

# Sea Scallop Assessment on Stellwagen Bank 2021

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Scallop PDT Survey Data Call #1  
September 1, 2021



# ME DMR/UMaine GOM Dredge Survey 2021

## Survey Design

- Random stratified dredge survey
- 178 tows
- Target tow: 5 minutes at 3.5 kts
- June-July

## Vessel

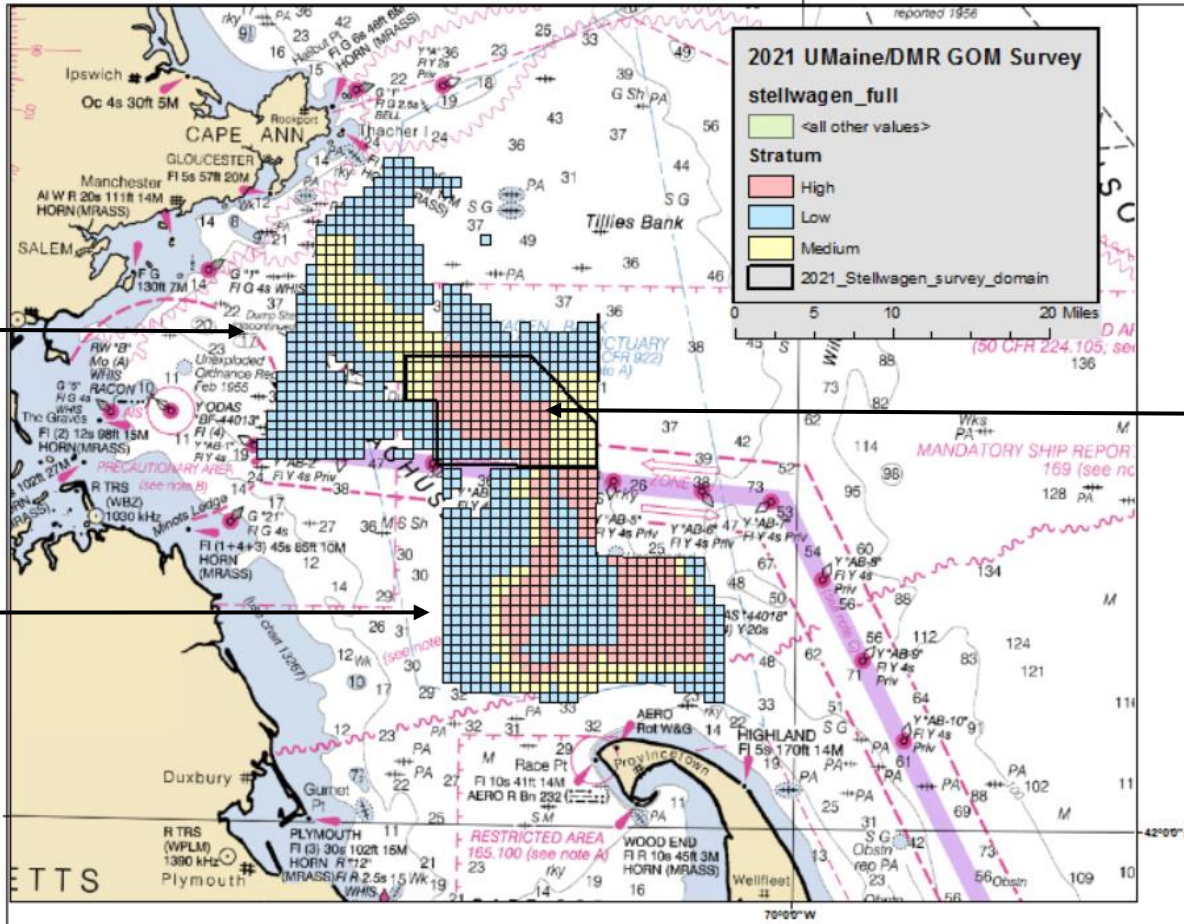
- F/V Nicole Leigh

## Gear

- 7ft unlined drag
- 2" ring, 5" twine top
- Rock chains



# Survey Area 2021

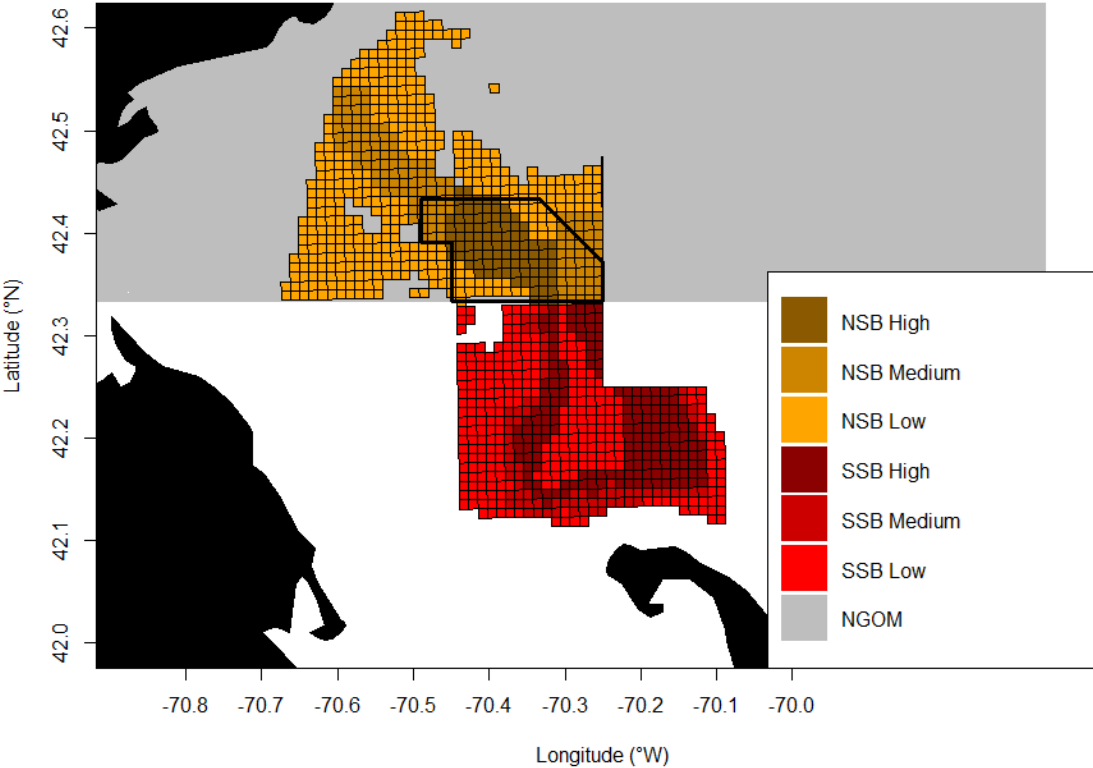


Northern  
Stellwagen  
Bank  
(NSB)

Southern  
Stellwagen  
Bank  
(SSB)

Northern  
Stellwagen  
Bank Area  
of Interest  
(AOI)

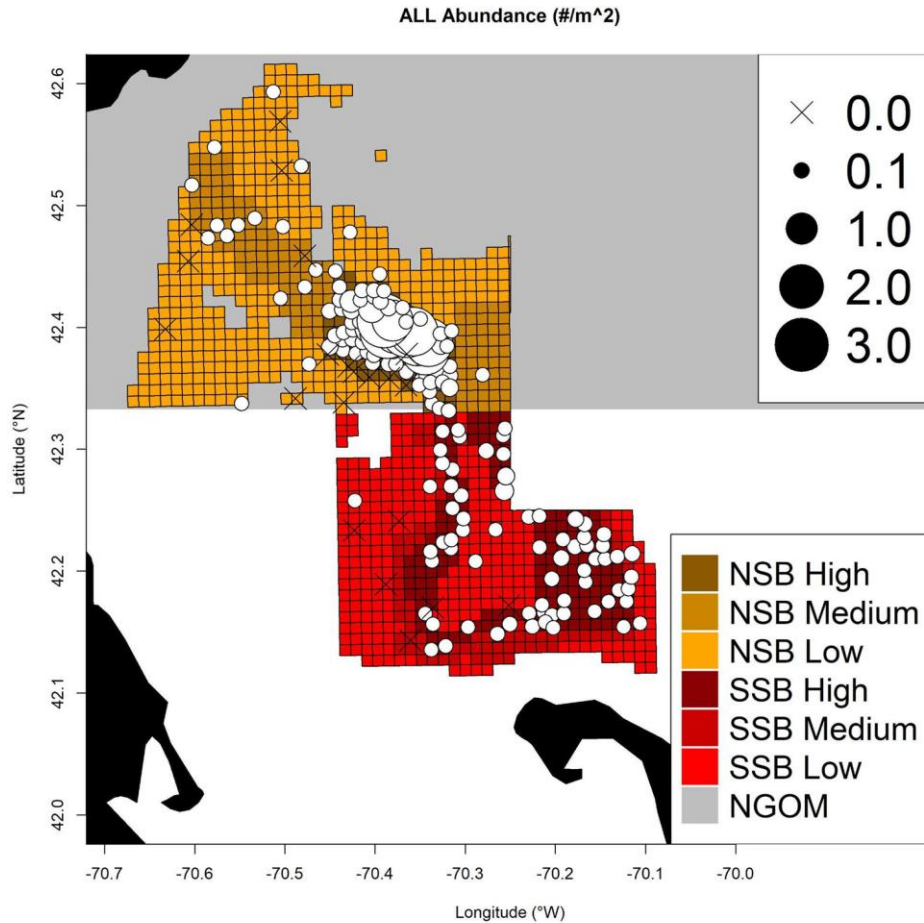
# Substrata Area Delineation



Area	Density	# of Cells (1 km <sup>2</sup> )	# stations sampled
NSB	High	93	74
	Medium	145	11
	Low	387	18
AOI	High	89	71
	Medium	52	2
	Low	34	3
SSB	High	175	59
	Medium	71	4
	Low	276	12

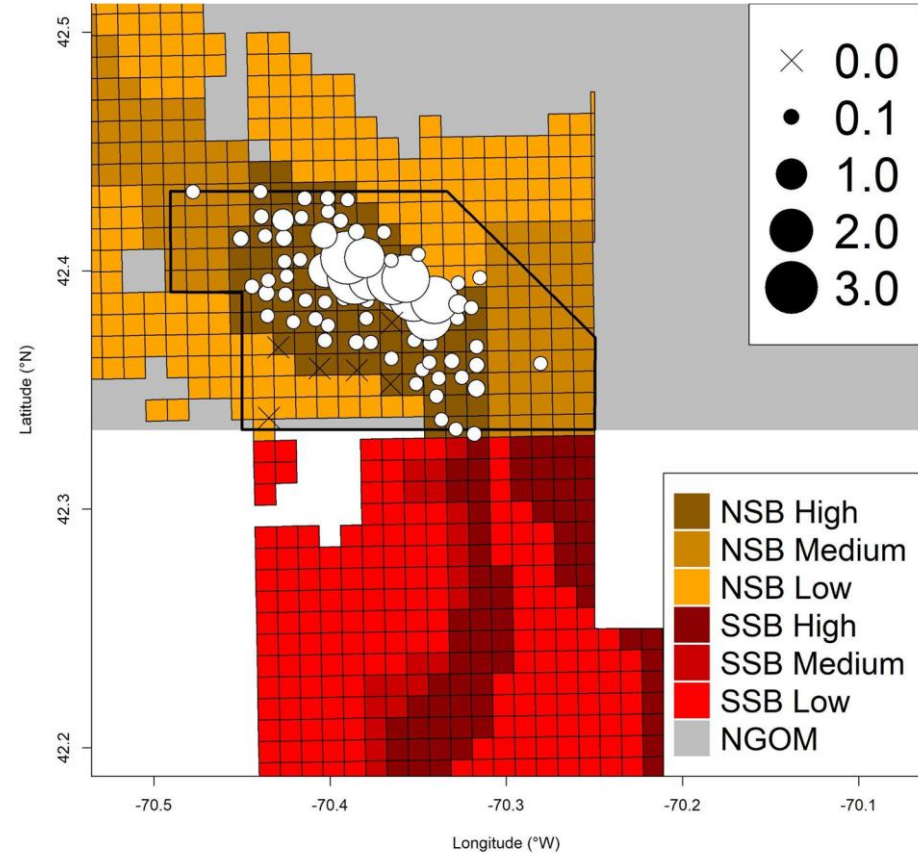


# Full Survey Area Abundance (#/M<sup>2</sup>)



# NGOM Area of Interest Total Scallop Abundance (#/M<sup>2</sup>)

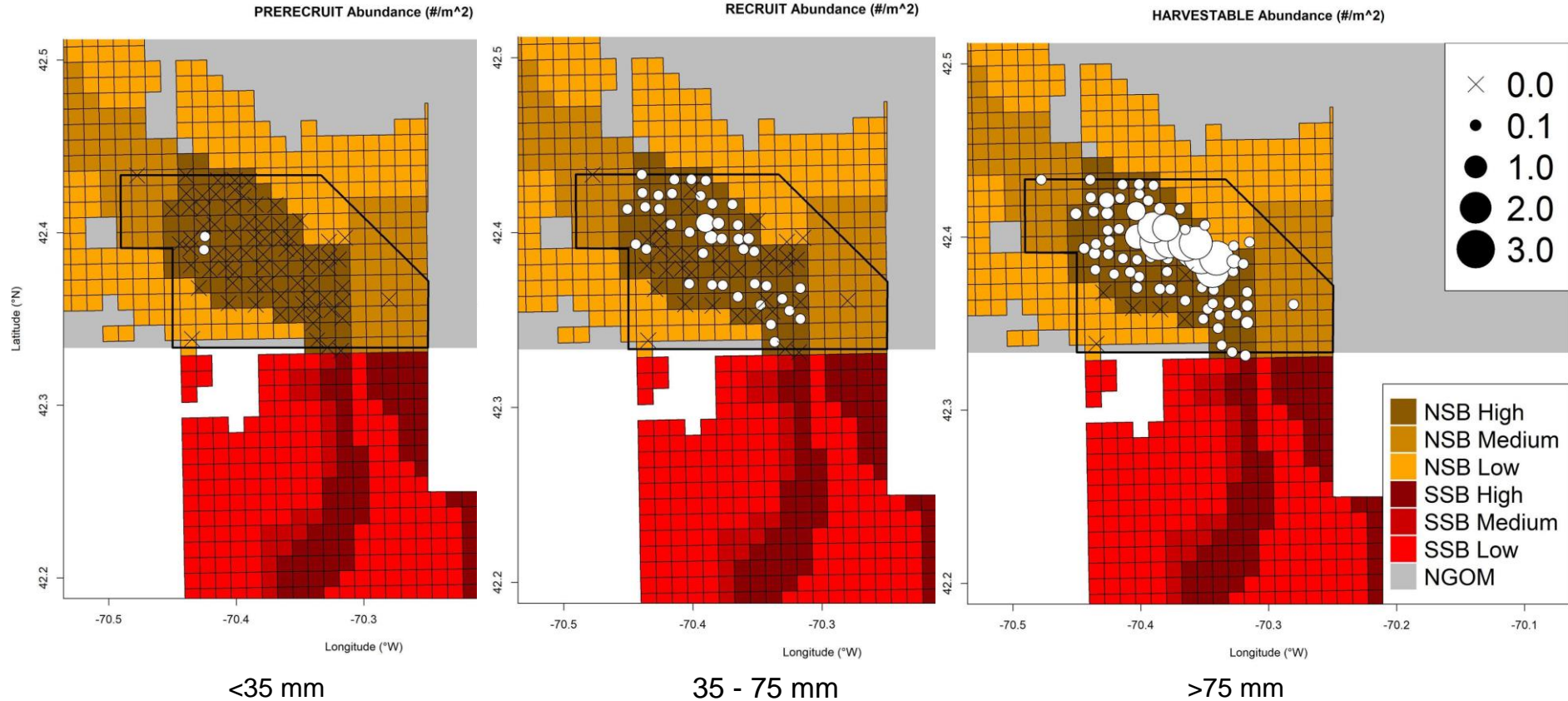
ALL Abundance (#/m<sup>2</sup>)



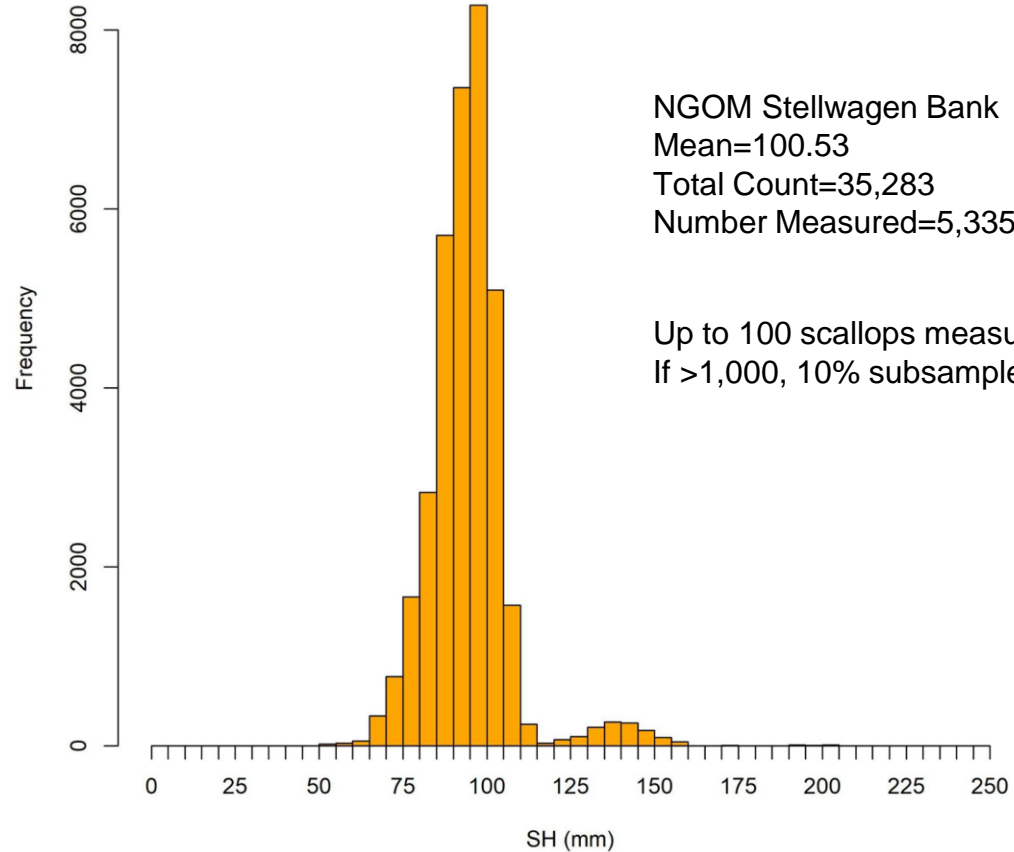
Dredge efficiency = 0.4  
 Size cutoff for estimates is 40mm  
 Hart 2020 SH/MW equation

GOM	NumMil	SE	MeanWt (g)	Avg. Size (mm)	# Tows
NGOM Stellwagen Bank (AOI)	86.02	41.95	21.02	100.53	76

# NGOM Area of Interest Abundance

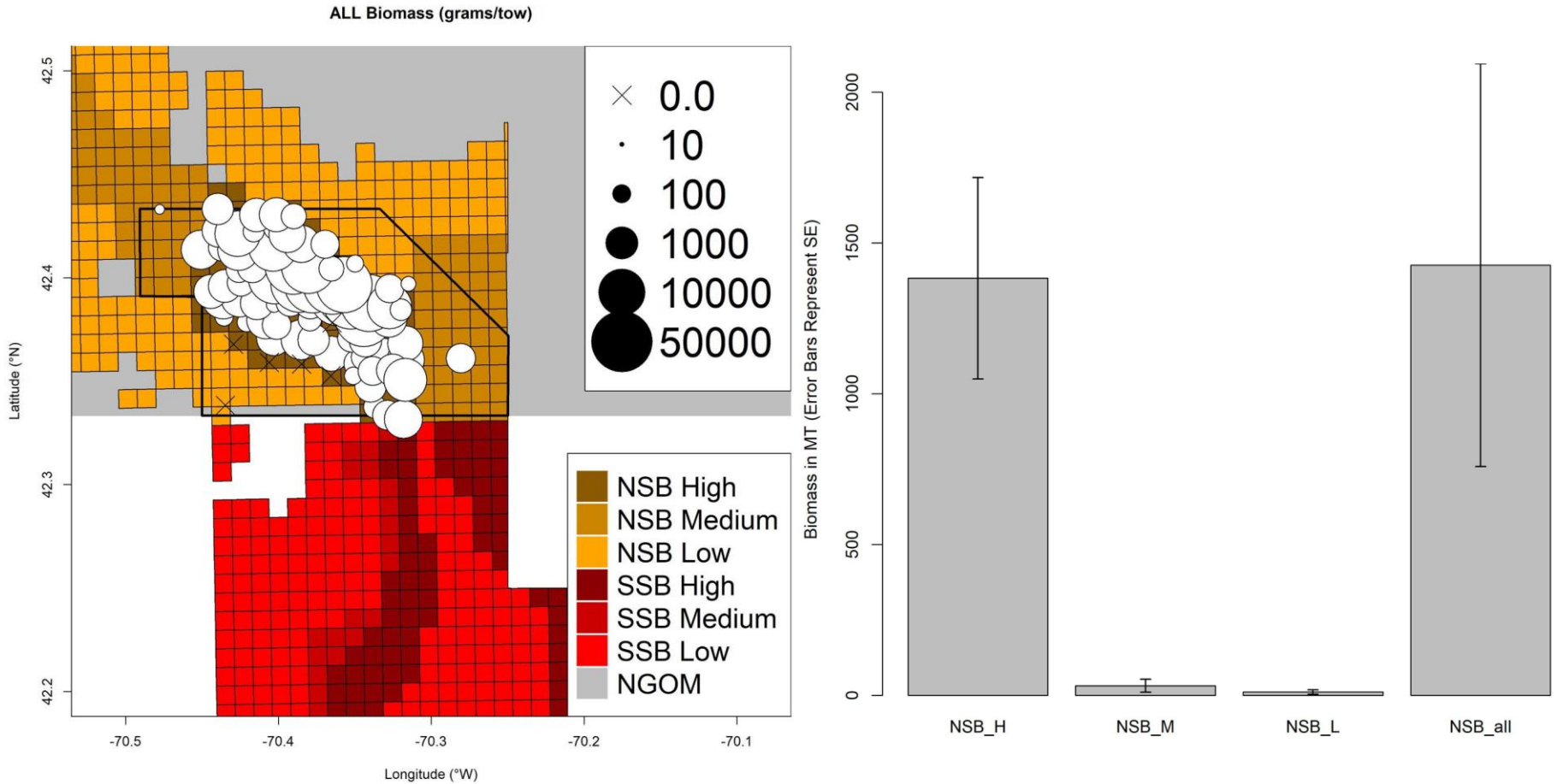


# Length Frequency Area of Interest



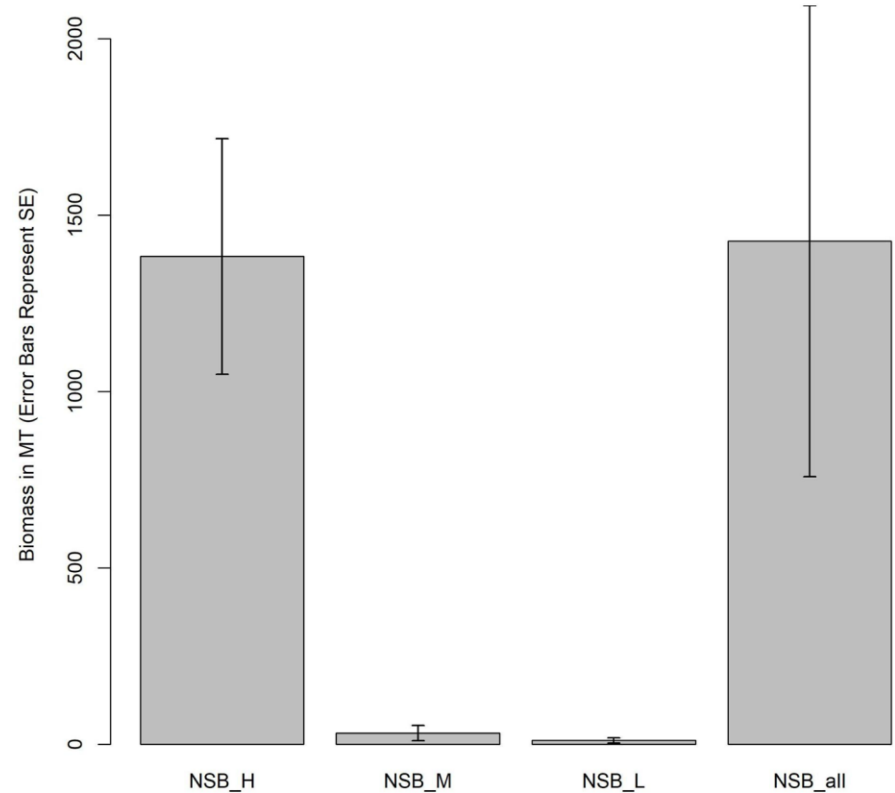


# Area of Interest Biomass



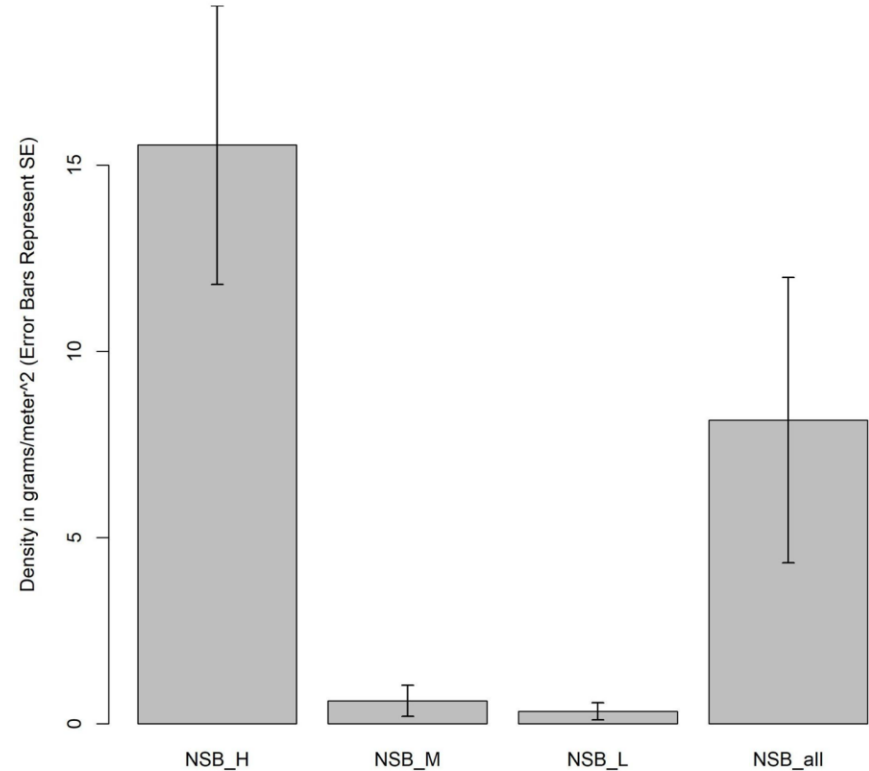
# Area of Interest Biomass

Area_Stratum	Biomass (MT)	SE
NSB_H	1382.92	333.42
NSB_M	32.44	21.65
NSB_L	11.40	7.78
NSB_all	1426.76	667.81



# Area of Interest Density

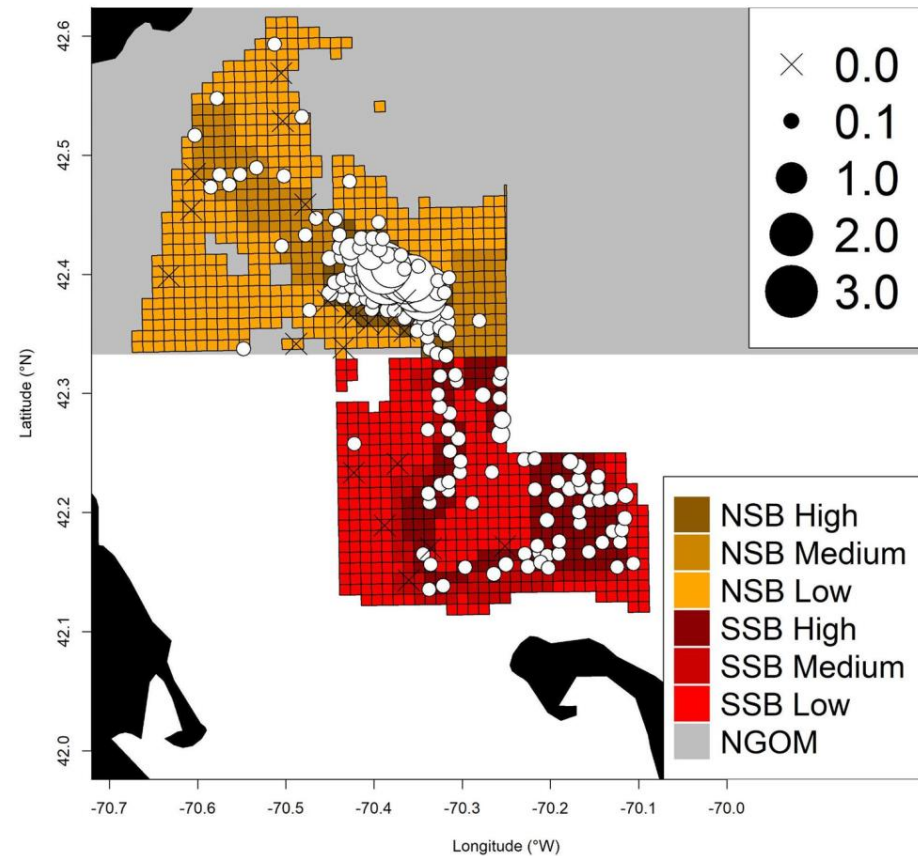
Area_Stratum	Mean Density (g/m <sup>2</sup> )	SE
NSB_H	15.54	3.75
NSB_M	0.62	0.42
NSB_L	0.34	0.23
NSB_all	8.15	3.83



# Dredge Efficiency Sensitivity Analysis in Area of Interest

	No adjustment 0.4		Reduced efficiency 0.26		Reduced efficiency 0.13	
	NumMill	Biomass MT	NumMill	Biomass MT	NumMill	Biomass MT
NGOM Stellwagen Bank	86.02	1426.76	132.34	2195.01	264.67	4390.03

# Full Survey Area Total Scallop Abundance (#/M<sup>2</sup>)

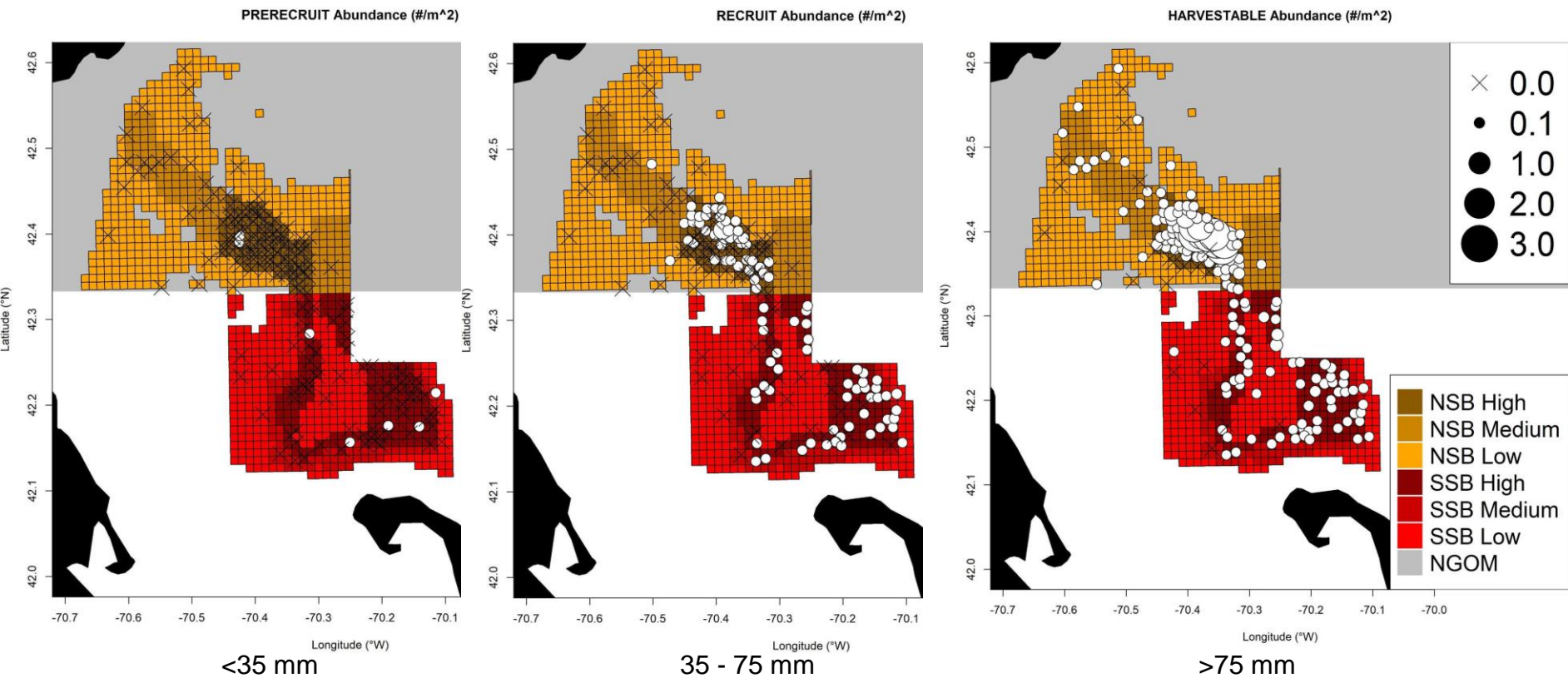


**Dredge efficiency = 0.4**  
**Size cutoff for estimates is 40mm**  
**Hart 2020 SH/MW equation**

GOM	NumMil	SE	MeanWt (g)	Avg. Size (mm)	# Tows
NGOM Stellwagen Bank (Full survey area)	89.65	41.46	21.43	101.31	103
Non-NGOM Stellwagen Bank (Stellwagen South)	17.76	4.62	20.38	98.11	75



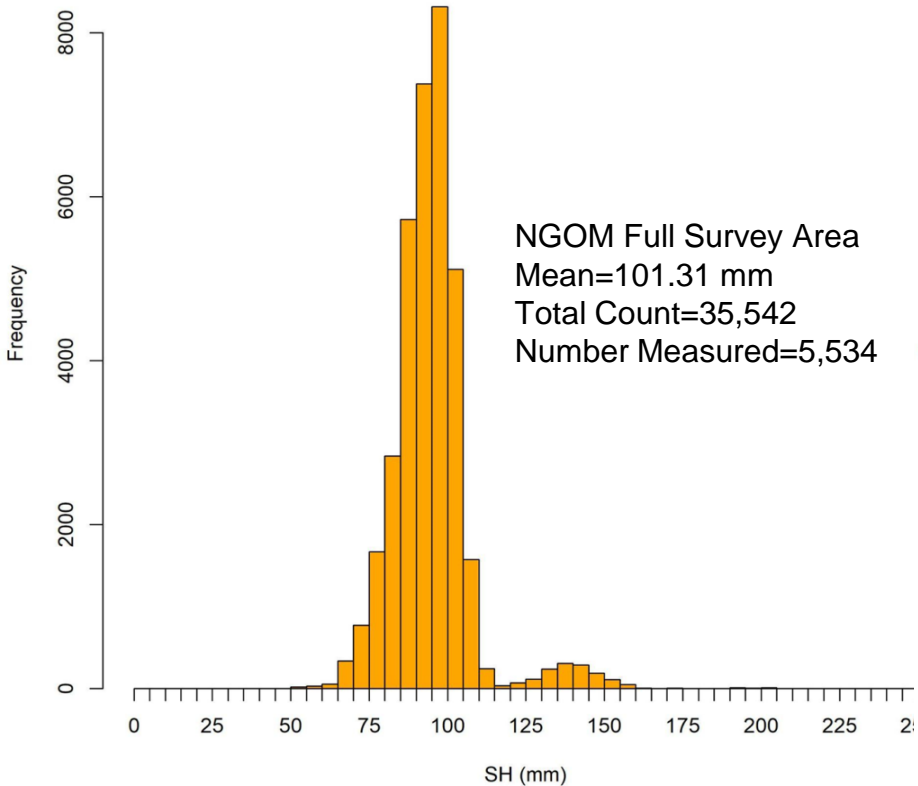
# Full Survey Area Scallop Abundance



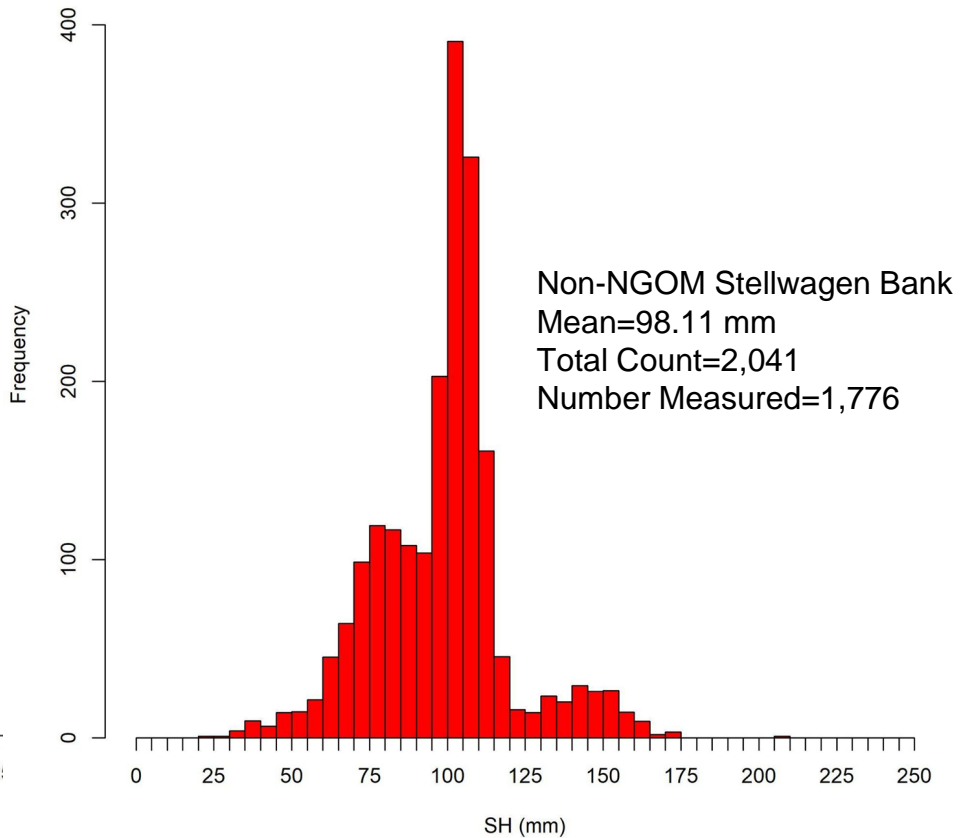
# Length Frequency Full Survey Area

Up to 100 scallops  
measured/tow  
If >1,000, 10%  
subsampled

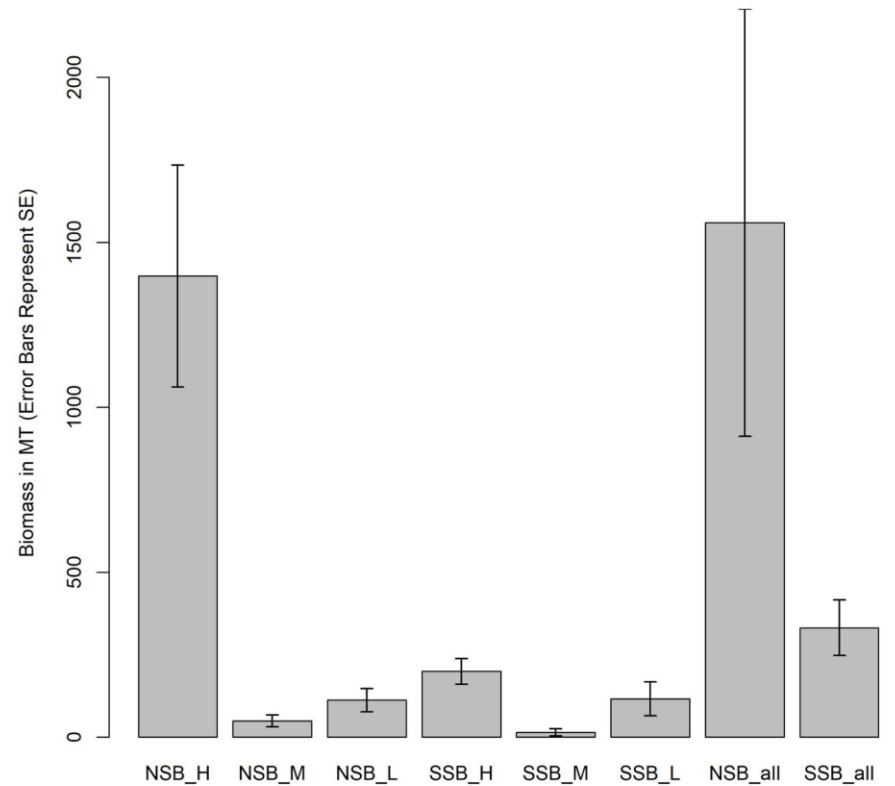
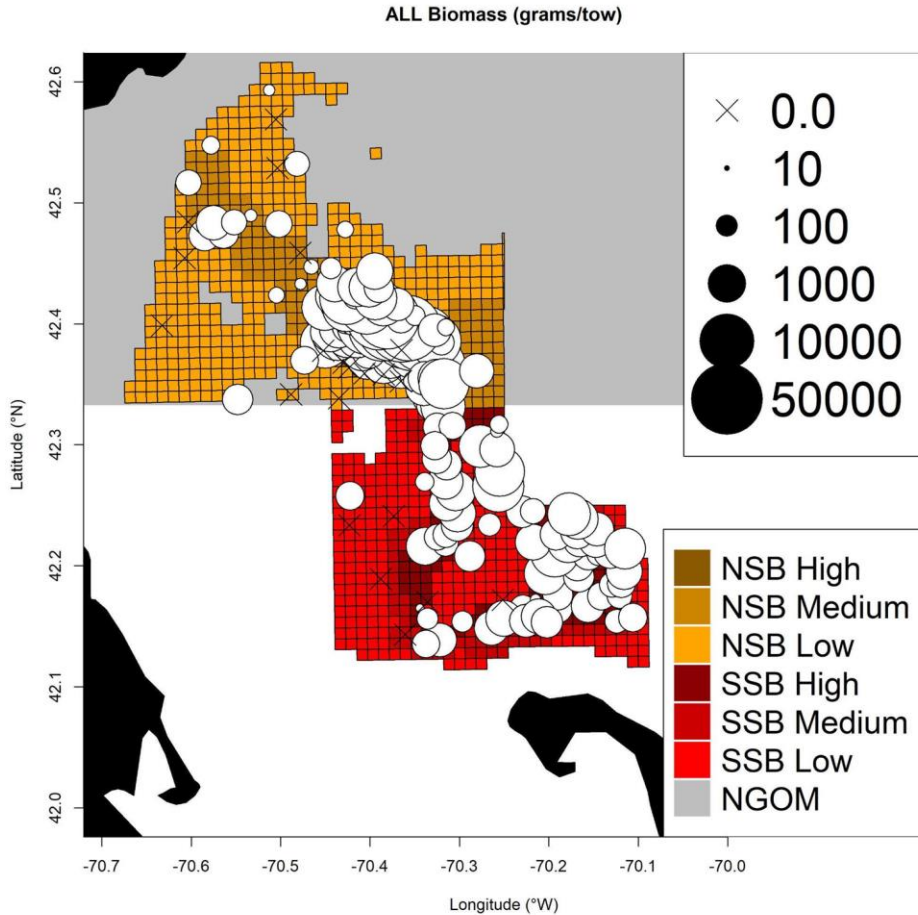
## Length Frequency NSB



## Length Frequency SSB

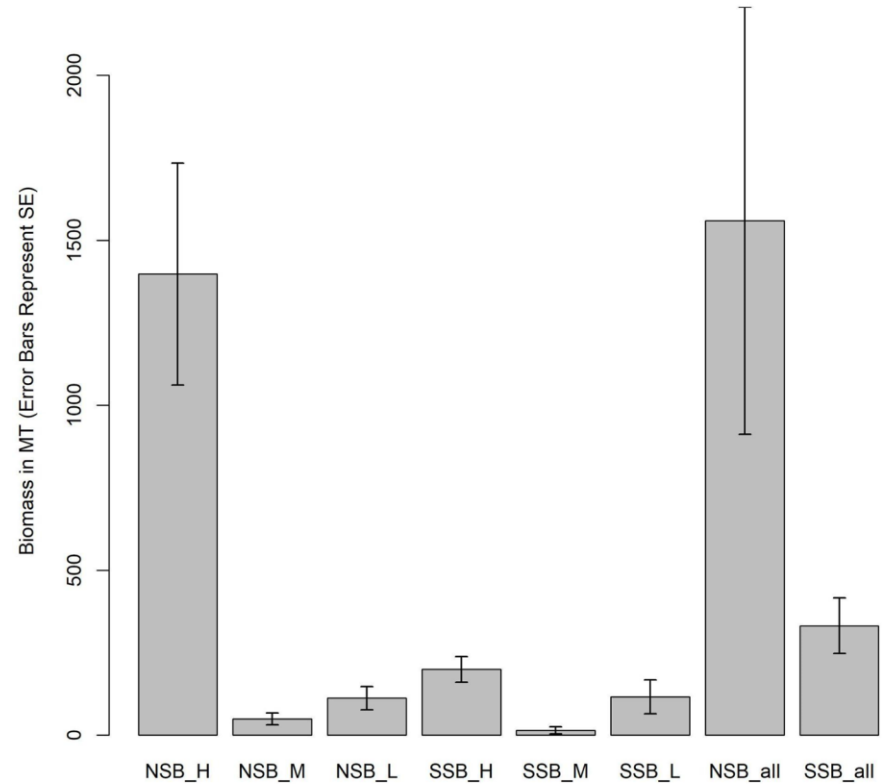


# Full Survey Area Biomass



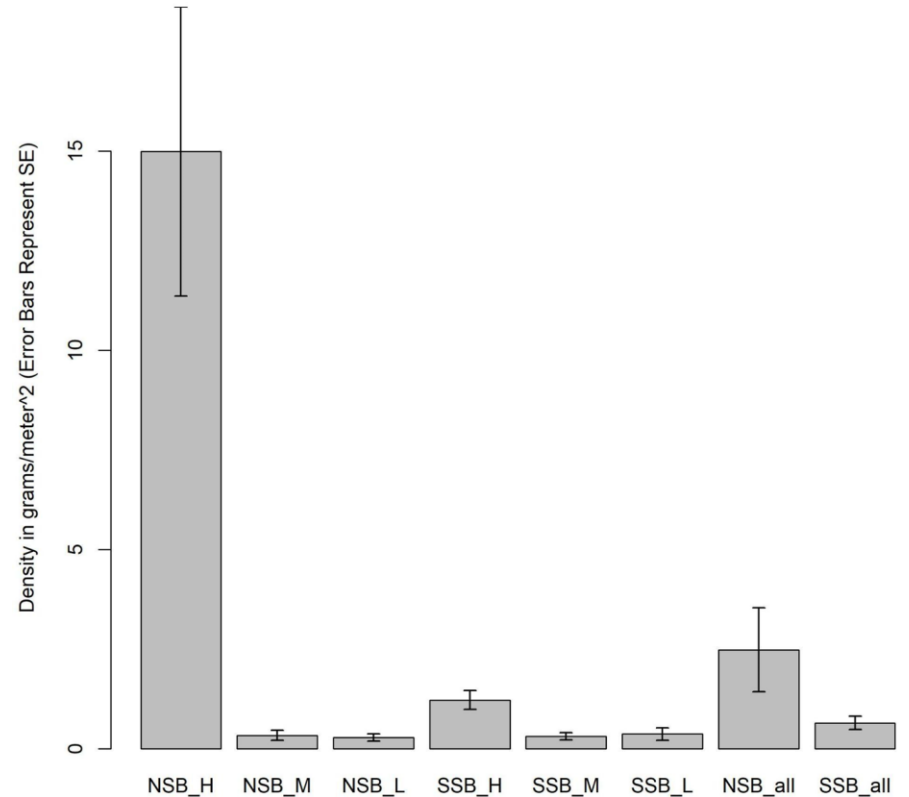
# Full Survey Area Biomass

Area_Stratum	Biomass (MT)	SE
NSB_H	1394.75	337.62
NSB_M	49.61	18.01
NSB_L	111.41	35.55
SSB_H	214.47	41.54
SSB_M	22.64	6.69
SSB_L	103.99	43.16
NSB_all	1555.78	646.33
SSB_all	341.09	85.97



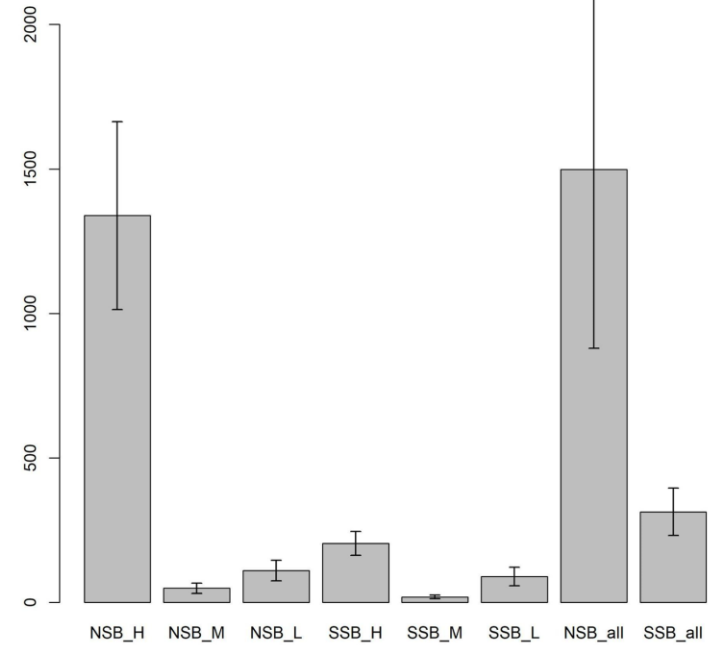
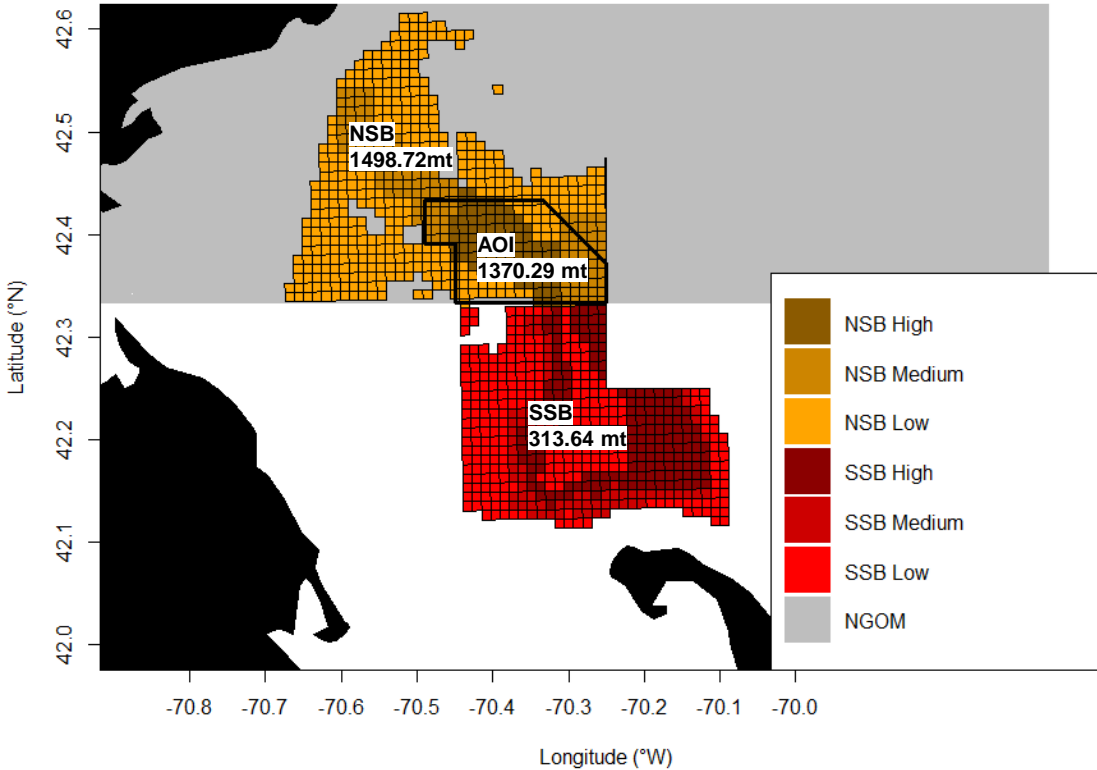
# Full Survey Area Density

Area_Stratum	Mean Density (g/m <sup>2</sup> )	SE
NSB_H	15.0	3.63
NSB_M	0.34	0.12
NSB_L	0.29	0.09
SSB_H	1.23	0.24
SSB_M	0.32	0.09
SSB_L	0.38	0.16
NSB_all	2.49	1.05
SSB_all	0.65	0.16

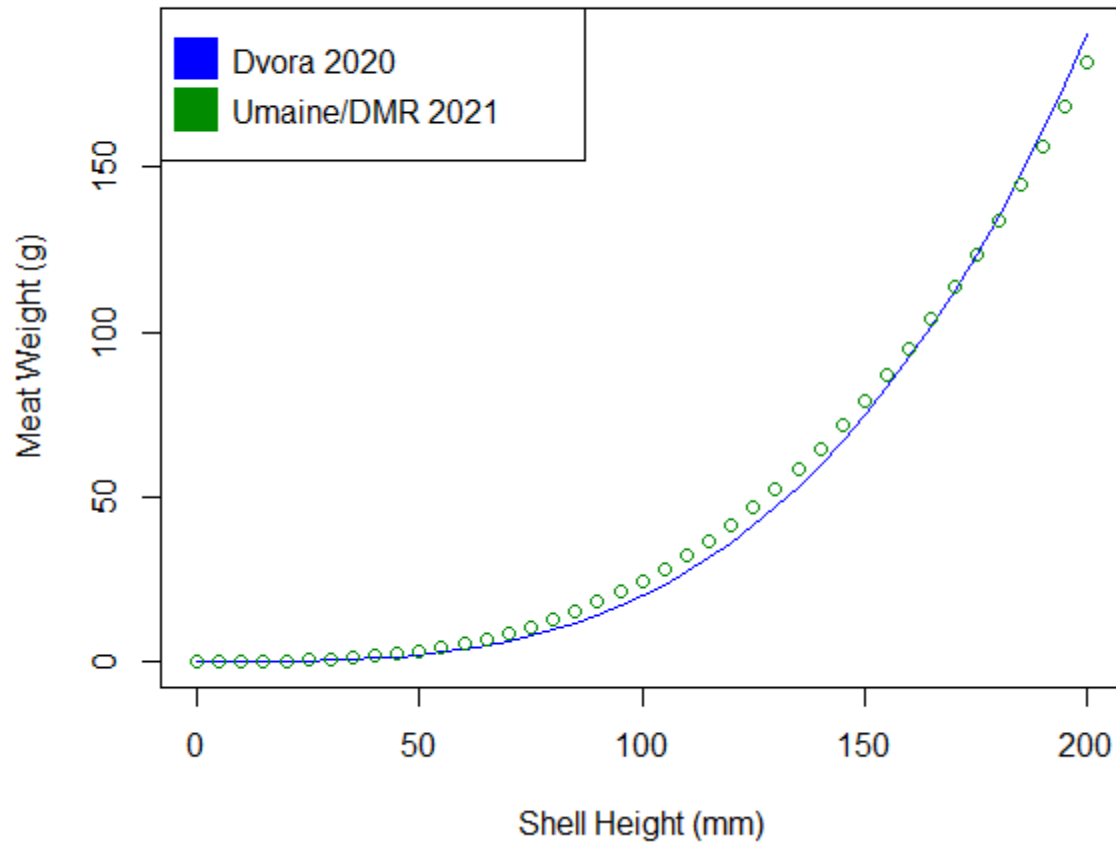




# Scallop Biomass (>75 mm)



# Shell Height/Meat Weight Curve



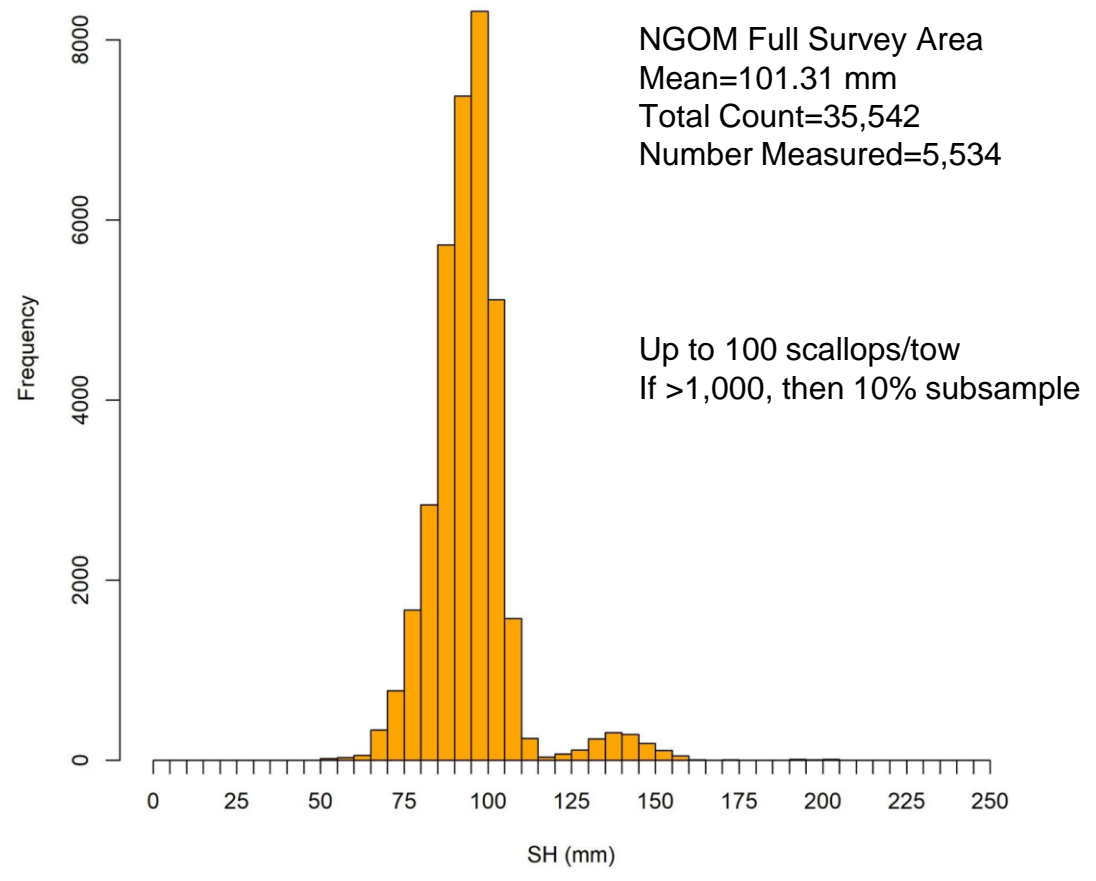
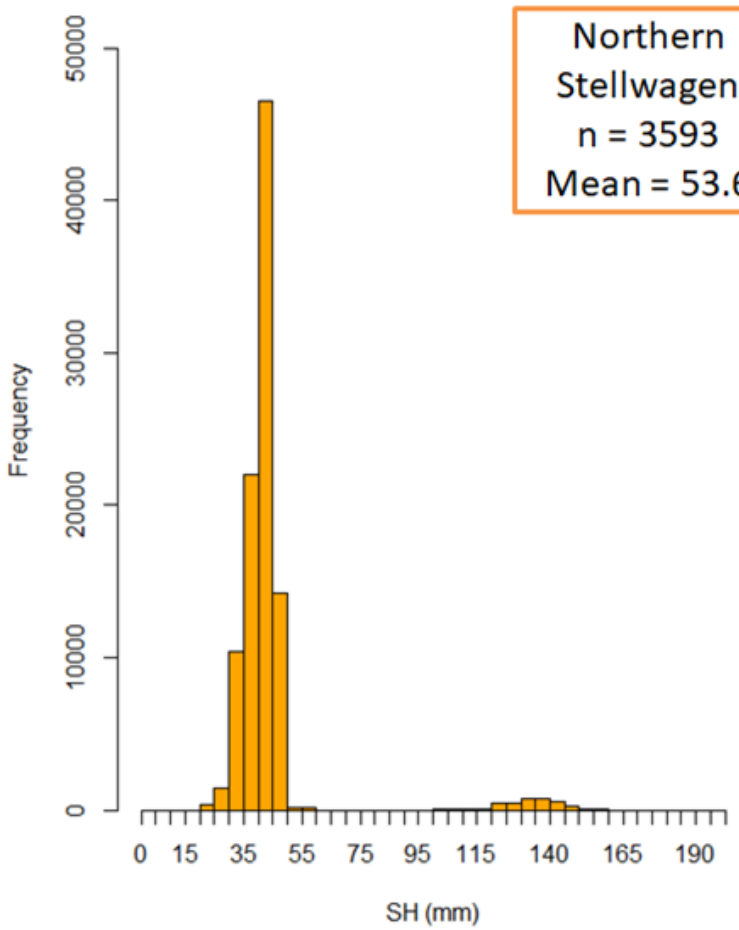
# Sensitivity Analysis-Biomass

	Biomass estimate (metric tons) using: Hart 2020 SH/MW equation	Hart SE	Biomass estimate (metric tons) using: DMR/UMaine 2021 SH/MW equation	DMR/U Maine SE
NGOM Stellwagen Bank	1426.76	667.81	1474.52	693.17
Non-NGOM Stellwagen Bank (Stellwagen South)	341.09	85.97	355.39	92.02

# 2019

## Length Frequency Comparisons NSB

# 2021

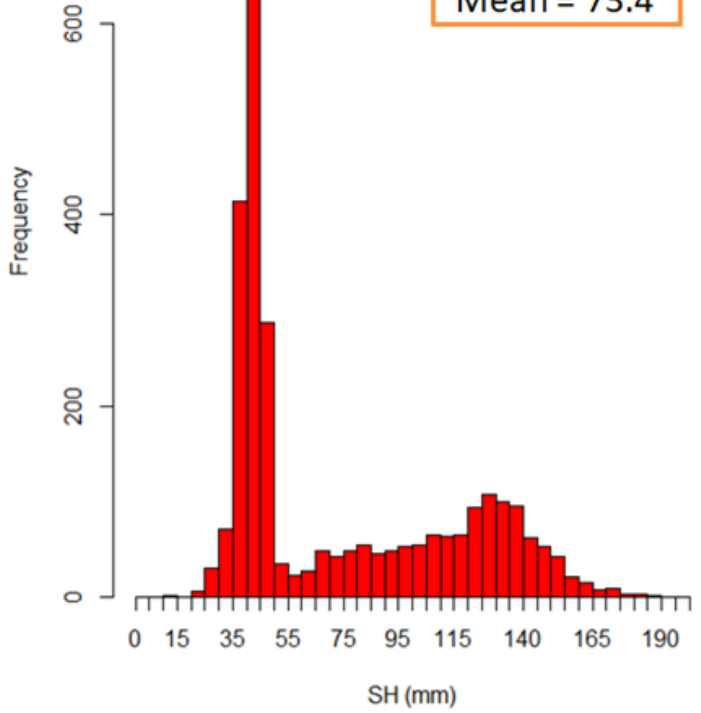


2019

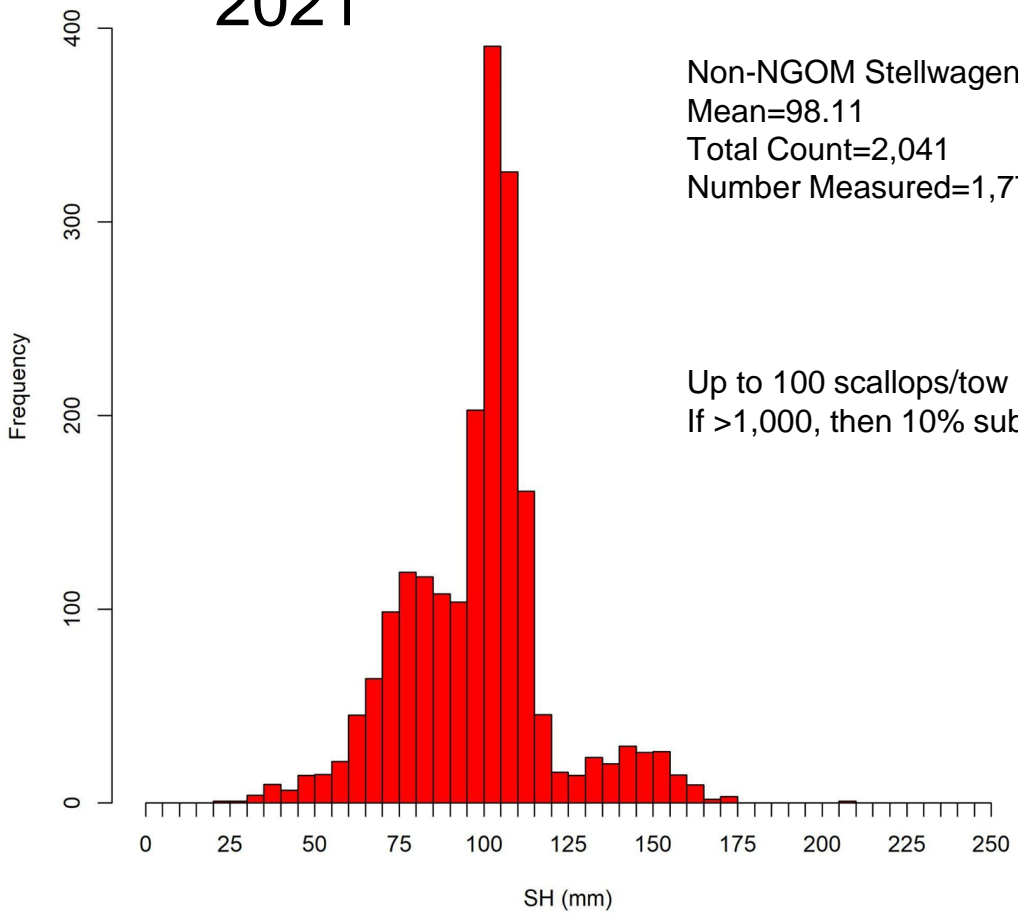
# Length Frequency Comparisons SSB

2021

Southern  
Stellwagen  
n = 2059  
Mean = 73.4



Non-NGOM Stellwagen Bank  
Mean=98.11  
Total Count=2,041  
Number Measured=1,776



Up to 100 scallops/tow  
If >1,000, then 10% subsample



# Biomass Comparisons (SH > 75mm) in MT

<b>Area</b>	<b>2016</b>	<b>2019</b>	<b>2021</b>
<b>Northern Stellwagen Bank</b>	1681	579	1499
<b>Southern Stellwagen Bank</b>	Not surveyed	434	313
<b>Total</b>	NA	1013	1812



# Acknowledgements

- NOAA's 2021 RSA Program
- Stellwagen Bank National Marine Sanctuary
- Special thanks to the crew of the F/V Nicole Leigh!



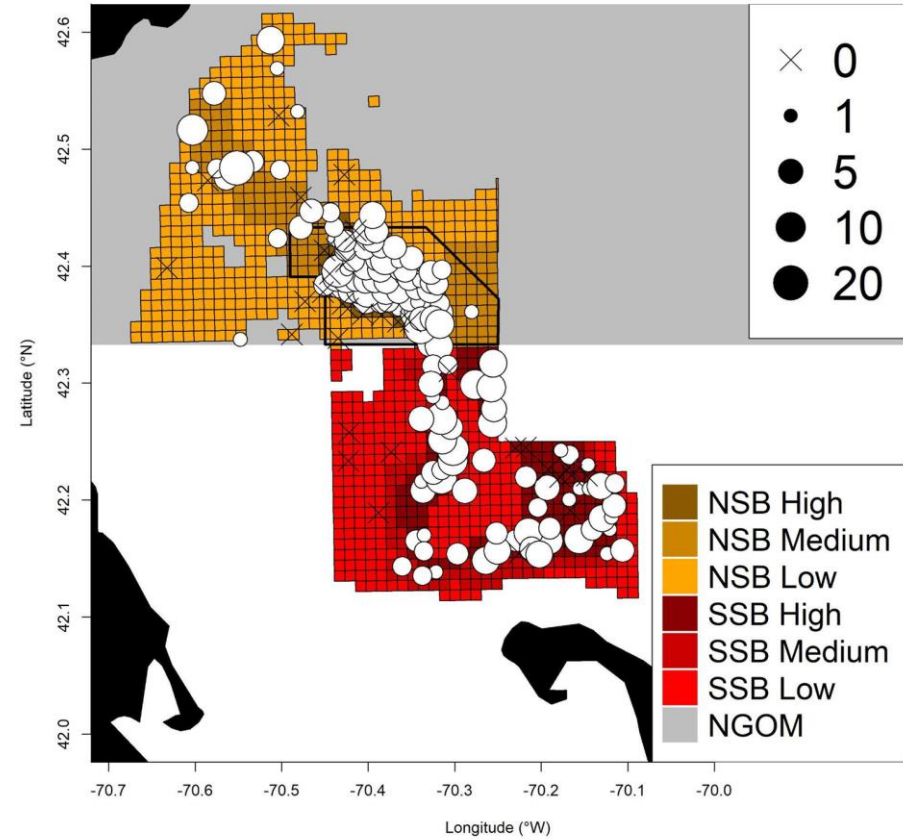


Questions?

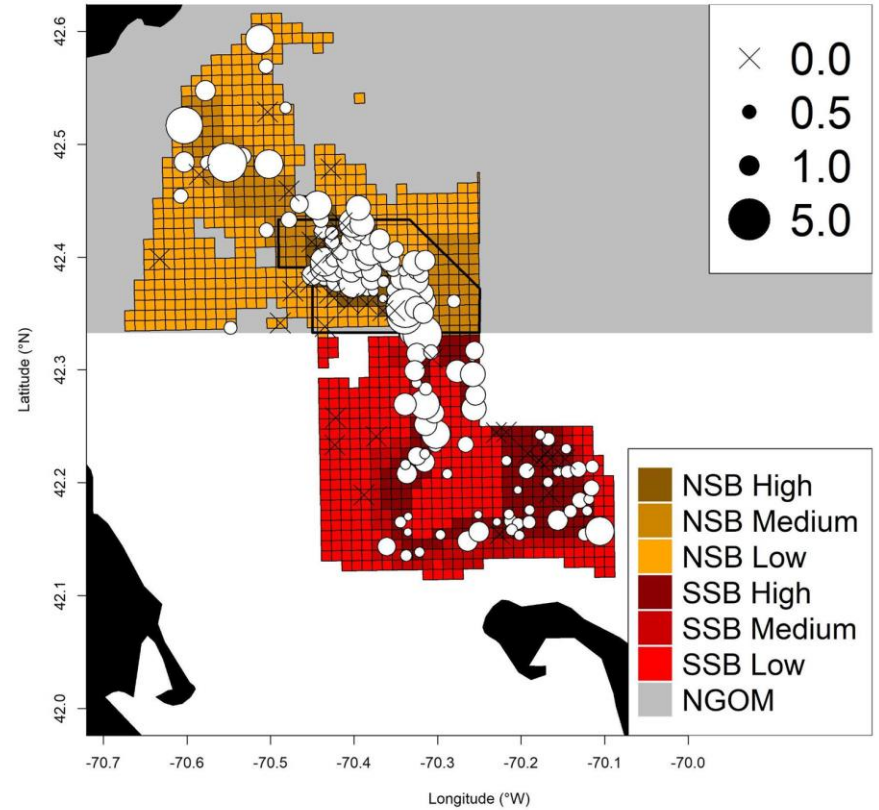
Addendum

# Bycatch

Yellowtail Flounder Reported Quantity (#)



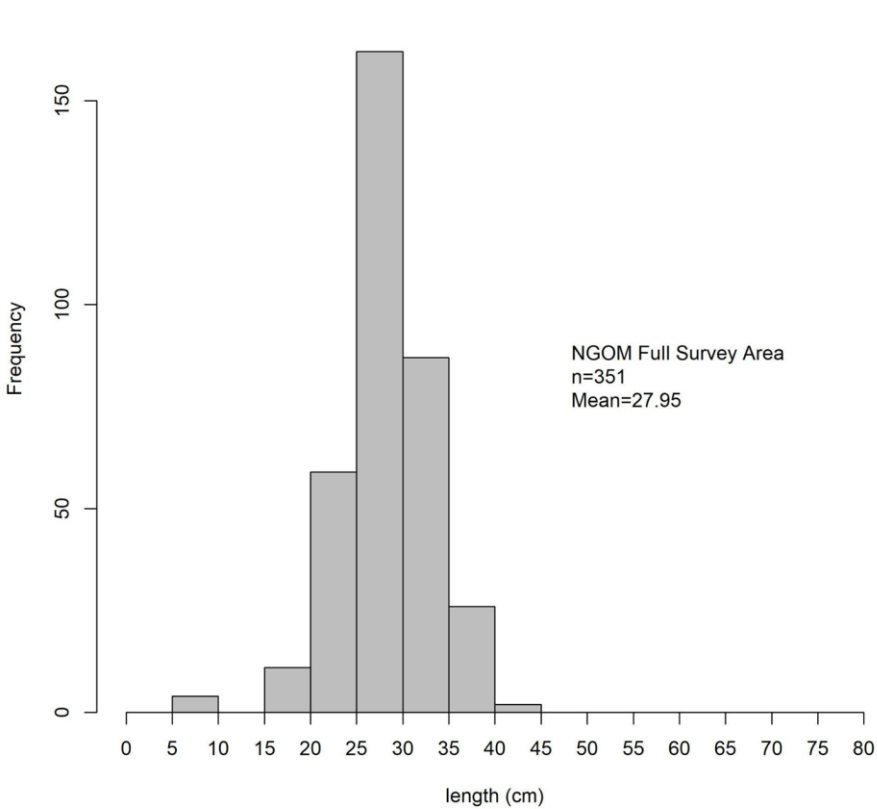
Yellowtail Flounder Weight (kg)



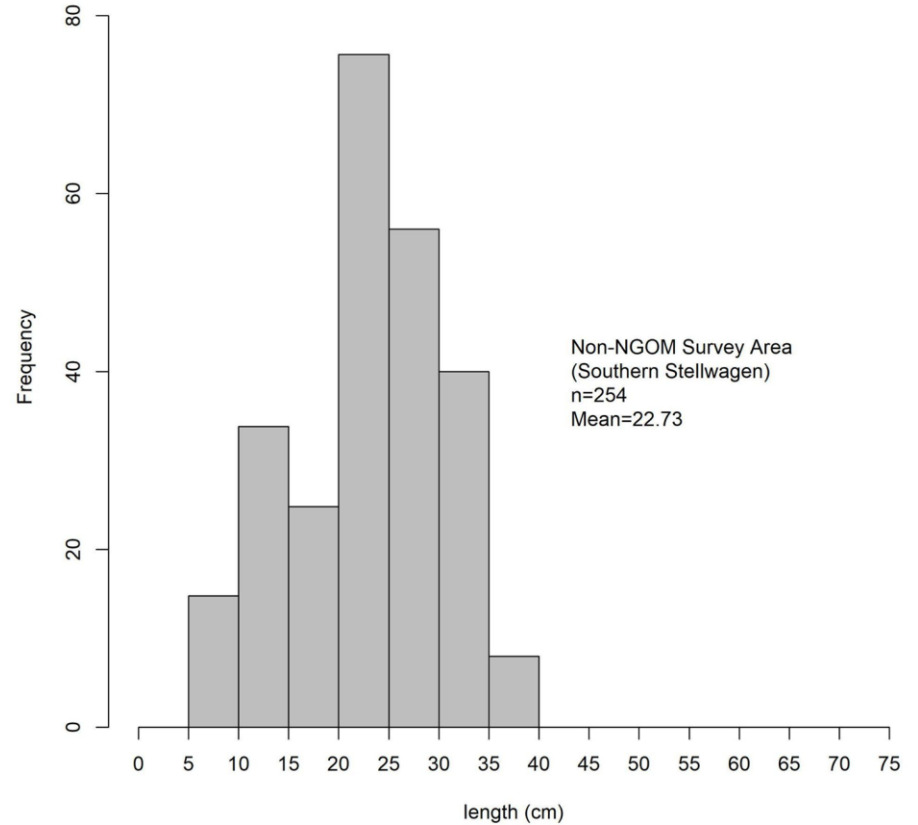


# Bycatch

## Yellowtail Flounder Length Frequency NSB

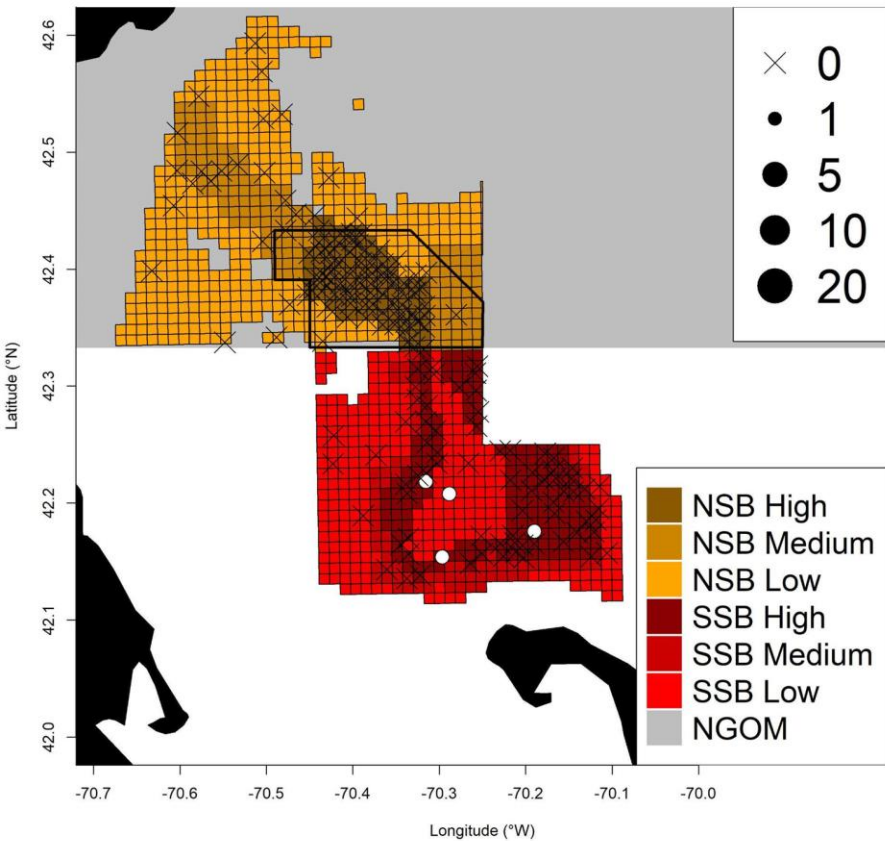


## Yellowtail Flounder Length Frequency SSB

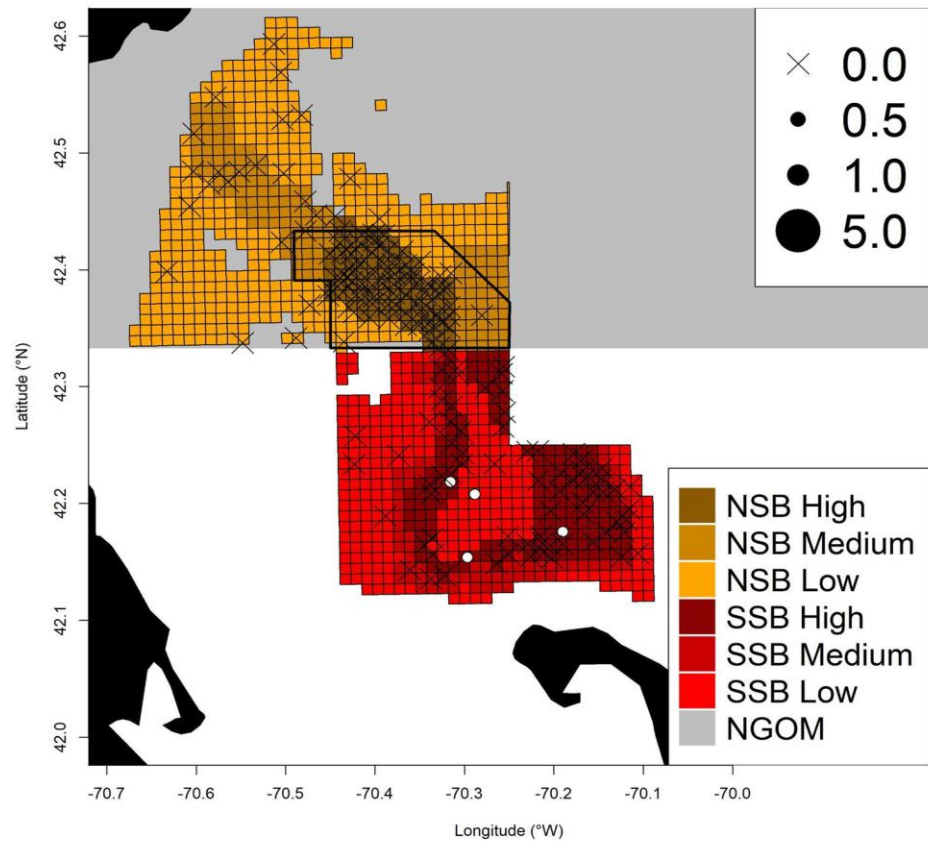


# Bycatch

Windowpane Flounder Reported Quantity (#)

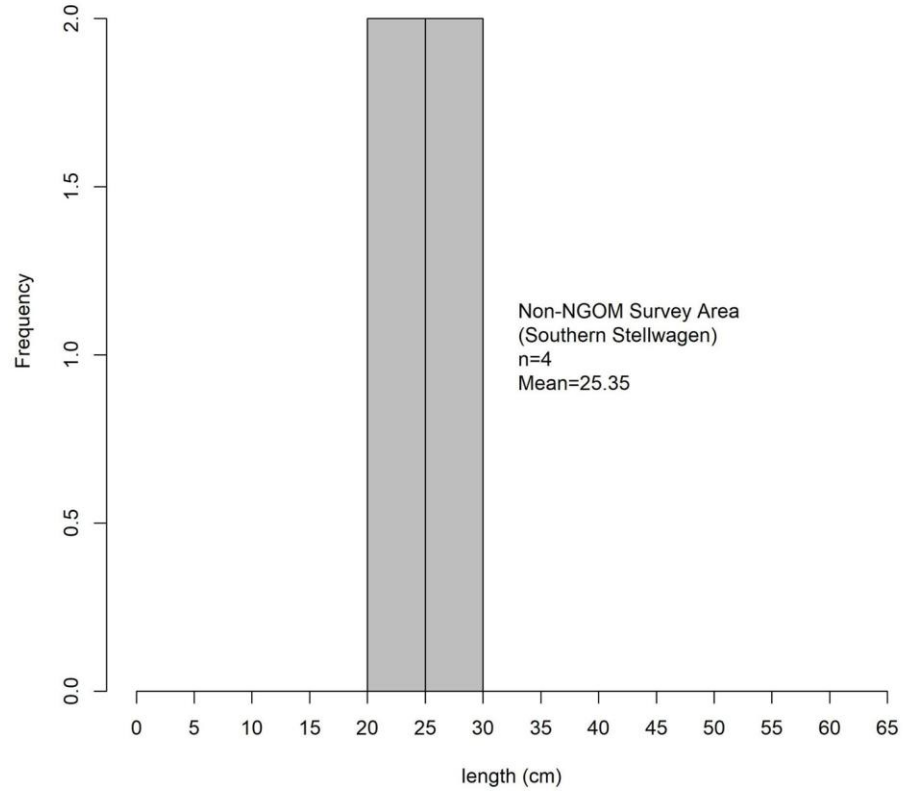


Windowpane Flounder Weight (kg)



# Bycatch

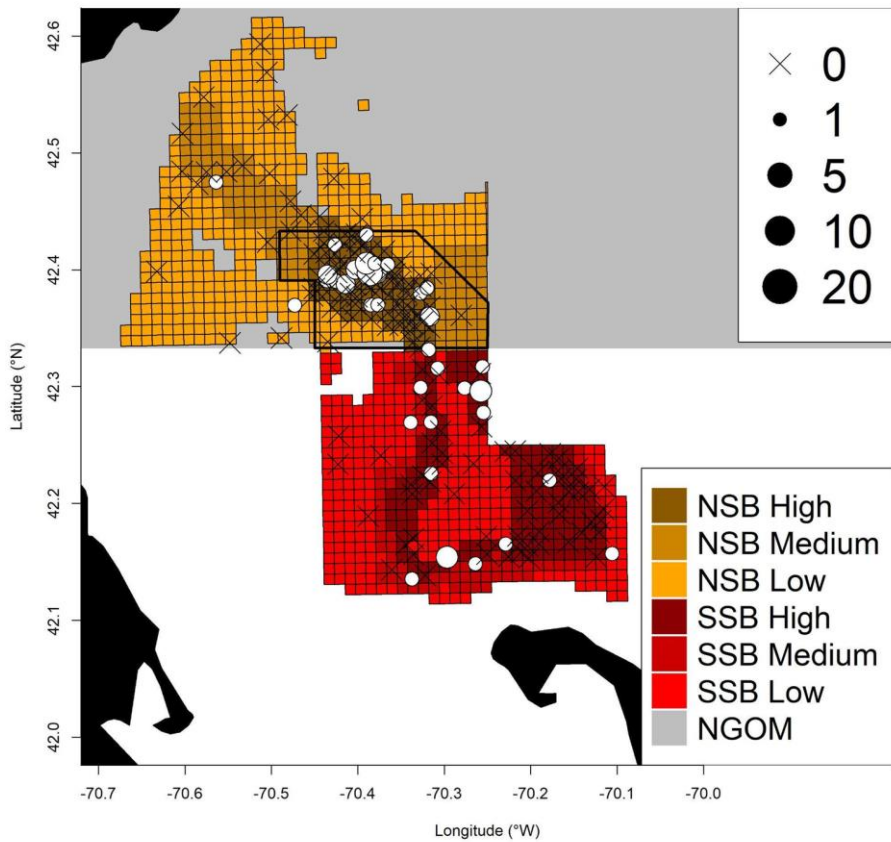
Windowpane Flounder Length Frequency SSB



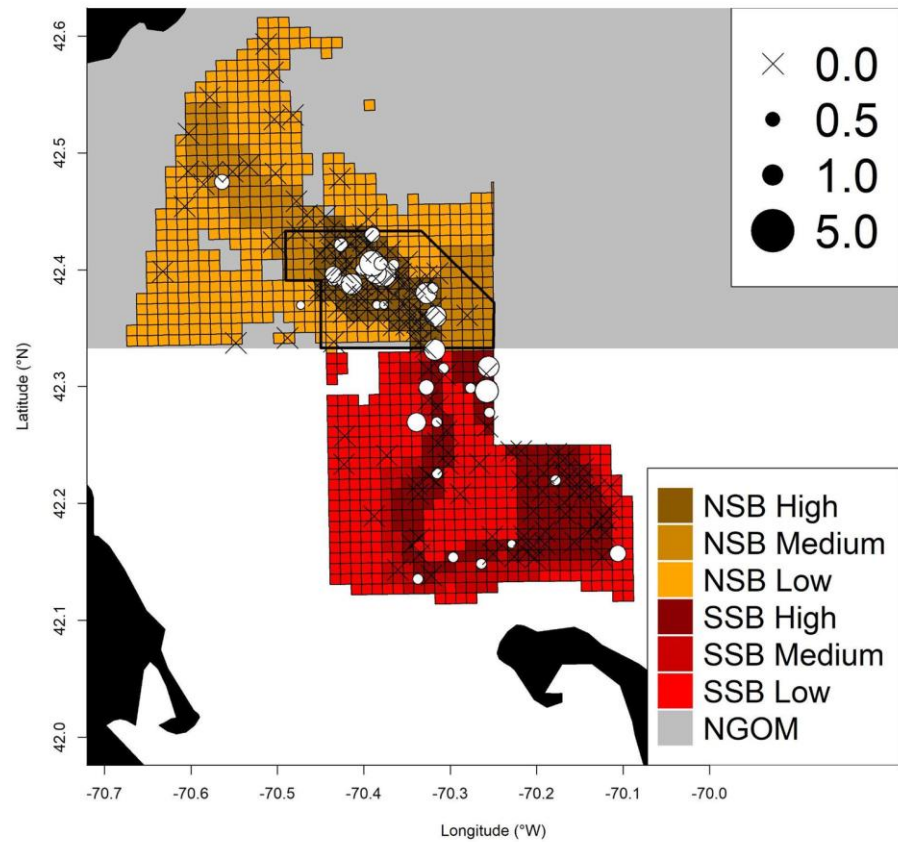


# Bycatch

Winter Flounder Reported Quantity (#)

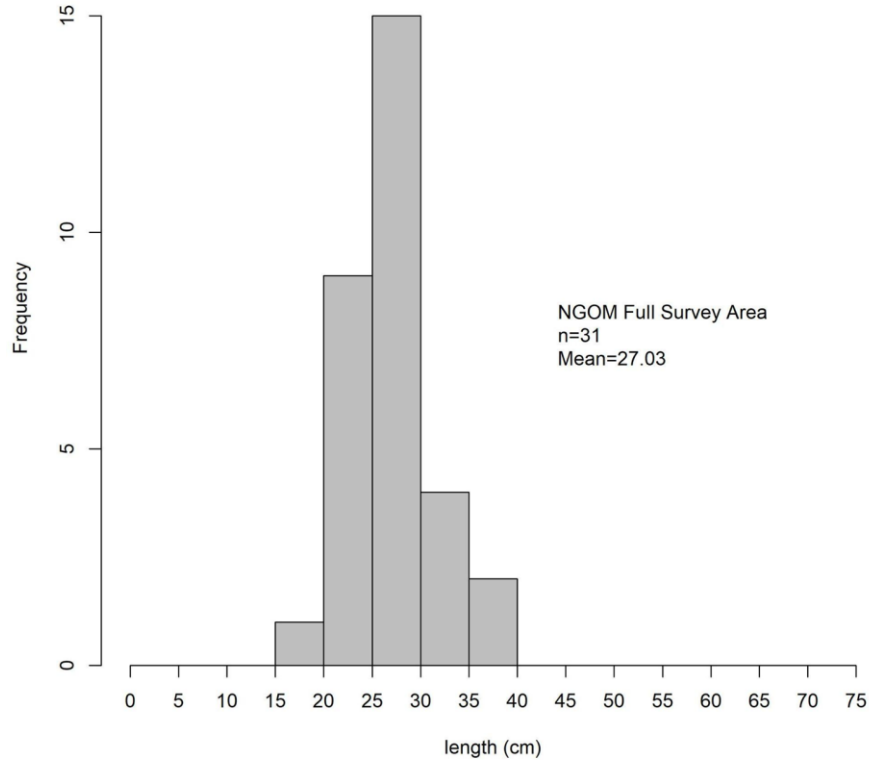


Winter Flounder Weight (kg)

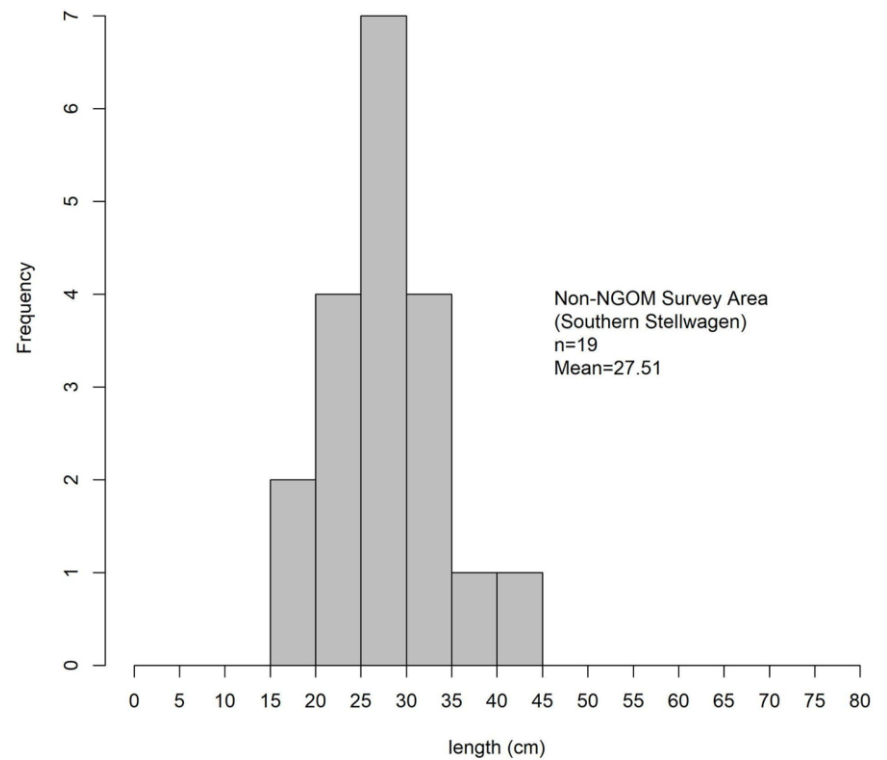


# Bycatch

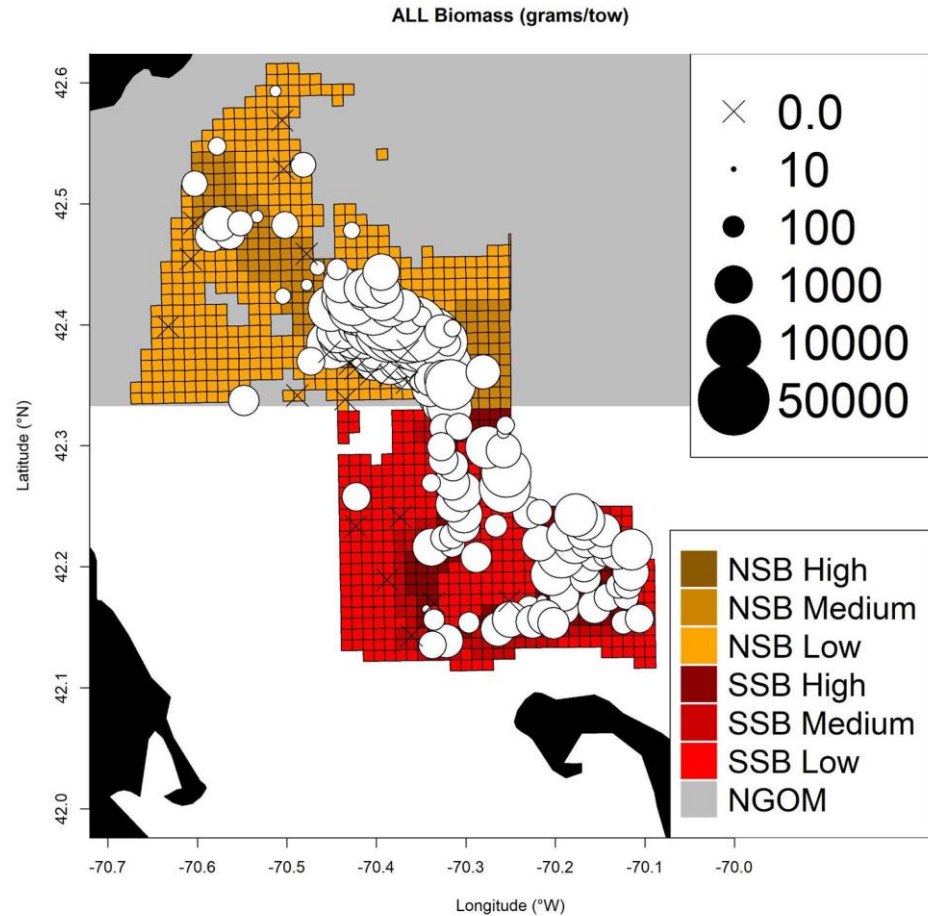
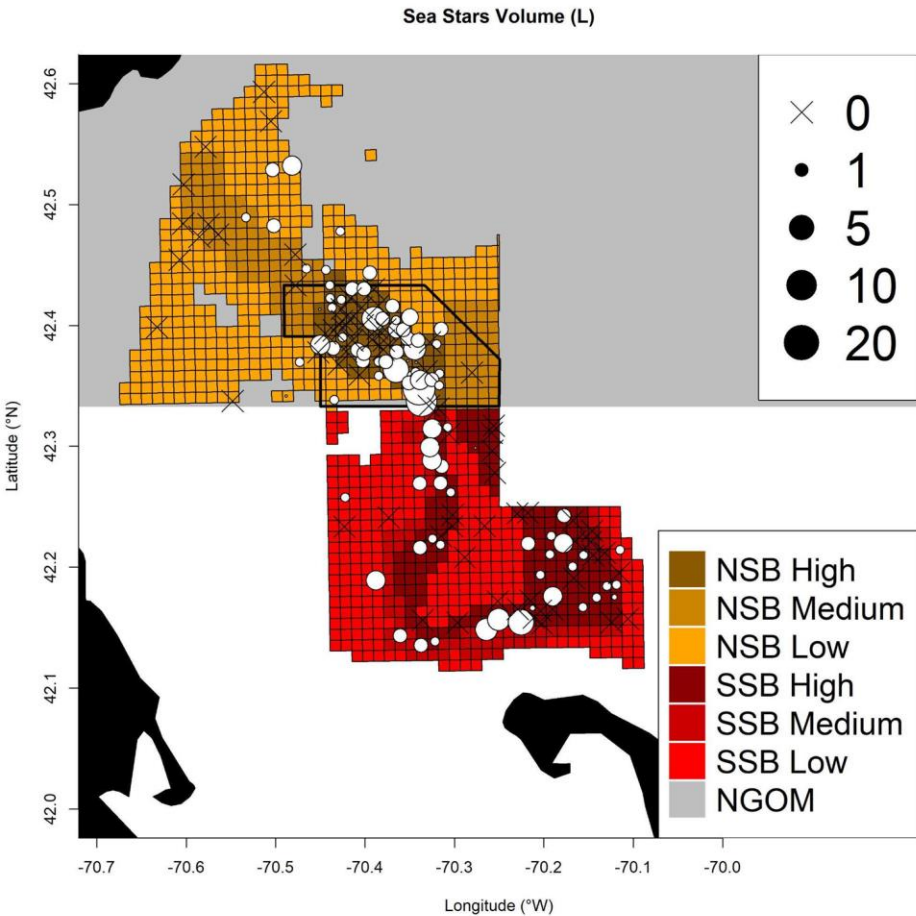
Winter Flounder Length Frequency NSB



Winter Flounder Length Frequency SSB

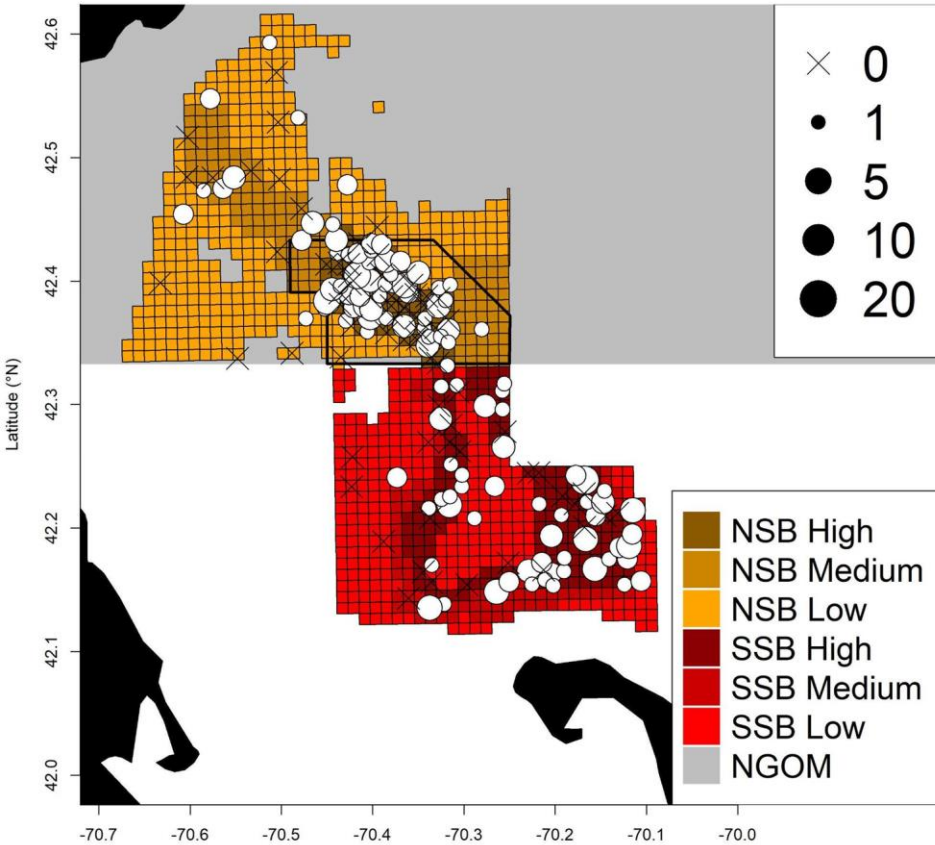


# Bycatch

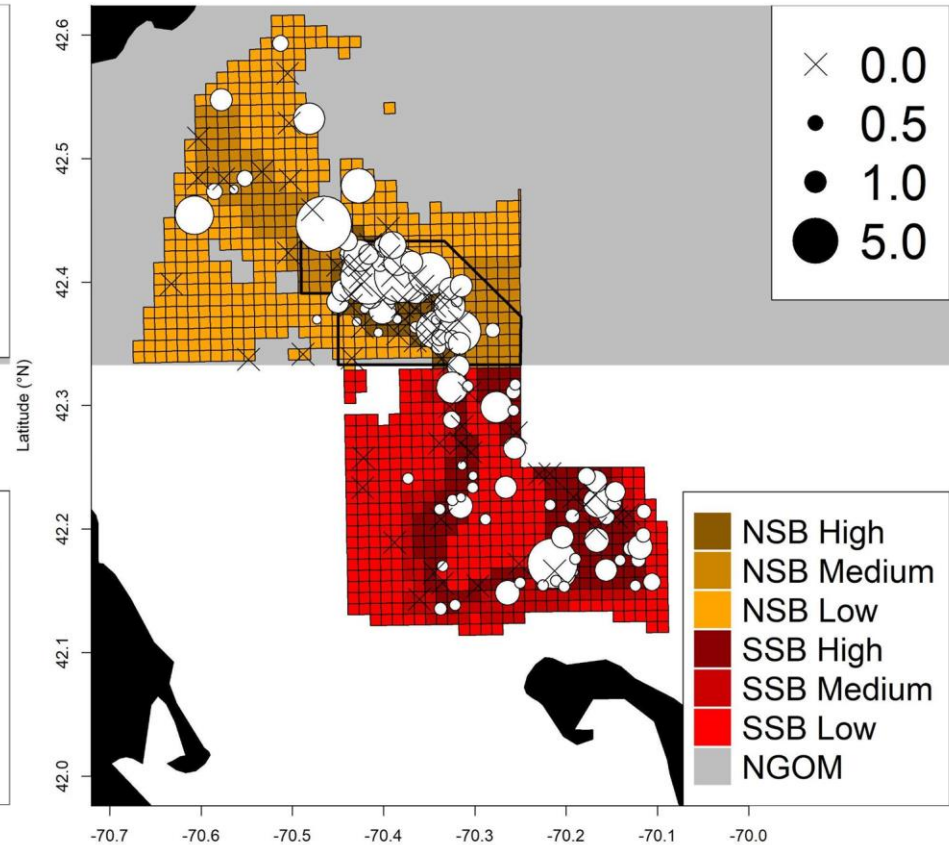


# Bycatch

Monkfish Reported Quantity (#)

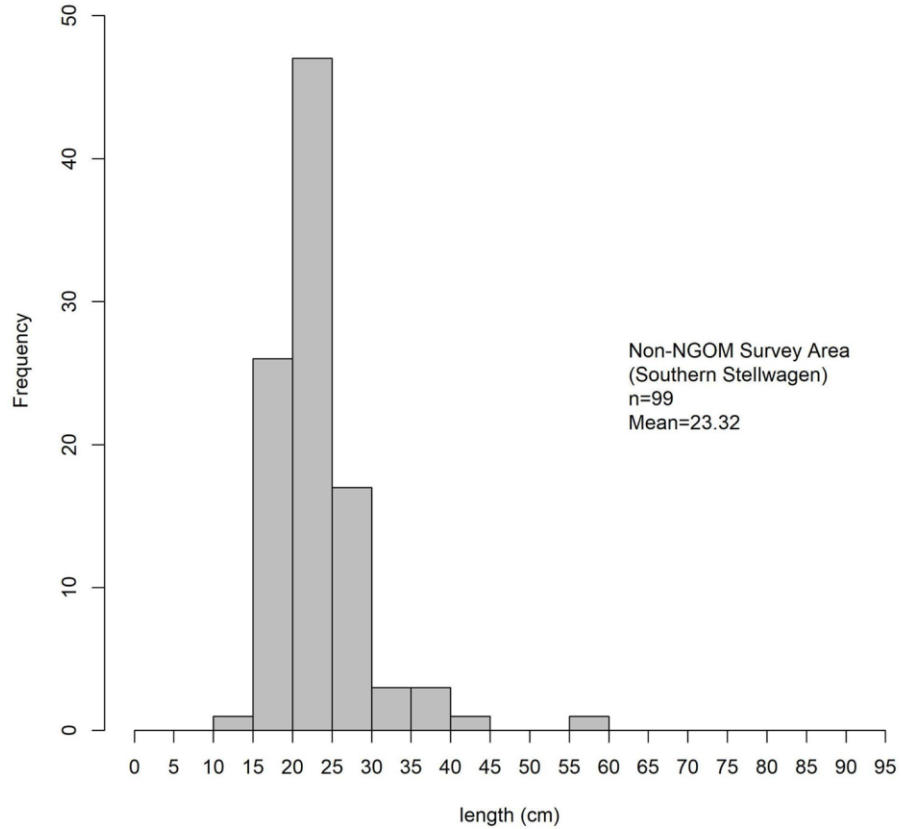


Monkfish Weight (kg)



# Bycatch

Monkfish Length Frequency SSB



# Shell Height to Meat Weight Comparisons in NGOM AOI

	Abundance (NumMill)	SE	Biomass (MT)	SE	Density (g/m <sup>2</sup> )	SE	Mean weight (g)
Hart 2020	86.02	41.95	1426.76	667.81	8.15	3.83	21.02
GLMM	86.02	41.95	1474.52	693.17	8.43	3.97	21.63
GLMM_NC	86.02	41.95	1469.82	690.96	8.40	3.96	21.60

# Shell Height to Meat Weight Comparisons SSB

	Abundance (NumMill)	SE	Biomass (MT)	SE	Density (g/m <sup>2</sup> )	SE	Mean weight (g)
Hart 2020	17.76	4.62	341.09	85.97	0.65	0.16	20.38
GLMM	17.76	4.62	355.39	92.02	0.68	0.18	20.88
GLMM_NC	17.76	4.62	356.05	91.70	0.68	0.18	20.88

# Shell Height to Meat Weight GLMM Equations

## **GLMM with no covariates for inside the AOI**

$$W = \exp(-10.3796 + 2.894025 \cdot \ln(H))$$

## **GLMM with covariates for inside the AOI**

$$W = \exp(90.21118 + 2.894163 \cdot \ln(H) - 26.79 \cdot \ln(L) - 0.07074 \cdot \ln(D))$$

*W is weight in grams*

*H is shell height in mm*

*L is latitude in degrees*

*D is depth in fathoms*



## Biomass Comparisons (SH > 75mm) in MT

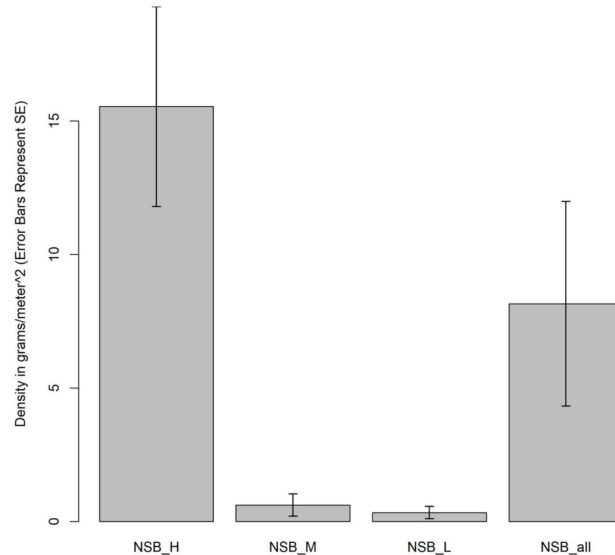
<b>Area</b>	<b>2012</b>	<b>2016</b>	<b>2019</b>	<b>2021</b>
<b>Northern Stellwagen Bank</b>	92 (larger survey area)	1681	579	1499
<b>Southern Stellwagen Bank</b>	Not Surveyed	Not surveyed	434	313
<b>Total</b>	N/A	NA	1013	1812

# Area of Interest Biomass by Substrata

<b>Biomass Percentiles</b>	<b>q0.025</b>	<b>q0.10</b>	<b>q0.15</b>	<b>q0.20</b>	<b>q0.25</b>	<b>Mean</b>	<b>q0.975</b>
<b>NSB_H</b>	771.6474	967.8021	1036.875	1092.746	1146.327	1382.917	2073.615
<b>NSB_M</b>	2.066242	2.066242	2.066242	2.066242	2.066242	32.44035	62.85702
<b>NSB_L</b>	0	1.228147	2.456293	2.456293	2.456293	11.40157	30.06504
<b>NSB_all</b>	NA	NA	NA	NA	NA	1426.759	NA

# Area of Interest Density by Substrata

Density Percentiles	q0.025	q0.10	q0.15	q0.20	q0.25	Mean	q0.975
NSB_H	8.670196	10.87418	11.65028	12.27805	12.88008	15.5384	23.29904
NSB_M	0.039735	0.039735	0.039735	0.039735	0.039735	0.623853	1.208789
NSB_L	0	0.036122	0.072244	0.072244	0.072244	0.33534	0.884266
NSB_all	NA	NA	NA	NA	NA	8.15291	NA



# Full NGOM Survey Area Biomass(MT) by Substrata

<b>Biomass Percentiles</b>	<b>q0.025</b>	<b>q0.10</b>	<b>q0.15</b>	<b>q0.20</b>	<b>q0.25</b>	<b>Mean</b>	<b>q0.975</b>
<b>NSB_H</b>	779.842	978.4652	1047.495	1107.564	1155.276	1394.751	2104.46
<b>NSB_M</b>	17.70152	27.38124	30.71453	33.83079	36.77631	49.61027	87.17474
<b>NSB_L</b>	48.40408	67.02254	74.22172	80.69696	86.07446	111.414	186.905
<b>SSB_H</b>	141.3187	163.6493	171.2231	178.0466	184.8311	214.4652	302.6506
<b>SSB_M</b>	7.525281	14.27974	15.24097	16.01179	16.97301	22.6375	32.21398
<b>SSB_L</b>	35.25425	51.39619	58.43855	65.54233	71.91353	103.9868	198.5488
<b>NSB_all</b>	NA	NA	NA	NA	NA	1555.775	NA
<b>SSB_all</b>	NA	NA	NA	NA	NA	341.0894	NA

# Full NGOM Survey Area Density (g/m<sup>2</sup>) by Substrata

Density Percentiles	q0.025	q0.10	q0.15	q0.20	q0.25	Mean	q0.975
<b>NSB_H</b>	8.385398	10.52113	11.26339	11.90929	12.42232	14.99732	22.6286
<b>NSB_M</b>	0.122079	0.188836	0.211824	0.233316	0.25363	0.34214	0.601205
<b>NSB_L</b>	0.125075	0.173185	0.191787	0.208519	0.222415	0.287891	0.482959
<b>SSB_H</b>	0.807535	0.935139	0.978418	1.017409	1.056178	1.225515	1.729432
<b>SSB_M</b>	0.10599	0.201123	0.214662	0.225518	0.239057	0.318838	0.453718
<b>SSB_L</b>	0.127733	0.186218	0.211734	0.237472	0.260556	0.376764	0.71938
<b>NSB_all</b>	NA	NA	NA	NA	NA	2.48924	NA
<b>SSB_all</b>	NA	NA	NA	NA	NA	0.653428	NA

## Appendix 2: Sensitivity analysis for 7/14/2021 measurement error.

A measurement error was identified in the electronic measuring board used on July 14, 2021. Fifteen (15) stations on Southern Stellwagen Bank were impacted. To address this, a shell height to meat weight relationship based on data excluding 7/14/21 was generated and used to correct shell heights from 7/14 based on 7/14/21 meat weights. Results were compared to the estimates without 7/14/21 data. Both estimates were considered over the same area, with more low stratum stations sampled on the 14<sup>th</sup>.

<b>Predge; efficiency = 0.4</b>							
<b>&gt;40mm</b>							
<b>Hart 2020 SH/MW equation</b>							
<b>GOM</b>	<b>NumMil</b>	<b>BmsMT</b>	<b>SE</b>	<b>MeanWt (g)</b>	<b>Avg. Size (mm)</b>	<b>Scallop density (g/m<sup>2</sup>)</b>	<b># Tows</b>
Non-NGOM Stellwagen Bank (including 7/14/2021)	17.76	341.09	85.97	20.38	98.11	0.65	75
Non-NGOM Stellwagen Bank (excluding 7/14/2021)	16.80	331.77	84.44	20.49	98.13	0.64	60