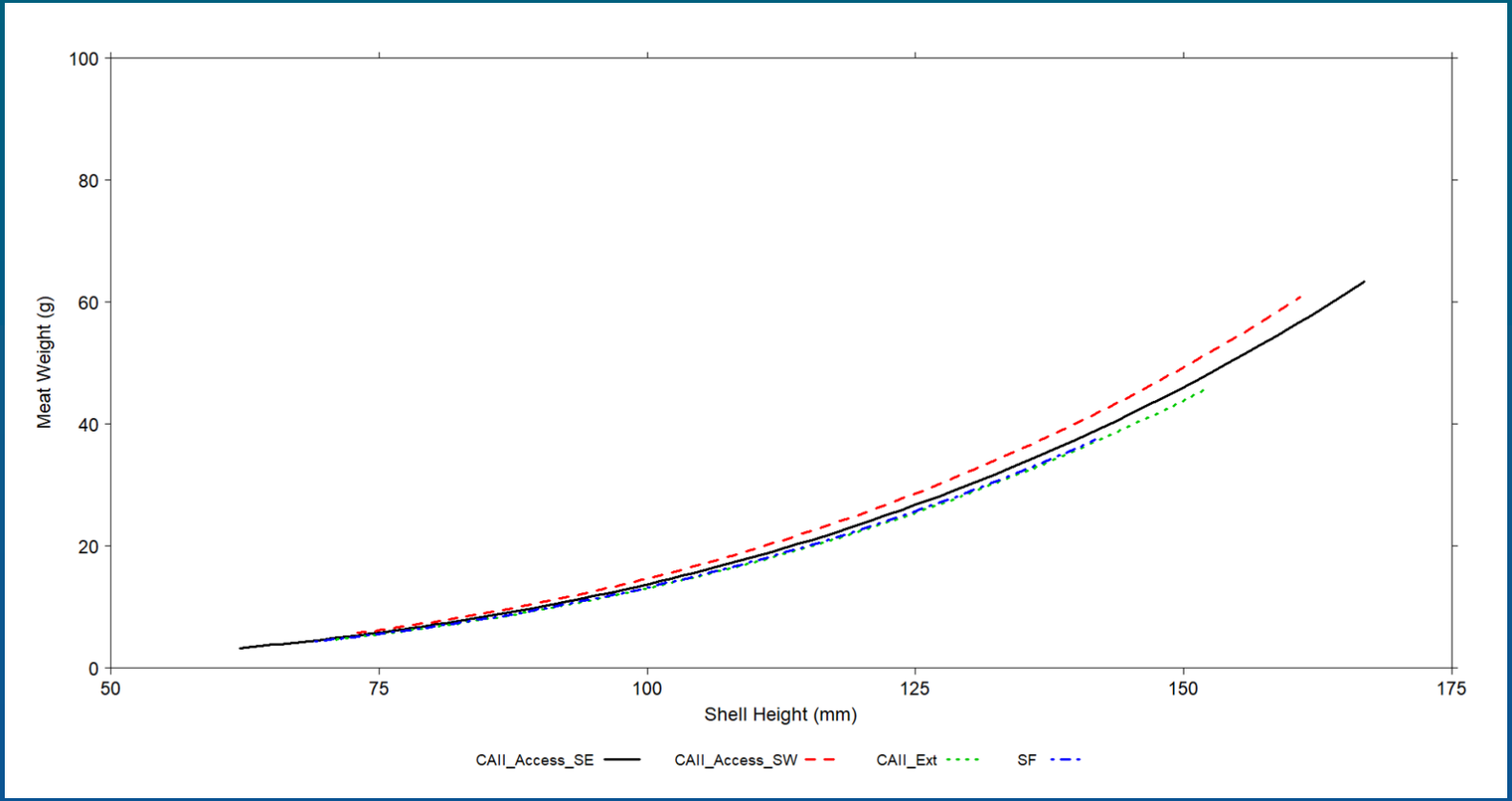
- SHMW samples (meat & gonad weight) were taken from all stations that had scallops (15/station):
  - MAB Survey: 4,761 (377 stations)
  - CA I II Survey: 1,352 (104 stations)
  - NL Survey: 2,302 (180 stations)
- The objective is to construct a model to predict meat weight based on a suite of potential covariates (i.e. shell height, depth, SAMS Area, sex, disease…)
- Maturity stage considered this year to account for trip delays
- A GLMM was used to fit model (Gamma distribution, log link, random effect at the station level) with R v 3.3.1 Package lme4

2020 MAB Survey
SHMW Results



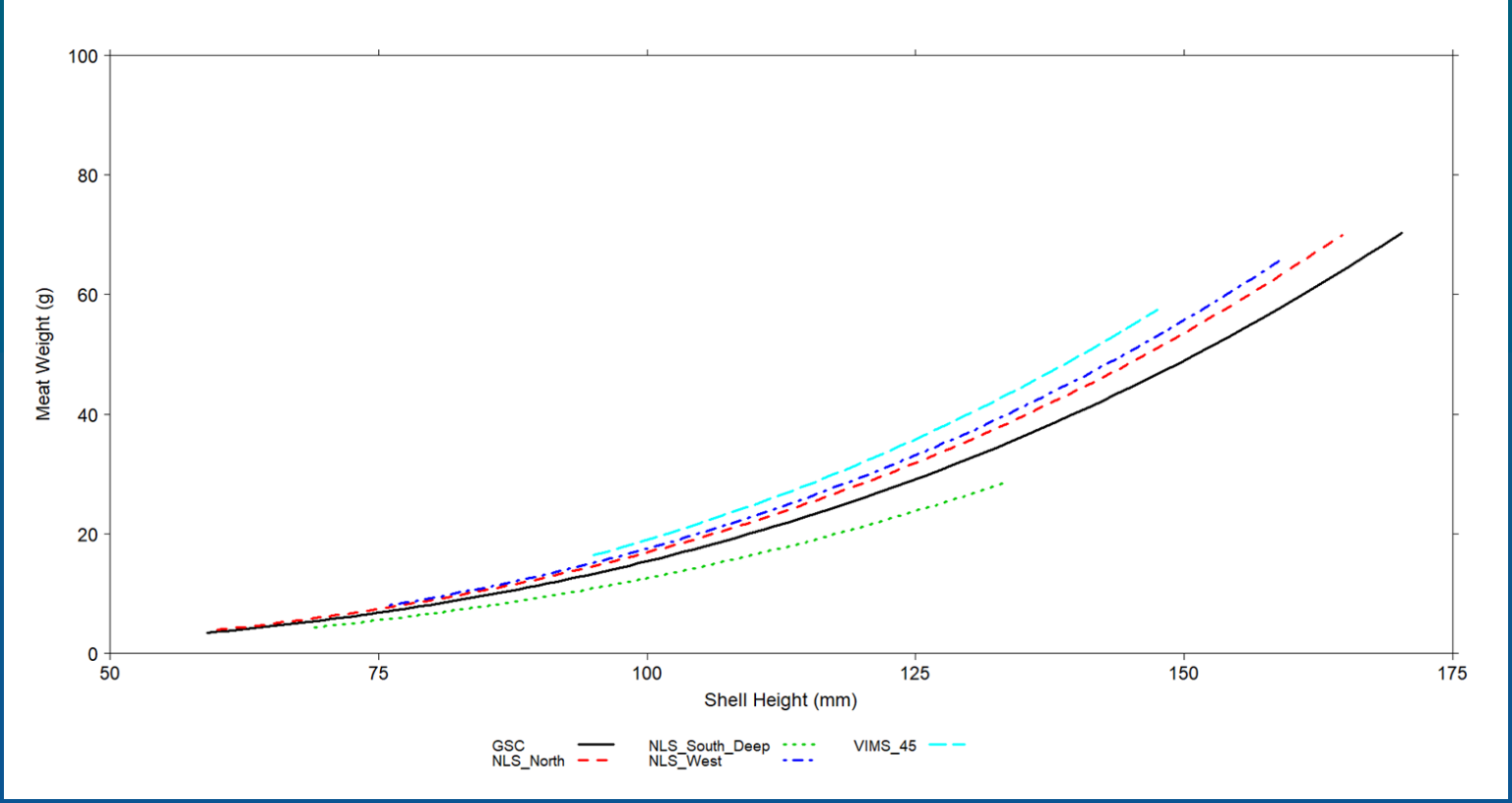
- Majority of SAMS Areas have similar SHMW relationship
- HCS has the smallest meat weight at a given shell height

2020 CAII Survey
SHMW Results



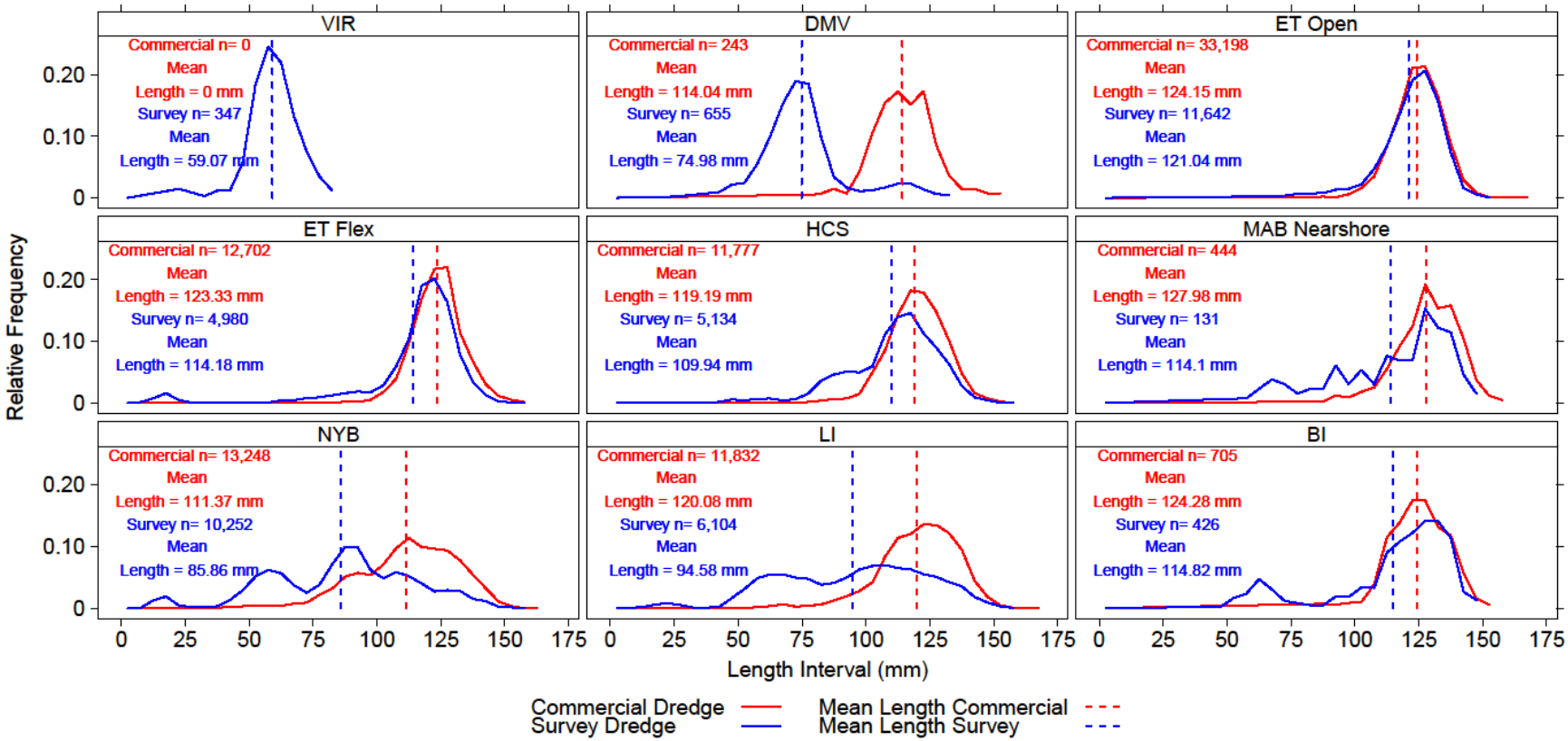
- **Extension and SF SHMW curves are lower than the Access Area SAMS Areas**

2020 NL & GSC Survey
SHMW Results

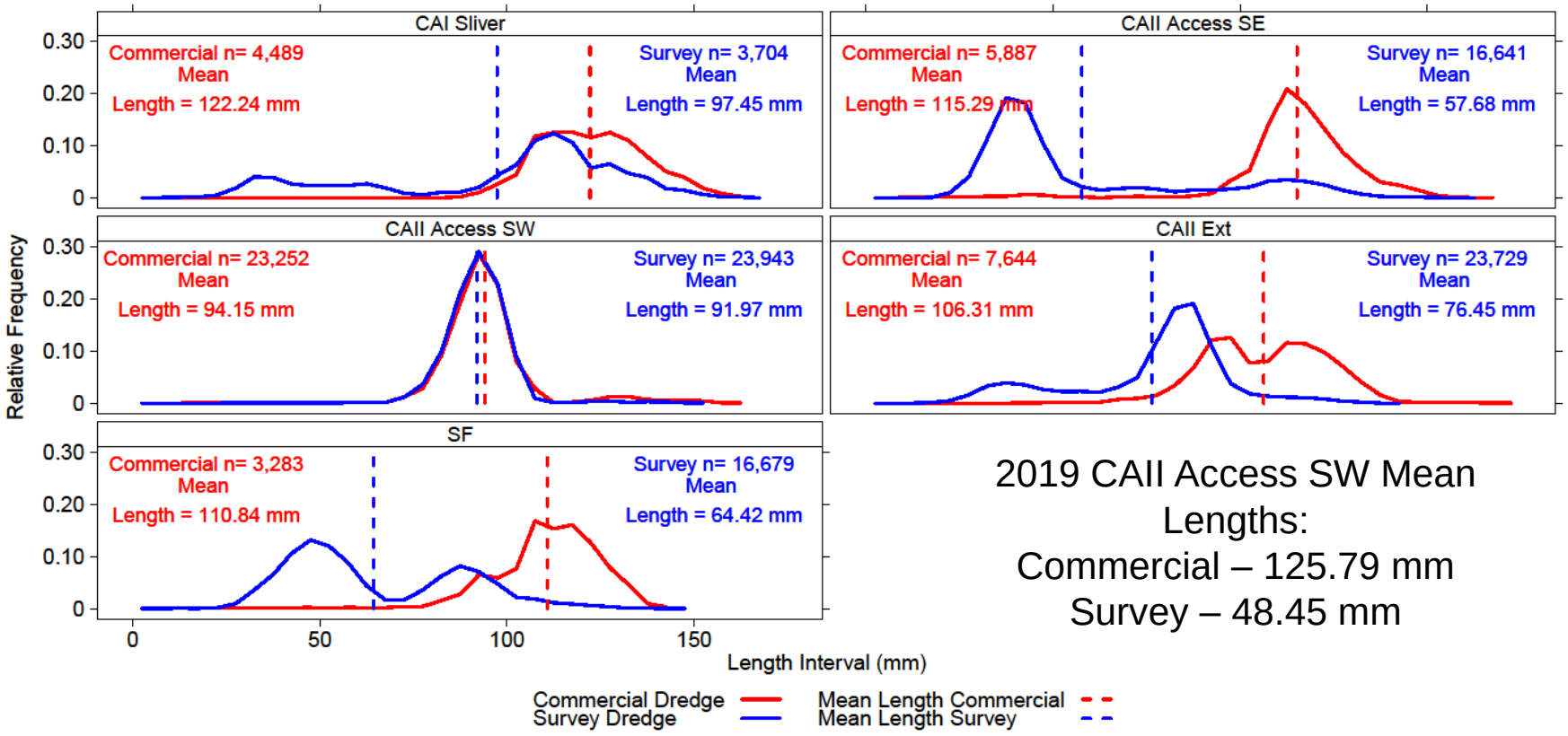


- Similar trend to previous years - South Deep SAMS Area has the lowest meat weight at shell height
- South Deep SAMS Area only area significantly different than reference area: NLS-North

2020 MAB Survey
Length Frequency- SAMS Areas

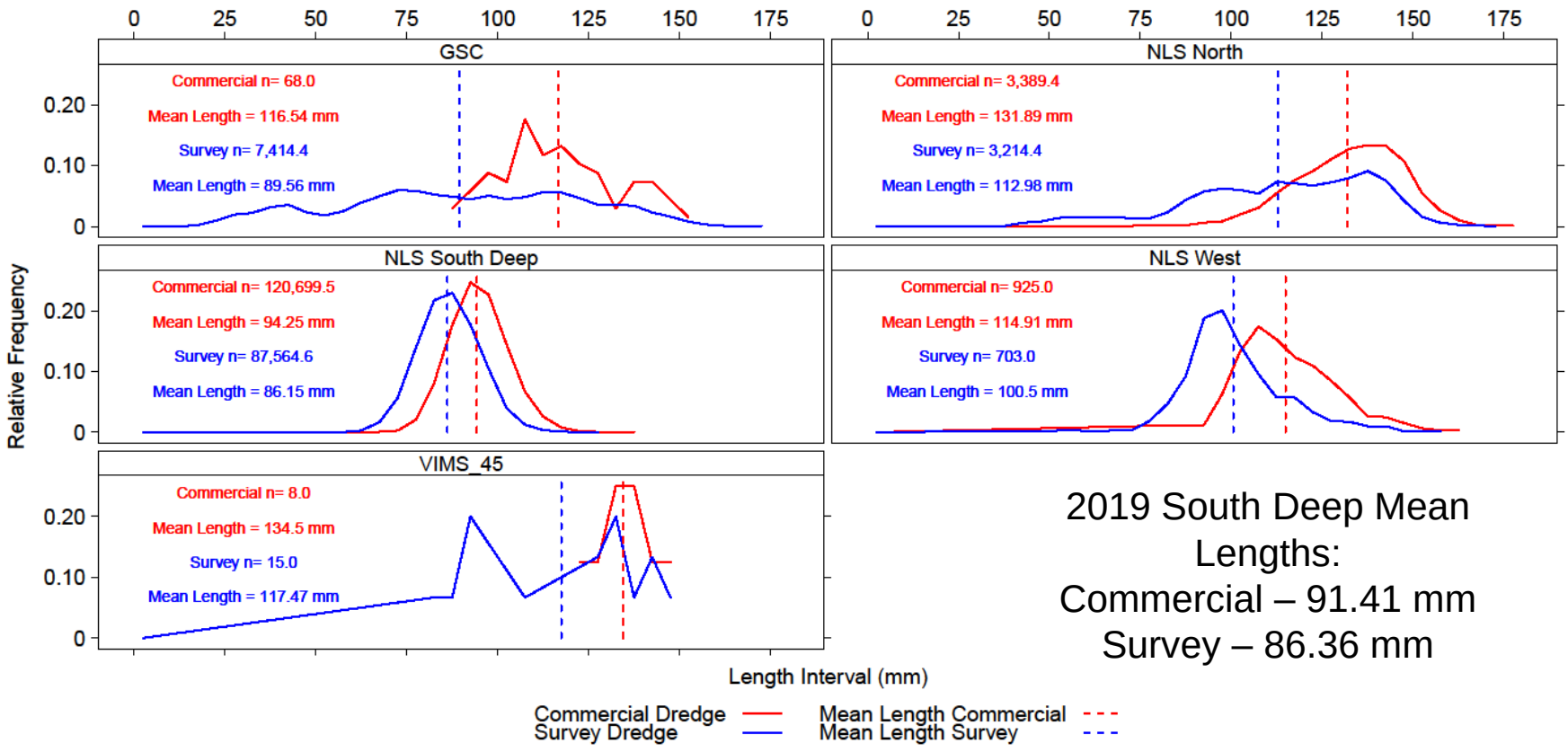


2020 CA I & CAII Survey
Length Frequency- SAMS Areas



2019 CAII Access SW Mean Lengths:
Commercial – 125.79 mm
Survey – 48.45 mm

2020 NL & GSC Survey
Length Frequency- SAMS Areas



2019 South Deep Mean Lengths:
Commercial – 91.41 mm
Survey – 86.36 mm

2020 VIMS-Industry Cooperative Surveys

Total Biomass Survey Gear – SAMS Areas

SAMS Area	Total Biomass (mt)	SE Biomass (mt)	CV Biomass (mt)	Density (scal/m^2)	Avg MW (g)	Total Number
BI	809.49	117.83	36.39	0.03	31.29	25,306,074
LI	6,151.03	337.95	13.74	0.02	20.32	294,927,146
HCS	4,095.27	232.76	14.21	0.06	23.33	174,733,150
NYB	4,006.92	229.92	14.35	0.07	16.04	256,377,426
MAB Nearshore	308.64	45.5	36.85	0.003	30.47	10,113,304
ET Flex	3,207.99	282.54	22.02	0.08	28.34	113,945,394
ET Open	7,811.18	369.51	11.83	0.12	29.63	265,744,949
DMV	351.48	60.5	43.03	0.01	9.52	36,976,499
VIR	70.87	11.1	39.16	0.01	4.71	16,057,046
GSC	6,055.78	850.7	14.05	0.09	24.55	241,832,123
NLS North	1,713.41	213.32	12.45	0.03	38.26	44,479,831
NLS South Deep*	36,046.60	7,704.96	21.37	1.79	10.02	3,613,124,841
NLS West	277.64	45.6	16.42	0.01	24.55	11,403,282
VIMS 45	12.59	5.76	45.75	0.001	46.37	270,343
CAI Sliver	1,489.72	270.51	45.4	0.07	24.67	60,239,016
CAII Access SE	5,185.14	528.15	25.46	0.2	13.66	370,563,308
CAII Access SW	21,356.75	4,722.28	55.28	1.03	19.72	1,079,041,330
CAII Ext	12,924.04	1,524.47	29.49	0.49	14.34	913,839,789
SF	6,747.69	819.44	30.36	0.42	8.81	765,698,558

- **NLS South Deep* estimates are with reduced q=.13**
- **SARC SHMW**

2020 VIMS-Industry Cooperative Surveys

Exploitable Biomass Commercial Gear - SAMS Areas

- GSC* & NLS North* estimates are from the survey dredge
- NLS South Deep has selectivity profile applied
- SARC SHMW

SAMS Area	Exp Biomass (mt)	SE Biomass (mt)	CV Biomass (mt)	Density (scal/m^2)	Avg MW (g)	Exp Number
BI	498.17	90.89	28.07	0.02	36.68	13,631,037
LI	6,081.67	426.12	10.78	0.01	34.4	176,077,048
NYB	2,566.31	175.51	10.52	0.02	29.76	85,181,778
MAB Nearshore	430.34	118.24	42.27	0	39.43	10,912,934
HCS	3,601.18	383.61	16.39	0.04	28.68	124,068,373
ET Flex	3,080.81	371.52	18.55	0.06	32.37	92,208,708
ET Open	7,443.41	621.97	12.86	0.11	31.74	233,926,657
DMV	88.53	46.08	80.07	0	26.34	3,360,604
VIR	0	0	0	0	0	0
GSC*	4,474.16	519.91	11.62	0.09	36.39	123,007,928
NLS North*	1,452.92	186.06	12.81	0.029	45.44	31,788,408
NLS South Deep	4,070.21	943.57	23.18	0.41	14.33	279,501,324
NLS West	167.37	25.82	15.43	0	37.9	4,379,582
VIMS 45	12.82	5.17	40.29	0	65.23	196,543
CAI Sliver	579.93	65.99	17.51	0.02	35.85	16,137,354
CAII Access SE	1,342.36	267.34	30.64	0.02	33.72	38,746,562
CAII Access SW	2,941.00	1,052.32	55.05	0.12	24.01	121,665,083
CAII Ext	1,468.64	261.52	27.4	0.02	30.86	47,537,237
SF	801.84	111.05	21.31	0.01	29.57	27,113,845

SARC 65 Total Biomass Estimates Compared to VIMS 2016-2020 Estimates NL & reduced q for South Deep

SAMS Area	Total Biomass (mt) SARC 65 q=.40	Total Biomass (mt) VIMS 2016-2020 q=.40	Total Biomass (mt) SARC 65 q=.13	Total Biomass (mt) VIMS 2016-2020 q=.13
NLS North	1,713.41	1,725.24		
NLS South Deep	11,715.14	12,547.05	36,046.60	38,606.31
NLS West	277.64	254.55		
VIMS 45	12.59	12.56		

Acknowledgements

- The owners, captains and crews:
  - *F/V Carolina Capes II*
  - *F/V Italian Princess*
  - *F/V Pyxis*
  - *F/V Celtic*
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