

# **2019 RSA HabCam Scallop Survey Short Report version 4**

(corrected exploitable biomass estimate; corrected ET biomass estimates; revised exploitable biomass estimates)

Prepared by:

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22-August-2019

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## 1.0 2019 SURVEY BIOMASS ESTIMATES

**Table 1.** Survey total biomass\* estimates by SAMS area.

<b>HabCam v3</b>							
<b>Georges Bank</b>	<b>NumMill</b>	<b>BmsMt</b>	<b>SE</b>	<b>MeanWt</b>	<b>Avg. Size (mm)</b>	<b>Scallop density</b>	<b>HabCam images annotated</b>
CL1-Access							
CL1-Sliver							
CL1-South							
CL2-North							
CA2-Access*	1035	11710	356	11.3	67.6	0.31	4526
CA2-Ext*	653	6714	117	10.3	71.6	0.4	2141
NLS-North*	71	3066	379	42.9	124.6	0.07	1939
NLS-South-shallow	219	3420	9	15.6	96.9	0.76	531
NLS-South-deep	3829	46060	871	12	91.2	5.24	1309
NLS-West	623	12575	3618	20.2	99.5	0.43	1946
NF							
GSC							
SF*	1074	8514	188	7.9	62	0.25	8634
<b>MidAtlantic</b>							
BI							
LI							
NYB							
MA inshore							
HCSAA							
ET-Open*	634	17215	229	27.1	120.7	0.23	5189
ET-Flex*	778	24357	457	31.3	121.5	0.43	3974
DMV							
Virginia							

\*: Scallops 40mm and greater; total biomass based on combined NEFSC and CFF HabCam data in CA2-Access, CA2-Ext, SF, NLS-N, ET-Open, and ET-Flex.

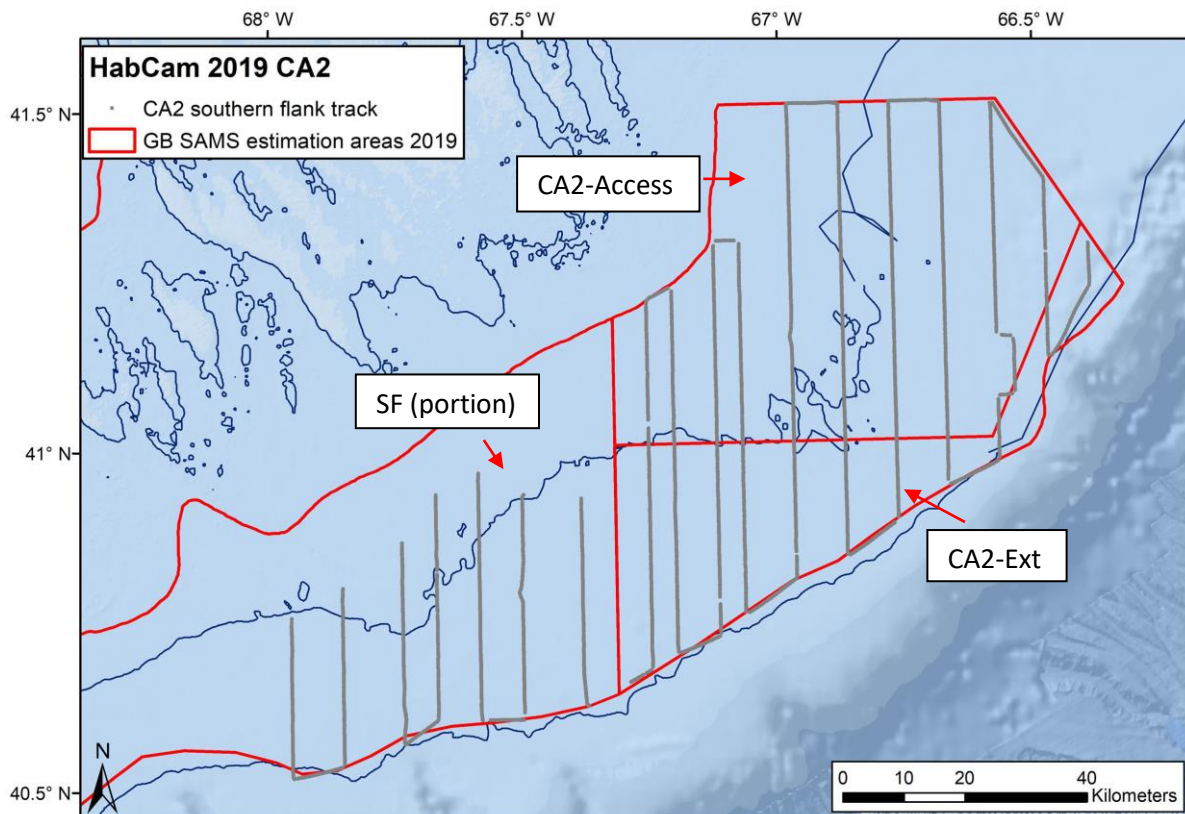
## 2.0 FIGURES OF SURVEY COVERAGE

Coonamessett Farm Foundation, in collaboration with Arnie's Fisheries, Inc. / FV *Kathy Marie* undertook three RSA sea scallop HabCam surveys in 2019 in the following areas:

- **Leg 1:** Closed Area 2 Access area (CA2-Access), CA2 Extension (CA2-Ext) and portions of the Southern Flank (SF) scallop management areas.
- **Leg 2:** Nantucket Lightship (NLS) scallop management area, including the former NLS-Ext, NLS-West (NLS-W), NLS-South (NLS-S) shallow and deep and the NLS-North (NLS-N).
- **Leg 3:** Elephant Trunk Open (ET-Open) and Flex (ET-Flex) scallop management areas

### Closed Area 2 / Southern Flank (portion)

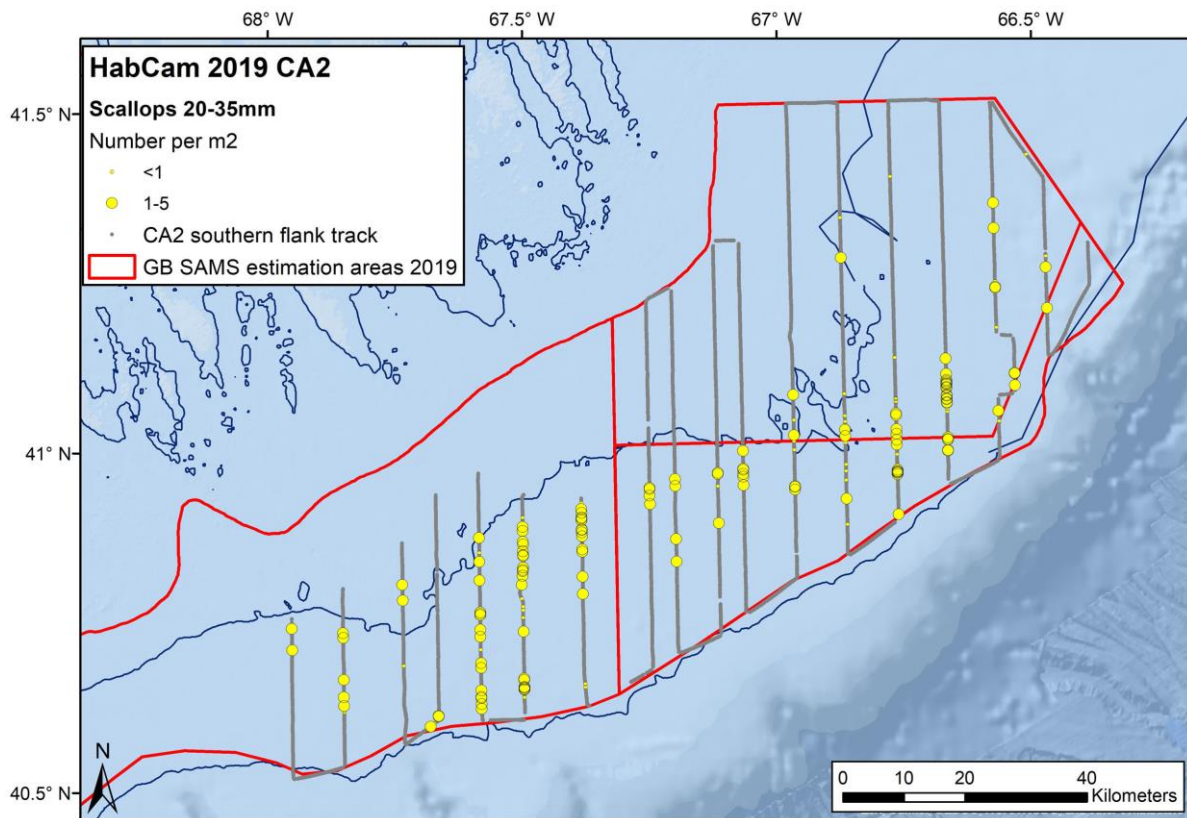
The first leg of the 2019 survey took place from June 27-July 4, 2019 in CA2-Access, CA2-Ext, and portions of the SF (**Figure 1**). The CA2 / SF survey covered approximately 540 nautical miles, during which we collected roughly 2.5 million stereo image pairs, of which 9,735 were annotated, yielding an annotation rate of approximately 1:250 images. Approximately 24 hours into the survey, we decided to increase the annotation rate from 1:400 to 1:200 images. This annotation rate was continued throughout the survey with the exception of certain areas with high sea star density and no scallops present. Quality control was performed on a minimum of 50% of the annotated images (QC rate was increased to 100% in areas of high scallop density).

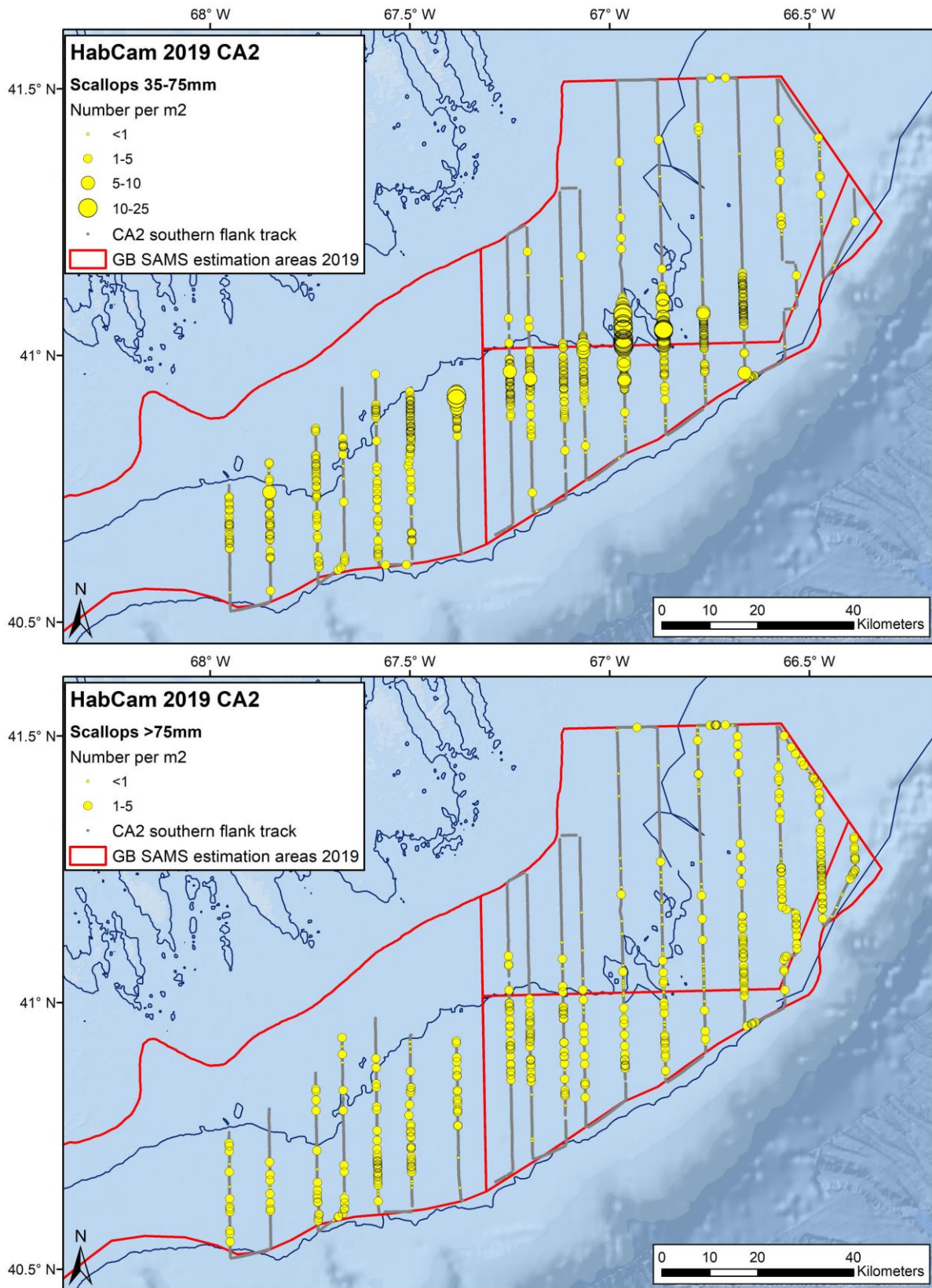


**Figure 1.** 2019 CFF RSA HabCam v3 survey track in CA2 / SF.

Due to mechanical issues with the RSA HabCam winch, coupled with high sea state, we decided to raise the HabCam vehicle up from survey altitude to approximately 10m while transiting between N-S transects in the Southern Flank (see **Figure 1**). No images were annotated during these transits.

The largest density (number per square meter) of recruit-sized scallops (35-75mm) was in the southern portion of CA2-Access and northern portion of CA2-Ext, extending south and west into the SF (**Figure 2**). Scallop seed, defined for this report as scallops smaller than 20mm, was seen in substantial numbers in some areas of the SF – however, due to variation in image quality and altitude impacting our ability to accurately quantify scallops < 20mm, information on scallop seed should be used qualitatively. Scallops < 20mm were excluded from initial distribution maps of pre-recruits and presented separately (see *Special Comments*). Pre-recruits 20-35mm were seen in fairly consistent density along the same area as recruits. Scallops >75mm were widely distributed throughout the survey area, with the exception of the north-central and western portions of CA2-Access.

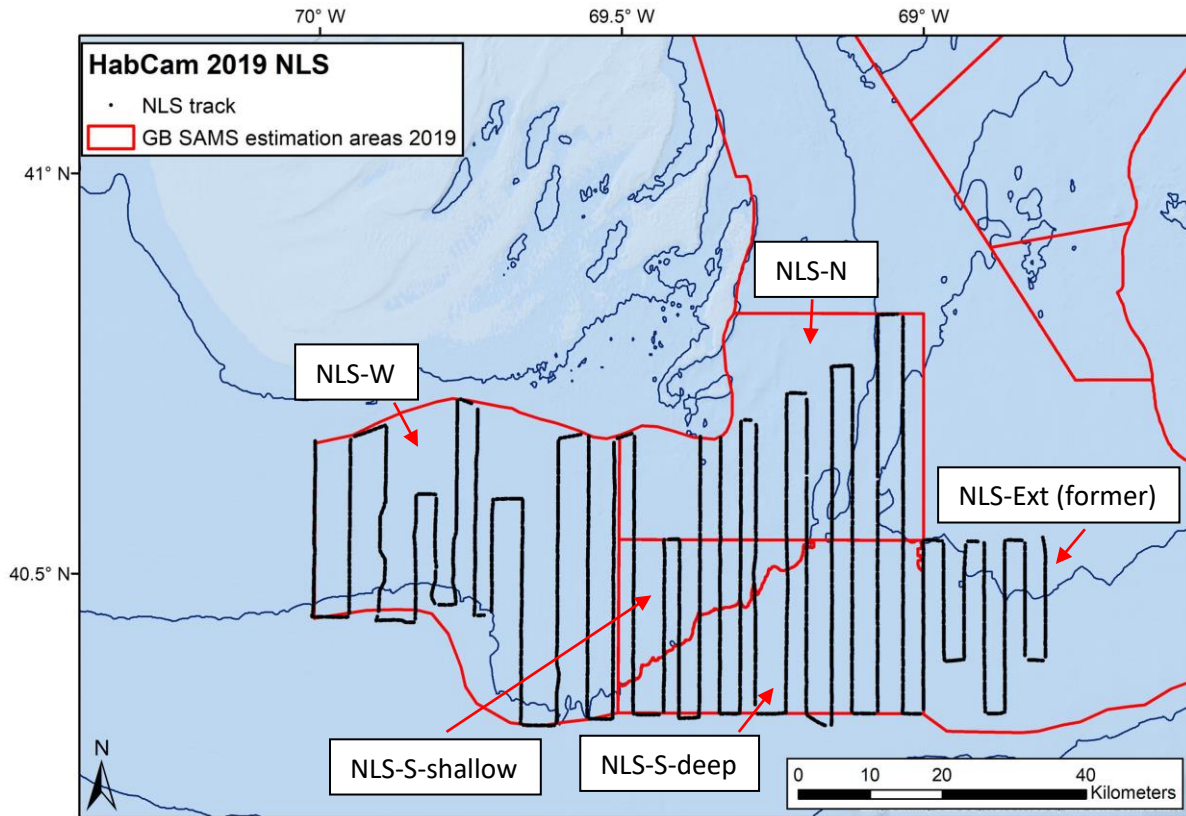




**Figure 2.** Distribution plots of scallops (top panel: pre-recruits 20-35mm, second panel: recruits 35-75mm, bottom panel: >75mm) in CA2-Access, CA2-Ext and portions of the SF. Larger circles represent more scallops per square meter in that particular size class. Scallops less than 20mm were omitted from the figure due to lack of confidence in quantitative analysis (see *Special Comments* section).

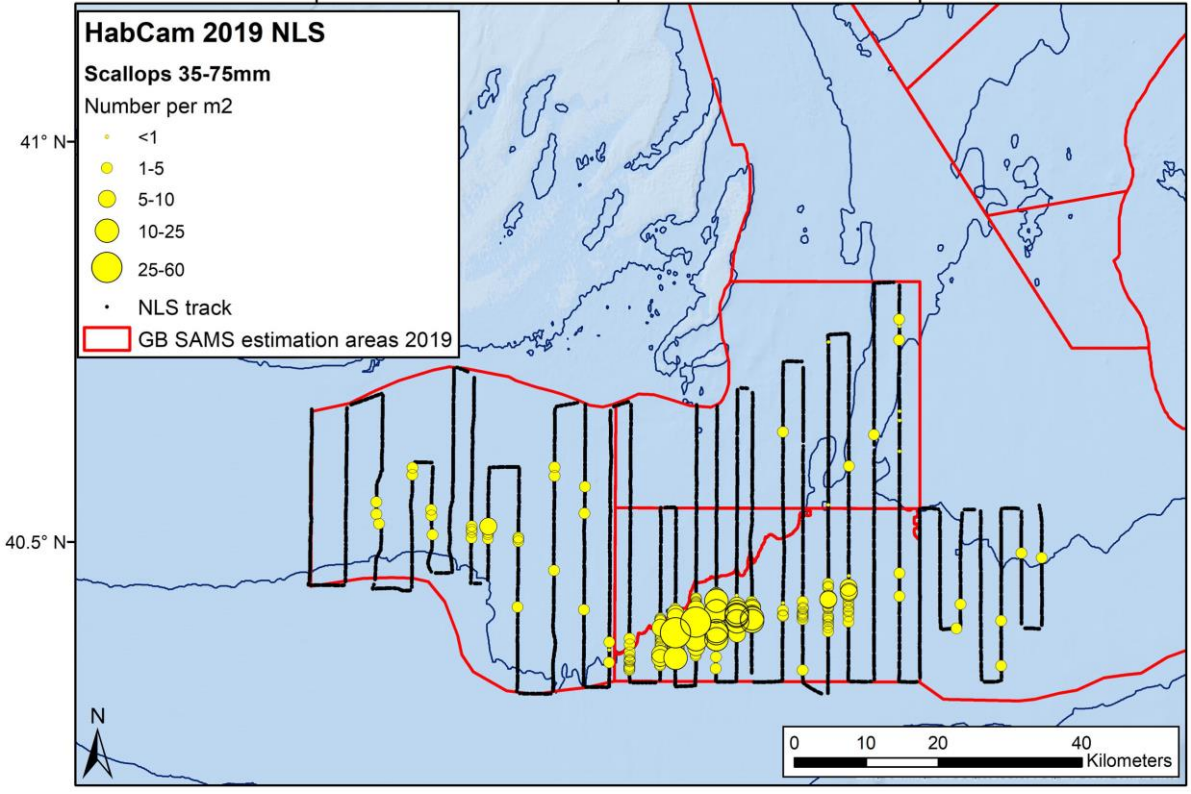
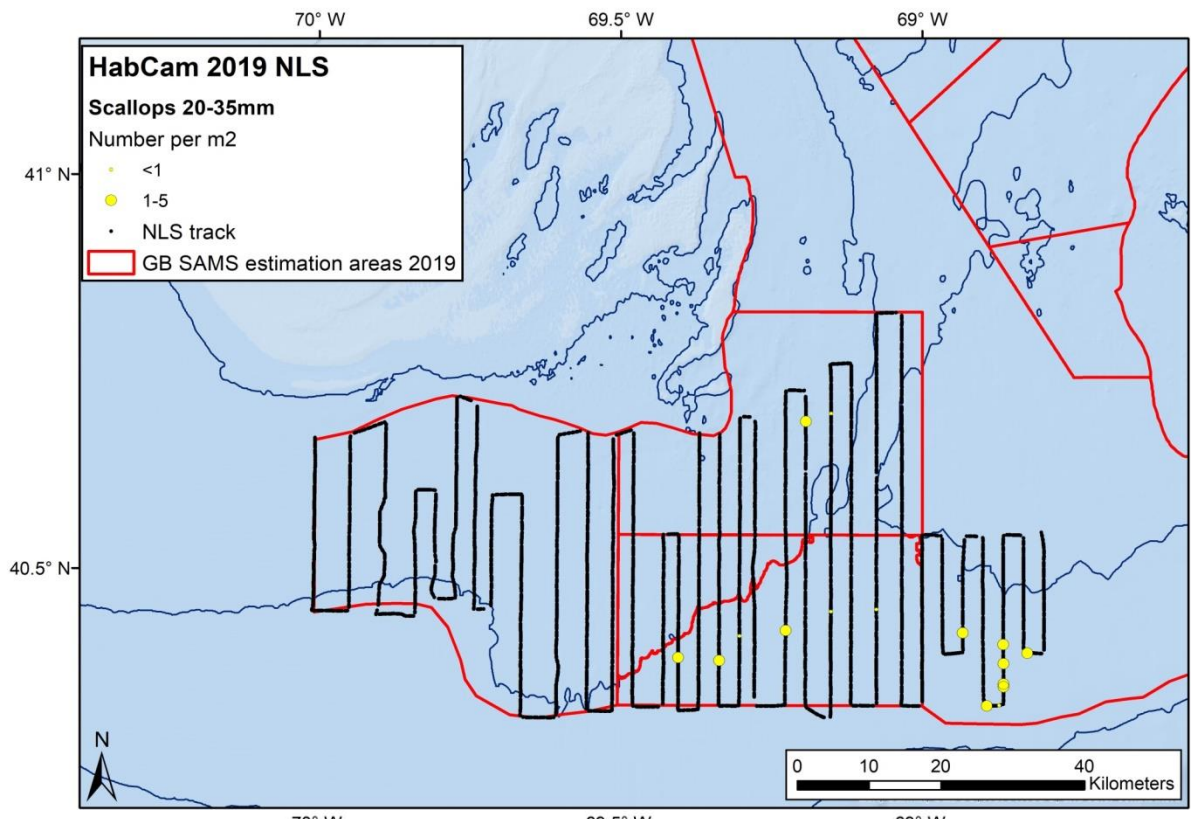
## Nantucket Lightship

The second leg of the 2019 survey took place from July 9-15, 2019 in the NLS (**Figure 3**). The NLS survey covered approximately 610 nautical miles, during which we collected roughly 2.6 million stereo image pairs, of which 6,505 were annotated, yielding an annotation rate of approximately 1:400 images. Quality control was performed on a minimum of 50% of the annotated images (QC rate was increased to 100% in areas of high scallop density).

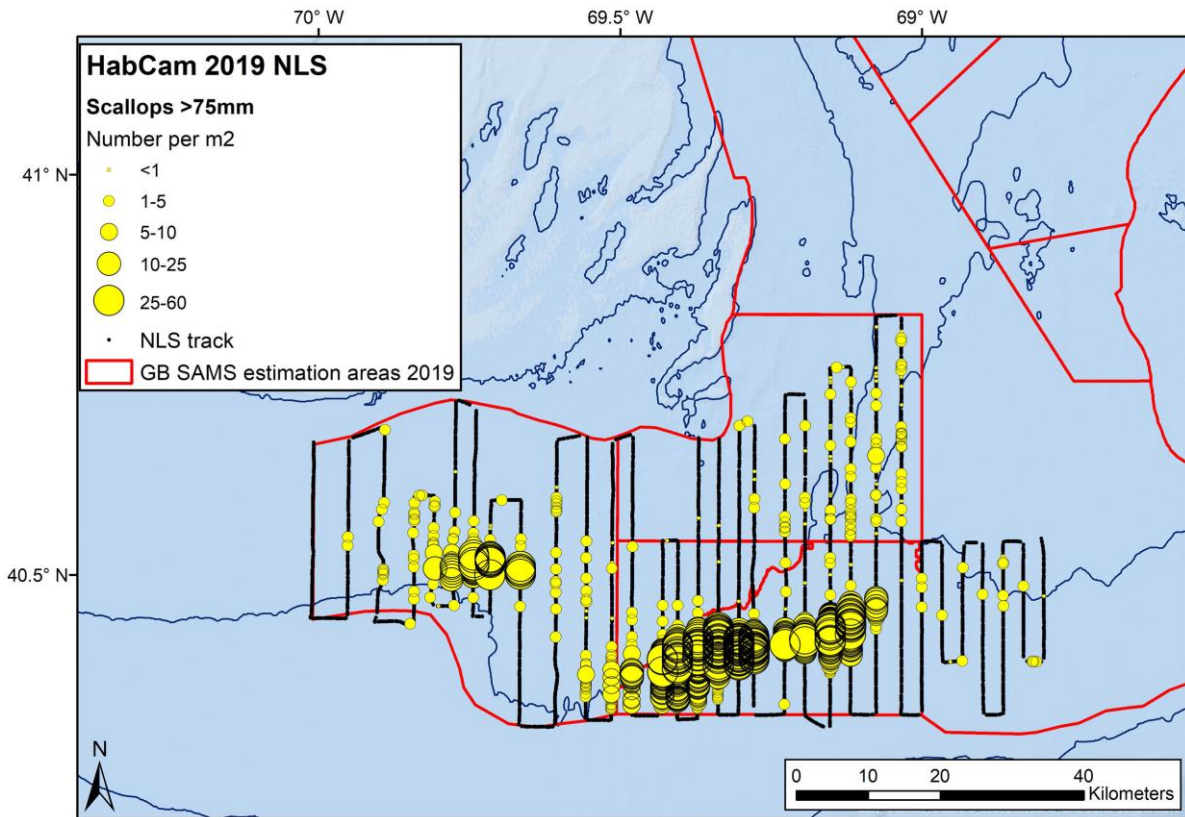


**Figure 3.** 2019 CFF RSA HabCam v3 survey tracks in the NLS.

The SAMS area in the NLS with the largest concentration of scallops >75mm was the NLS-S-deep, with the NLS-W also had a region with substantial >75mm scallop densities, despite heavy fishing pressure this season (**Figure 4**). Substantial numbers of recruit scallops (35-75 mm shell height) were present in the NLS-S-deep, though density of this size class is not as large as in 2017 & 2018. Pre-recruit scallops (<35mm) and scallop seed were not seen in substantial densities in the NLS.



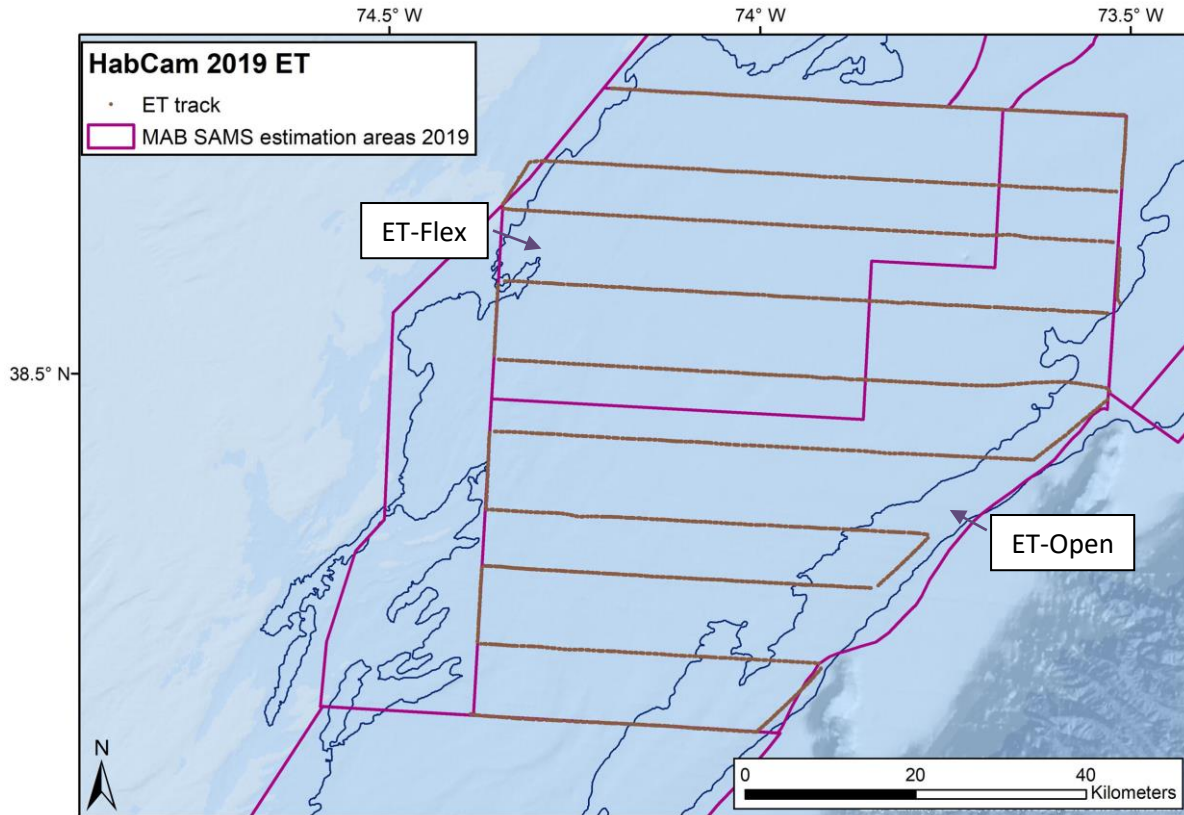




**Figure 4.** Distribution plots of scallops in the NLS SAMS areas (top panel: pre-recruits 20-35mm, second panel: recruits 35-75mm, bottom panel: >75mm) in the NLS. Larger circles represent more scallops per meter square in that particular size class.

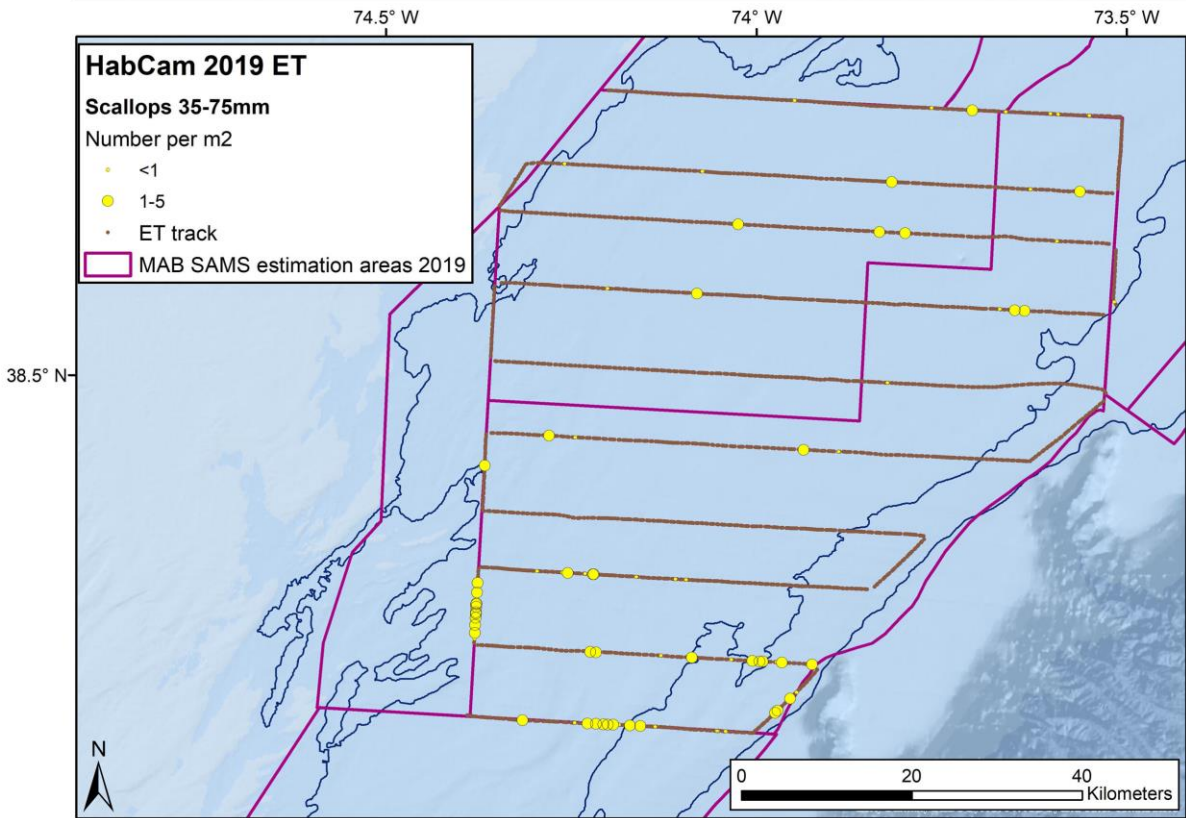
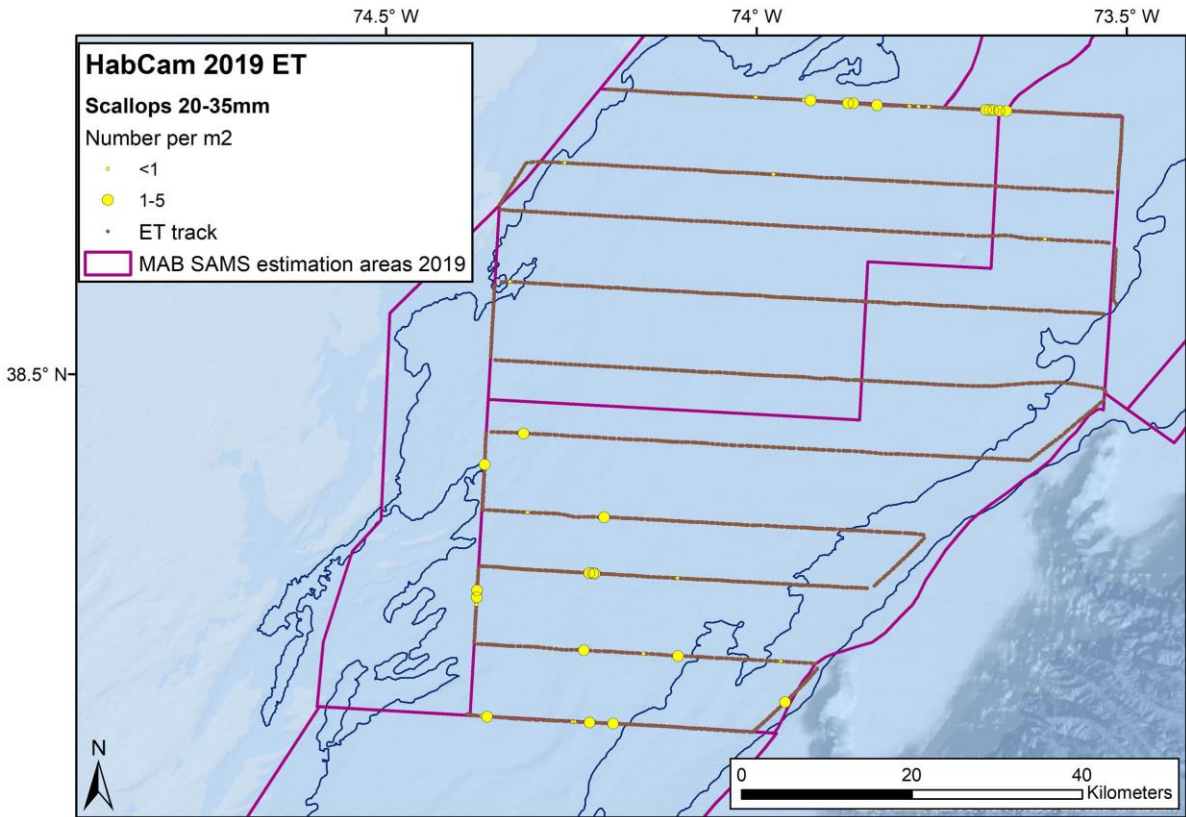
## Elephant Trunk

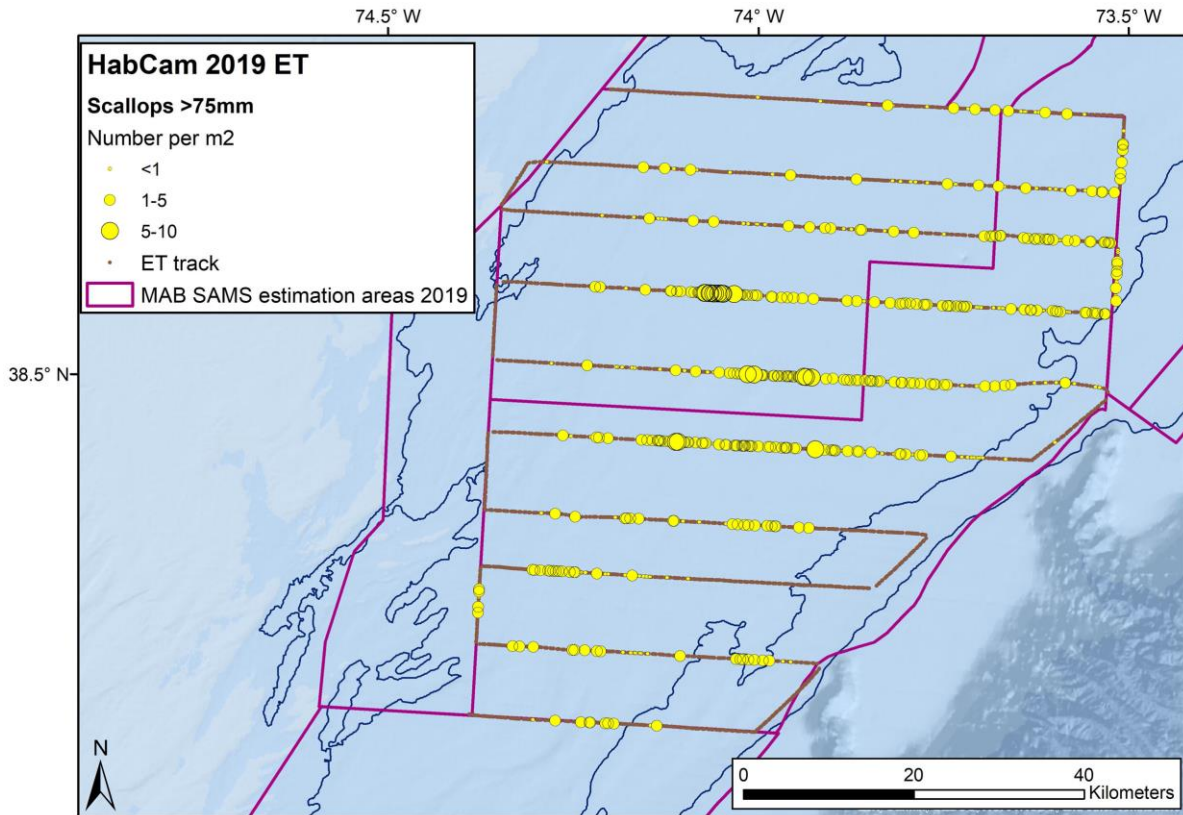
The third leg of the 2019 survey took place from July 25-30, 2019 in the ET (**Figure 5**). The ET survey covered approximately 360 nautical miles, during which we collected roughly 1.5 million stereo image pairs, of which 3751 were annotated, yielding an annotation rate of approximately 1:400 images. Quality control was performed on 100% of the annotated images.



**Figure 5.** 2019 CFF RSA HabCam v3 survey tracks in the ET.

Scallops >75mm were widely distributed over the survey track, with the most concentrated distribution in the southern portion of the ET-Flex (**Figure 6**). Recruit scallops (35-75 mm shell height) and pre-recruit scallops 20-35mm were not seen in substantial densities in the ET – however, substantial quantities of scallops <20mm were encountered at the extreme northern edge of the ET-Flex (see *Special Comments* section).



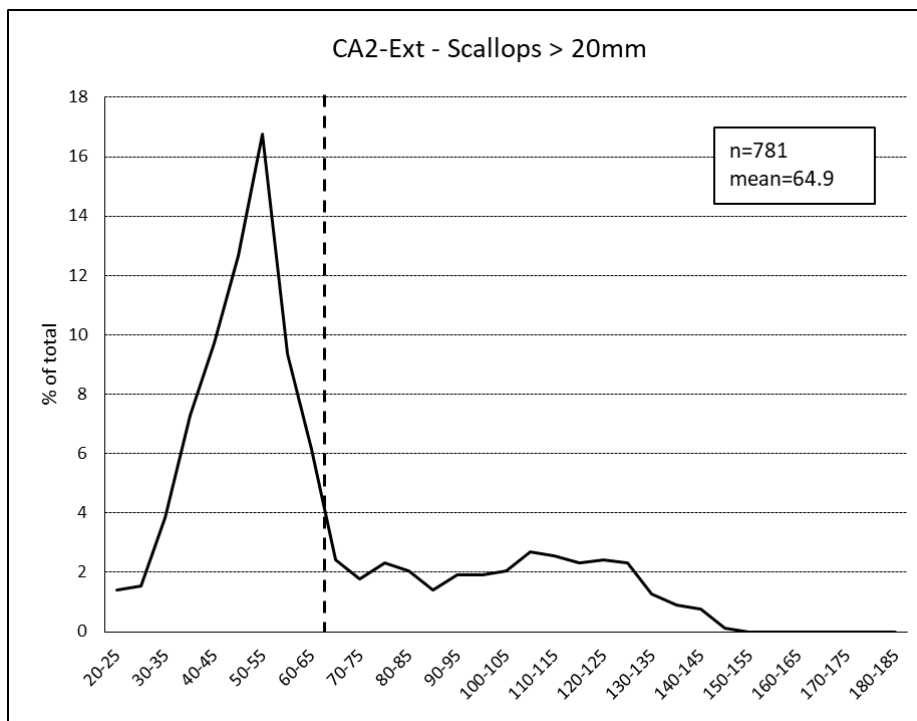
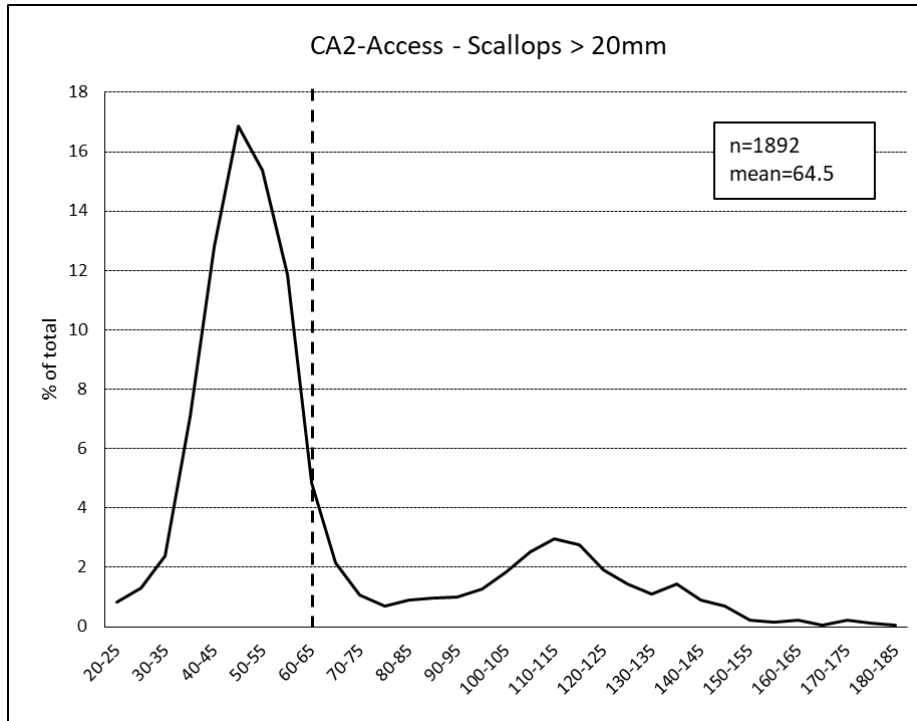


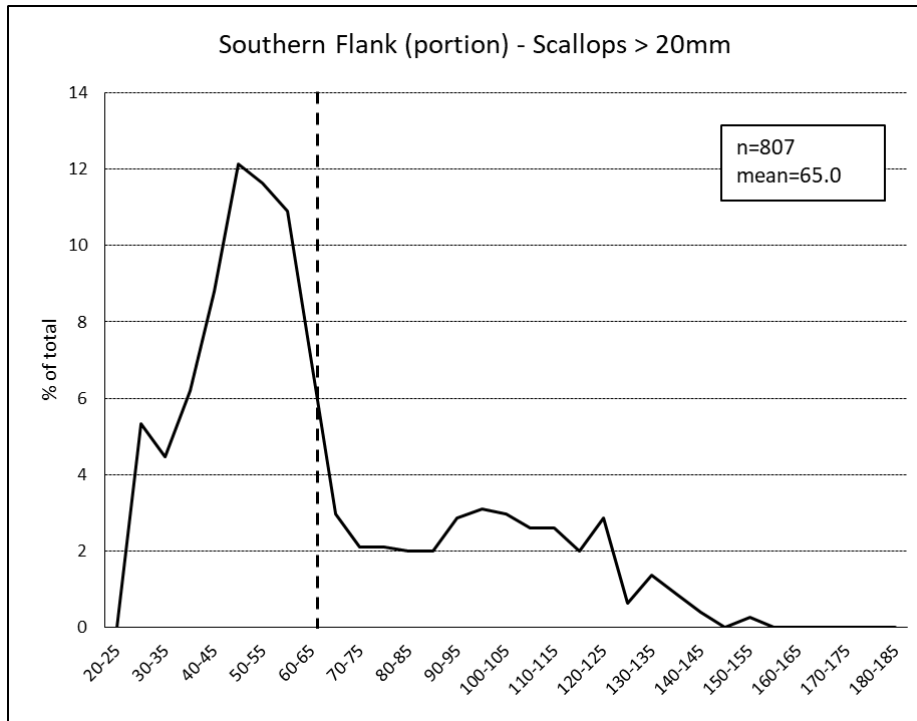
**Figure 6.** Distribution plots of scallops in the ET-Open and ET-Flex SAMS areas (top panel: pre-recruits 20-35mm, second panel: recruits 35-75mm, bottom panel: >75mm) in the NLS. Larger circles represent more scallops per meter square in that particular size class. Scallops less than 20mm were omitted from the figure due to lack of confidence in quantitative analysis (see *Special Comments* section).

### 3.0 LENGTH FREQUENCY PLOTS BY SAMS AREA

Length-frequency (L-F) plots are presented below. Due to variation in image quality and altitude impacting our ability to accurately quantify scallops < 20mm, scallops < 20mm were excluded from L-F plots in CA2 / SF and ET (no scallops < 20mm were found in the NLS).

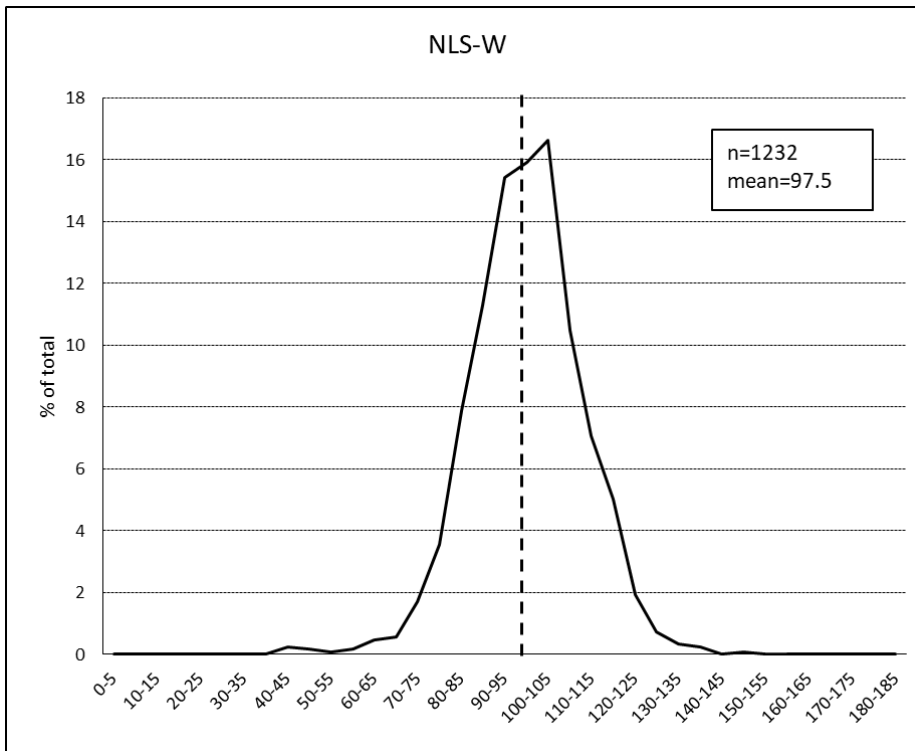
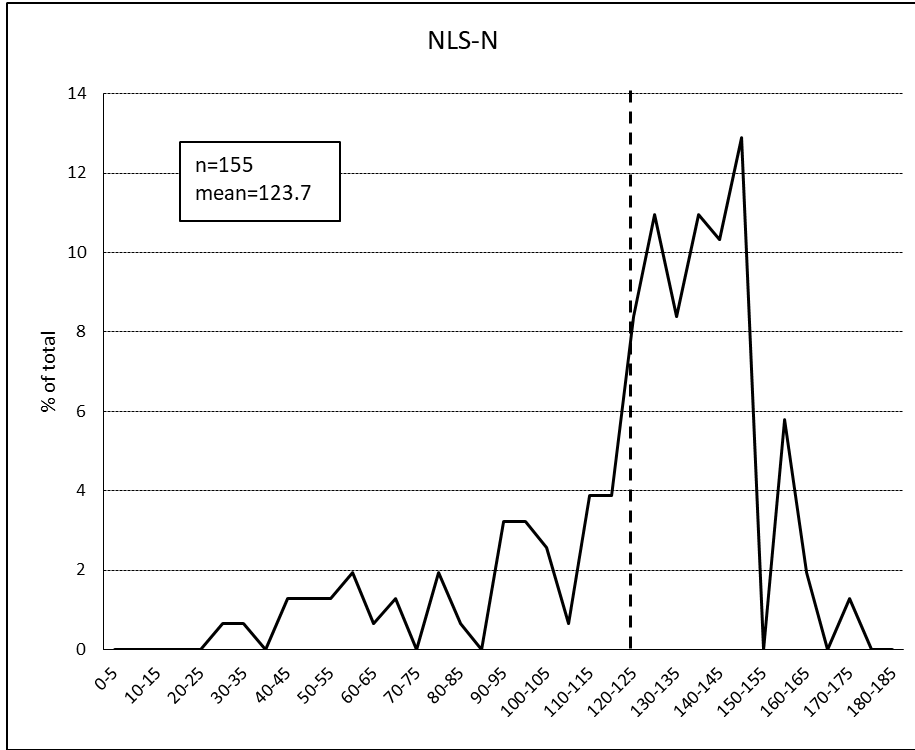
#### Closed Area 2 / Southern Flank (portion)

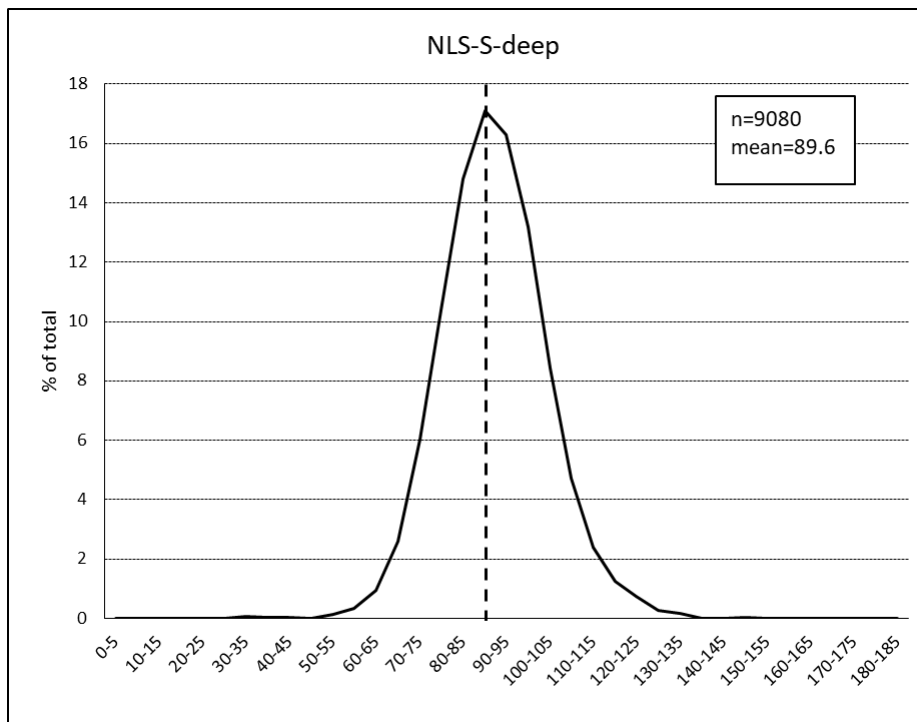
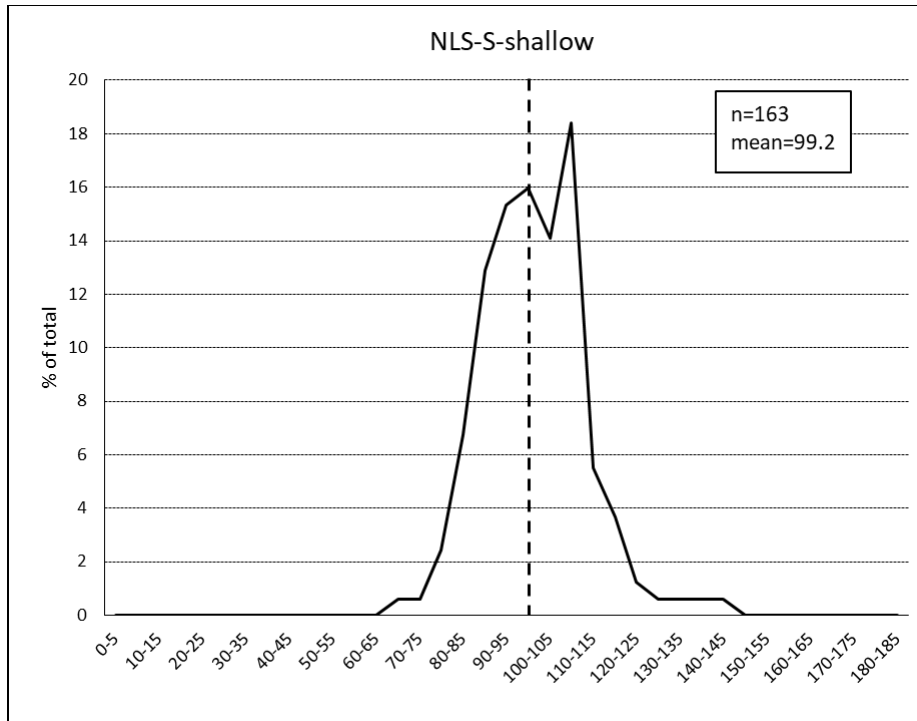




**Figure 7.** 2019 RSA HabCam length-frequency plots of sea scallops by SAMS area in CL2-Access (top panel), CL2-Ext (middle panel), and SF (portion; bottom panel). n=total number of scallops counted. Dashed line represents 5mm bin where mean shell height is contained. Scallops less than 20mm were not included in length-frequency plot due to lack of confidence in quantitative assessment.

# Nantucket Lightship

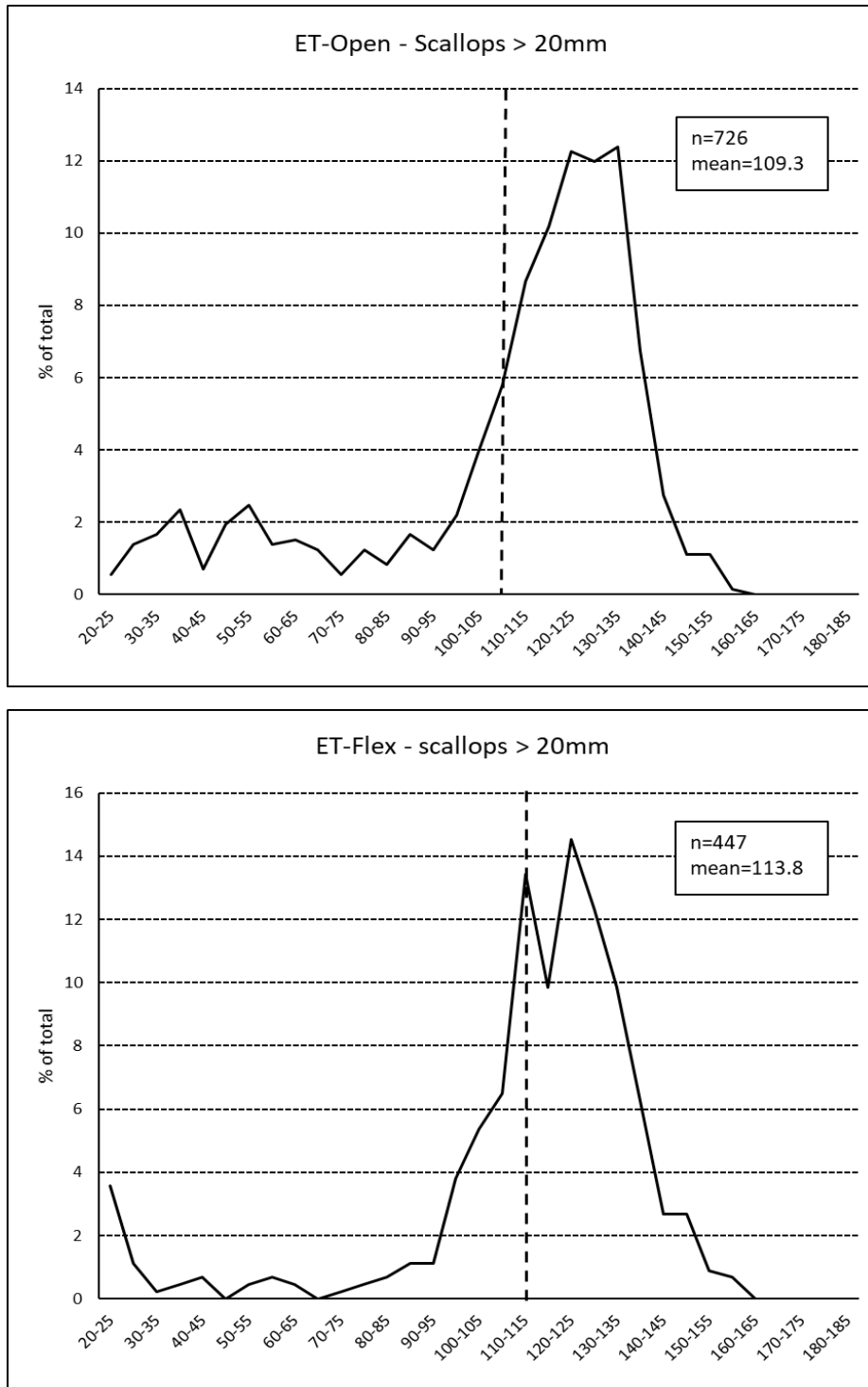




**Figure 8.** 2019 RSA HabCam length-frequency plots of sea scallops by SAMS area in NLS-N (top panel), NLS-W (second panel), NLS-S-shallow (third panel), and NLS-S-deep (bottom panel). n=total number of scallops counted. Dashed line represents 5mm bin where mean shell height is contained.



## Elephant Trunk



**Figure 9.** 2019 RSA HabCam length-frequency plots of sea scallops by SAMS area in ET-Open (top panel) and ET-Flex (bottom panel). n=total number of scallops counted. Dashed line represents 5mm bin where mean shell height is contained. Scallops less than 20mm were not included in length-frequency plot due to lack of confidence in quantitative assessment.

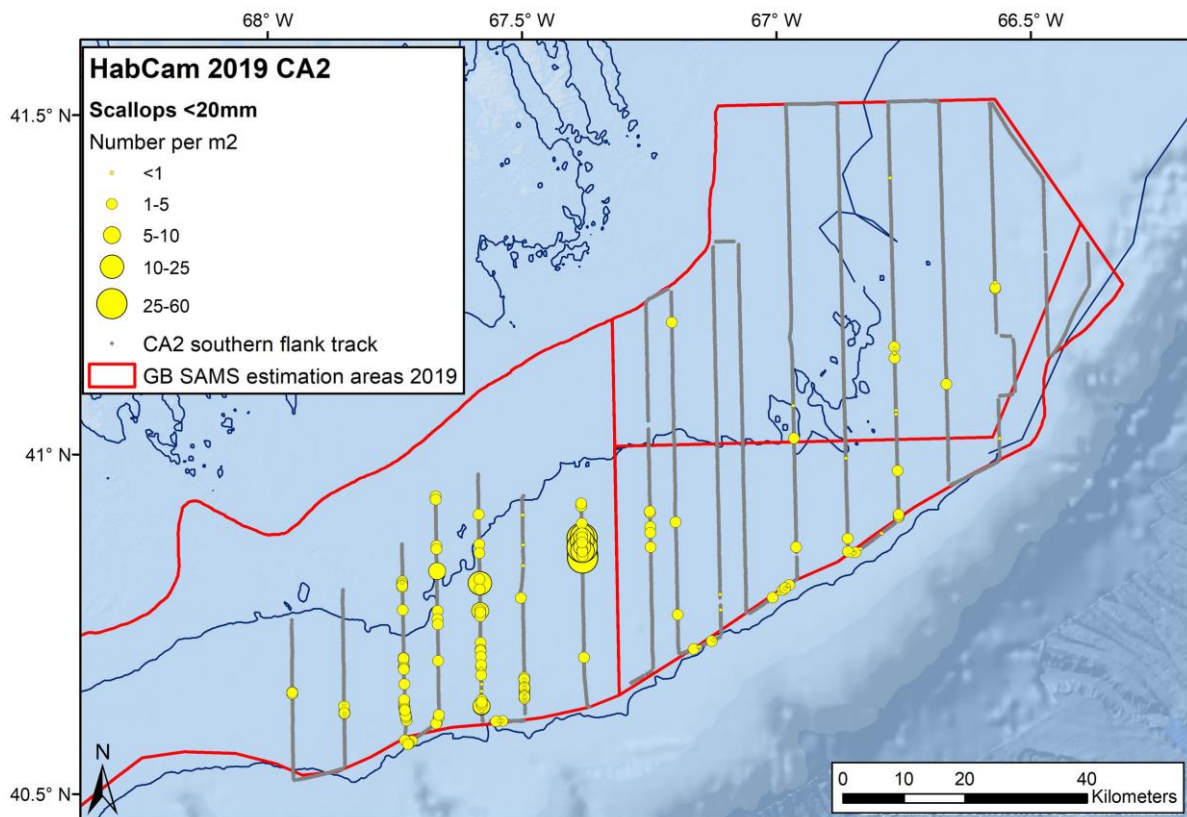
#### 4.0 SPECIAL COMMENTS

- A comparison of estimated total biomass in NLS SAMS areas using SH-MW equations from VIMS 2016-2019 and SARC 65 is presented in **Table 2**.

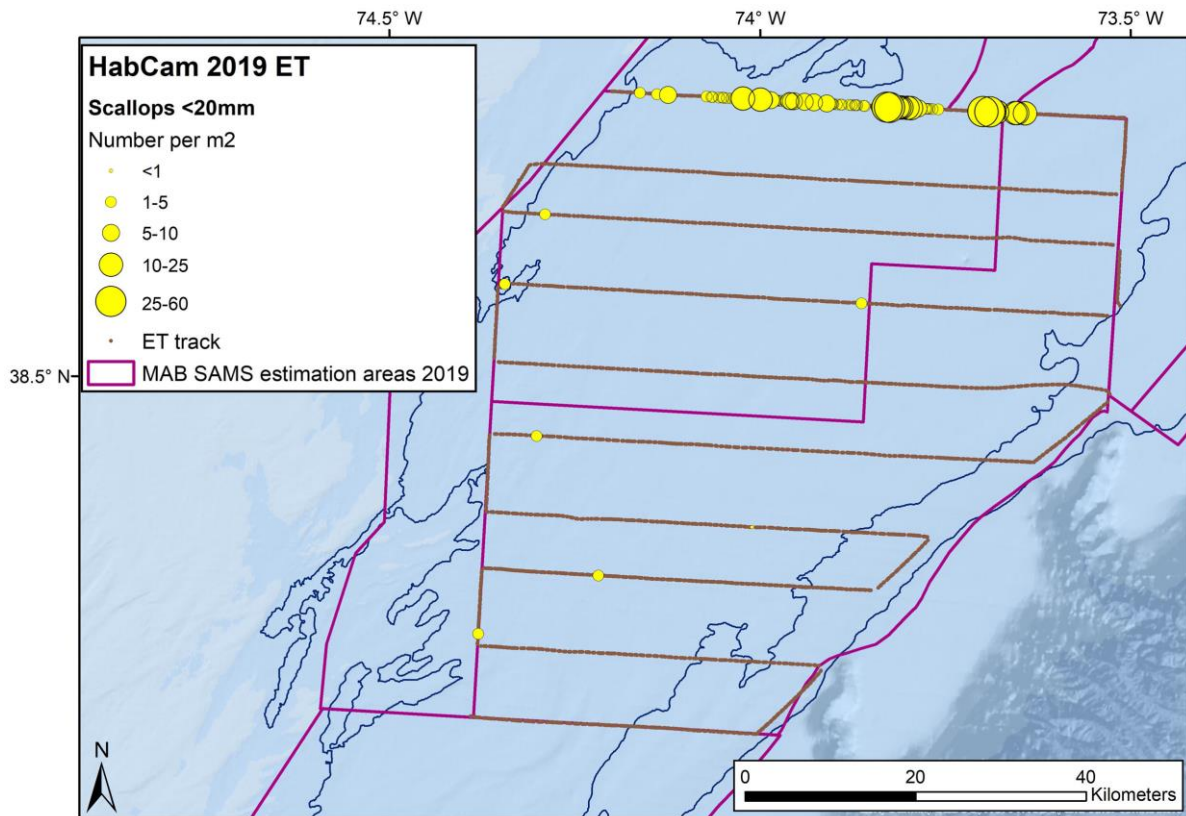
**Table 2.** Comparison of estimated total biomass in NLS SAMS areas using SH-MW equations from VIMS 2016-2019 and SARC 65

SAMS Area	Biomass	
	VIMS 2016-2019	SARC 65
NLS-North	3066.38	3295.44
NLS-South-deep	46060.47	48350.22
NLS-South-shallow	3420.05	4197.21
NLS-West	12574.7	17701.15

- Substantial quantities of scallop seed were noted in annotations in the eastern portion of the SF (**Figure 10**) and the northern extreme of the ET-Flex (**Figure 11**). Altitude and turbidity greatly influenced image quality which impacted whether we could positively identify all scallops seed in annotated images with a high degree of confidence. Thus, data for scallop seed should only be used qualitatively.

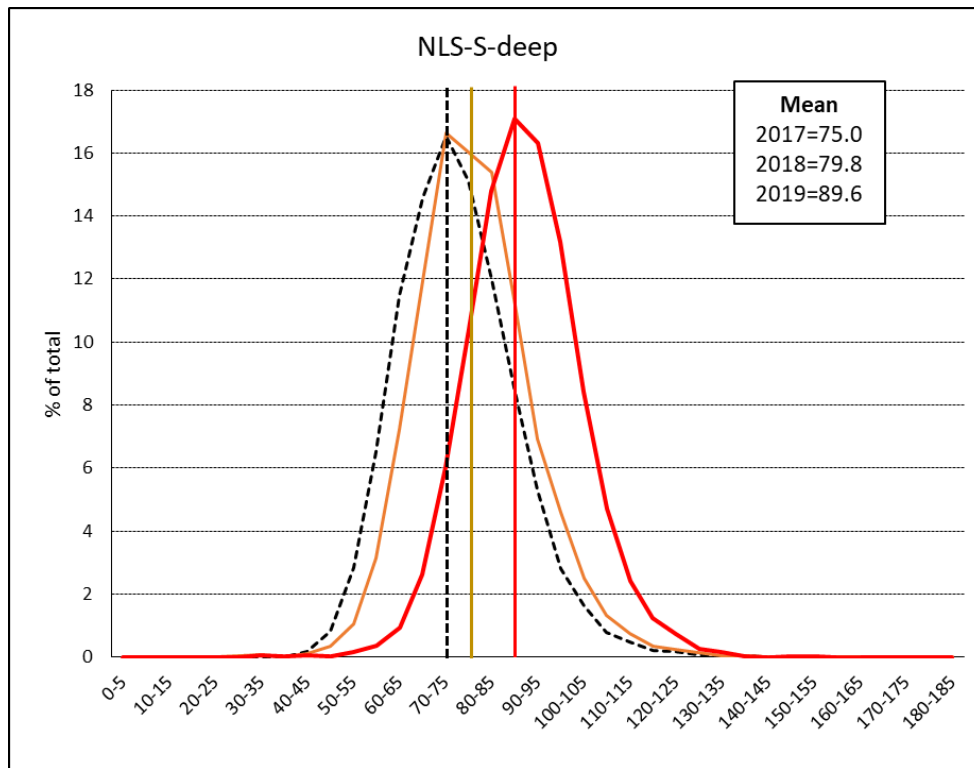


**Figure 10.** Distribution plot of scallops less than 20mm shell height observed in CA2 / SF during the 2019 RSA HabCam survey.



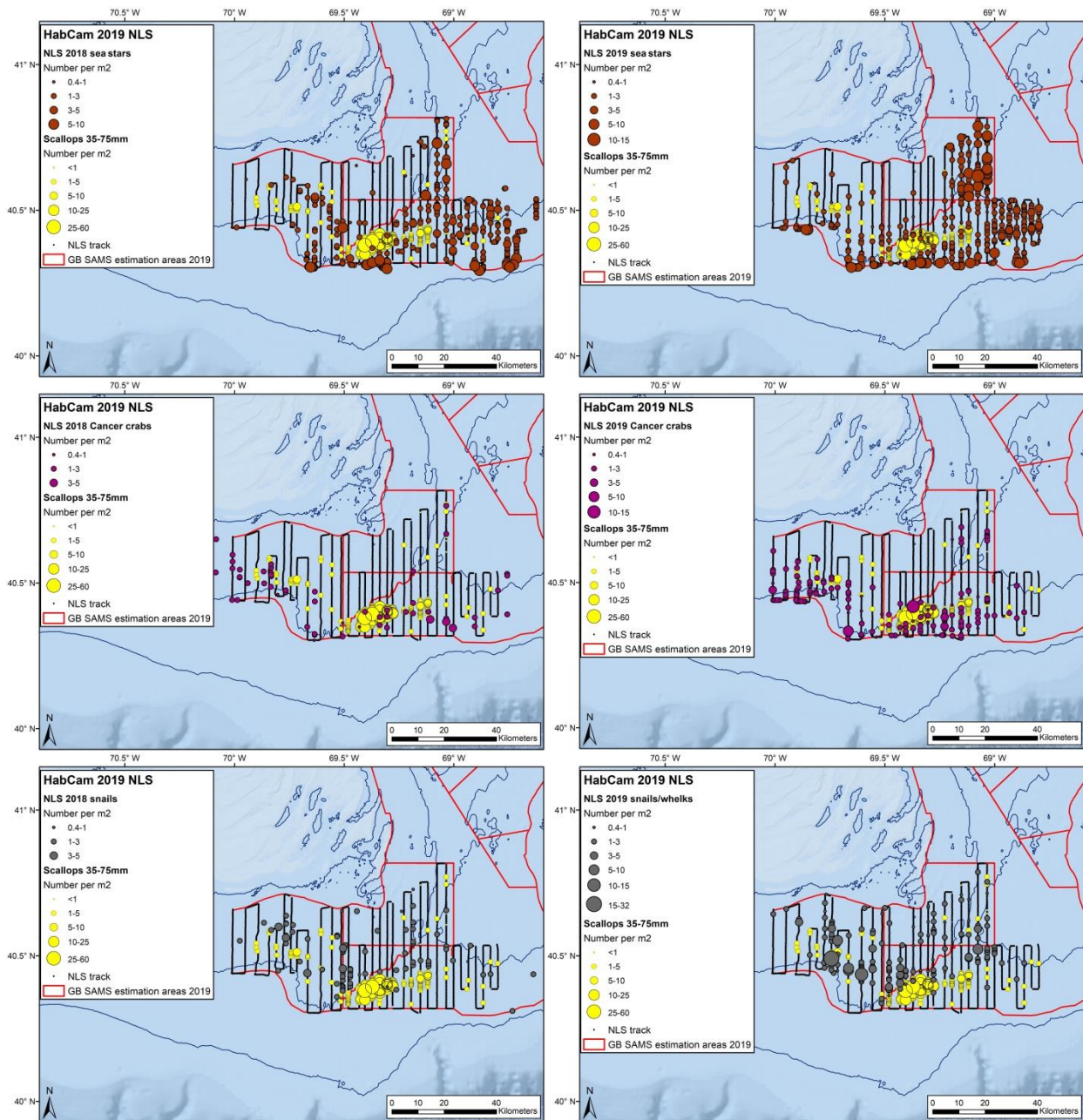
**Figure 11.** Distribution plot of scallops less than 20mm shell height observed in the ET during the 2019 RSA HabCam survey.

- Time series length-frequency plots of sea scallops in the NLS-S-deep 2017-2019 indicate an increased growth rate 2018-2019 as compared to 2017-2018 (as indicated by shell height; **Figure 12**).



**Figure 12.** Length-frequency plot of sea scallops observed in the deep (>70m) portions of the NLS-S SAMS area in 2017 (black dashed line), 2018 (orange solid line) and 2019 (red solid line). Vertical line represents 5mm bin where mean shell height is contained.

- Scallop predator distributions (sea stars, cancer crabs and moon snails / whelks) in the NLS 2018 and 2019 (overlaid on 2019 recruit scallop distribution) are presented in **Figure 13**.



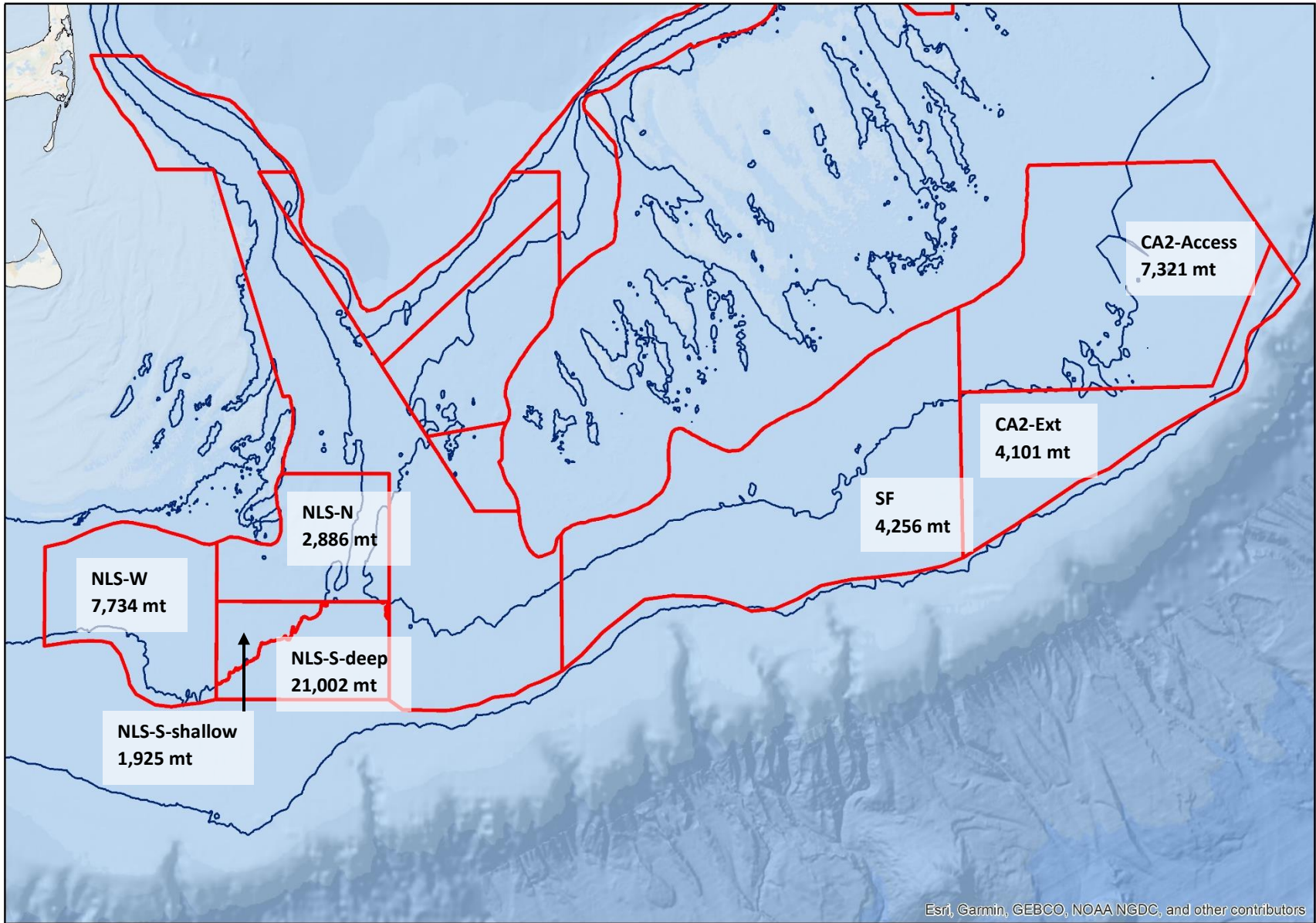
**Figure 13.** Scallop predator distributions (sea stars: top panels; cancer crabs: middle panels; and moon snails / whelks: bottom panels) in the NLS in 2018 (left panels) and 2019 (right panels). Predator distributions are overlaid on 2019 NLS scallop density for scallops 35-75mm.

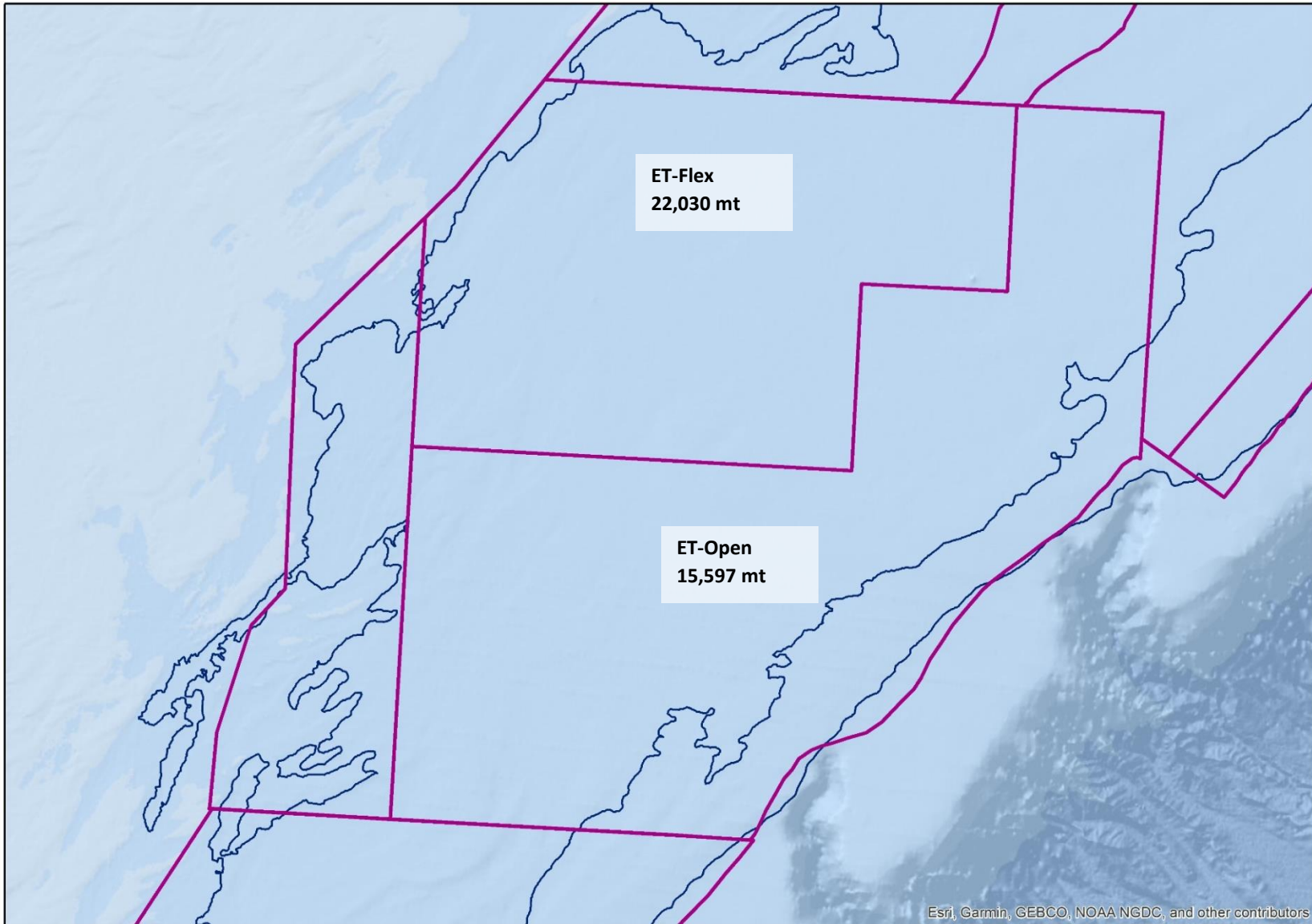
## 5.0 EXPLOITABLE BIOMASS ESTIMATES FOR 2019 (CURRENT FY)

**Table 3.** Survey exploitable biomass\* estimates by SAMS area.

<b>HabCam v3</b>				
<b>Georges Bank</b>	<b>NumMill</b>	<b>Exploitable BmsMT</b>	<b>SE</b>	<b>MeanWt</b>
CL1-Access				
CL1-Sliver				
CL1-South				
CL2-North				
CA2-Access*	200.2	7320.7	222.6	36.6
CA2-Ext*	151.5	4100.5	71.5	27.1
NLS-North*	58.4	2886.4	356.9	49.4
NLS-South-shallow	104.9	1924.5	5.2	18.4
NLS-South-deep	1410.7	21002	396.8	14.9
NLS-West	331.3	7734.1	2226.1	23.4
NF				
GSC				
SF*	140.2	4256.4	94.1	30.4
<b>MidAtlantic</b>				
BI				
LI				
NYB				
MA inshore				
HCSAA				
ET Open*	545.3	15596.5	207	28.6
ET Flex*	680.9	22029.9	413.8	32.4
DMV				
Virginia				

\*: Exploitable biomass based on combined NEFSC and CFF HabCam data in CA2-Access, CA2-Ext, SF, NLS-N, ET-Open, and ET-Flex.





**Figure 14.** Exploitable biomass by SAMS area in CA2 / SF, NLS (top panel) and ET (bottom panel) derived from 2019 RSA and NEFSC HabCam data (NEFSC and CFF data combined in all areas except NLS-S-deep, NLS-S-shallow, and NLS-W). SARC 65 SH-MW equations used for CA2 / SF, and ET; VIMS 2016-2019 SH-M equations used for NLS.