An Assessment of Sea Scallop Abundance and Distribution in the Mid-Atlantic Bight

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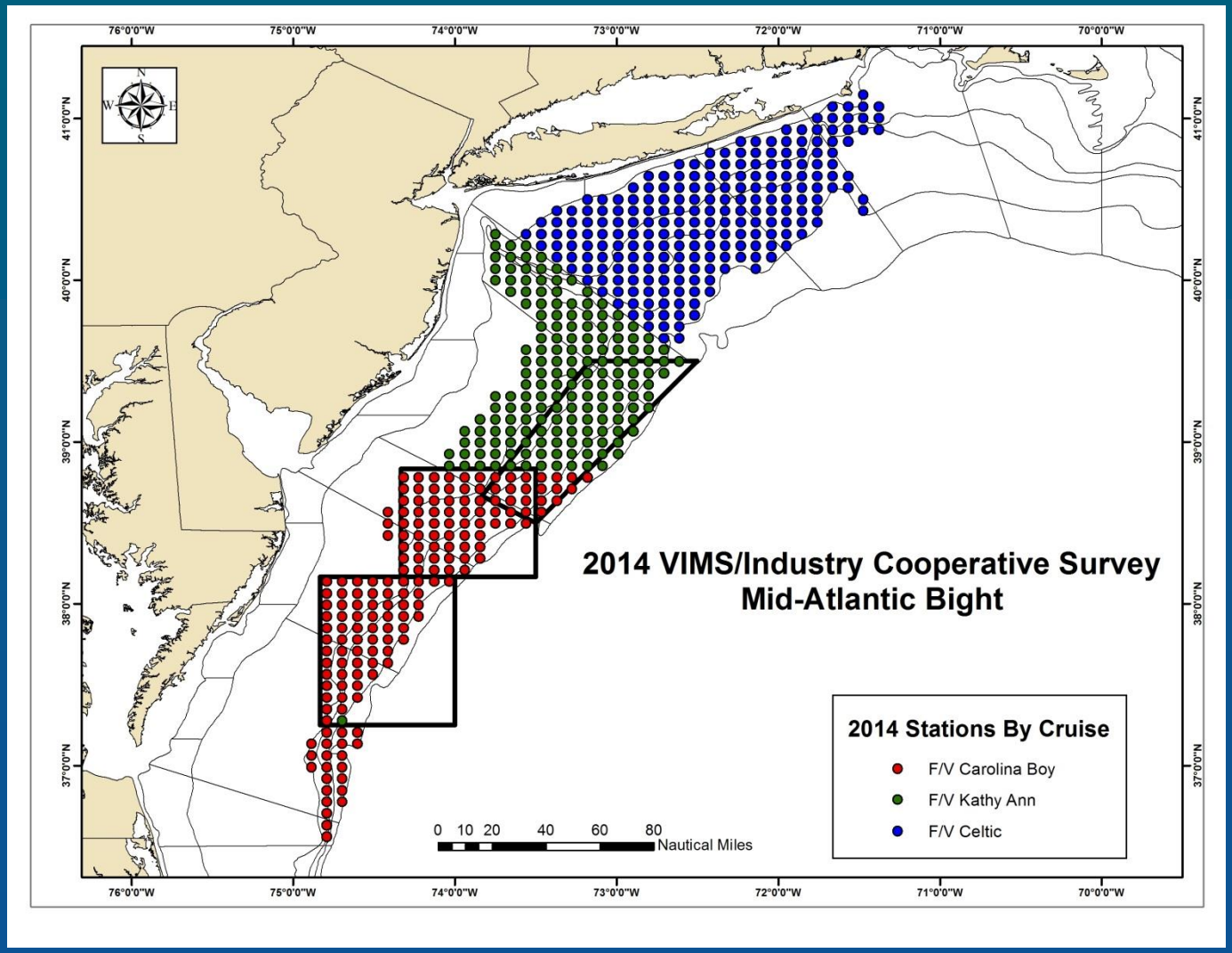
Preliminary – PDT use only.

2014 VIMS-Industry Cooperative Surveys

The 2014 Campaign – Mid-Atlantic Bight



2014 VIMS-Industry Cooperative Surveys
Primary Project Objectives

- **Assess the abundance and distribution of scallops in the Mid-Atlantic Bight.**
  - **Mid-Atlantic Bight (Block Island to VA/NC)**
    - **HCCA, DMV, ETCA, SAMS Area**

- **Estimate exploitable biomass**
  - **Biomass of scallops available for capture with 4 inch ring commercial dredge.**

2014 VIMS-Industry Cooperative Surveys
Secondary Project Objectives

- **Gear performance**
  - Estimate size selectivity and relative performance of 4.0 ring turtle CFTDD.
- **Scallop Biology & Product Quality**
  - Spatially and temporally explicit shell height:meat weight relationships.
  - Assess metrics associated with product quality.
  - Examine the incidence and pathology of the shell disease observed in the MAB.
- **Finfish Bycatch**
  - By utilizing a commercial dredge we can get a snapshot of finfish bycatch rates and species assemblages in the surveyed areas.
- **Additional Sample Requests**
  - Whelks, scallop genetic material

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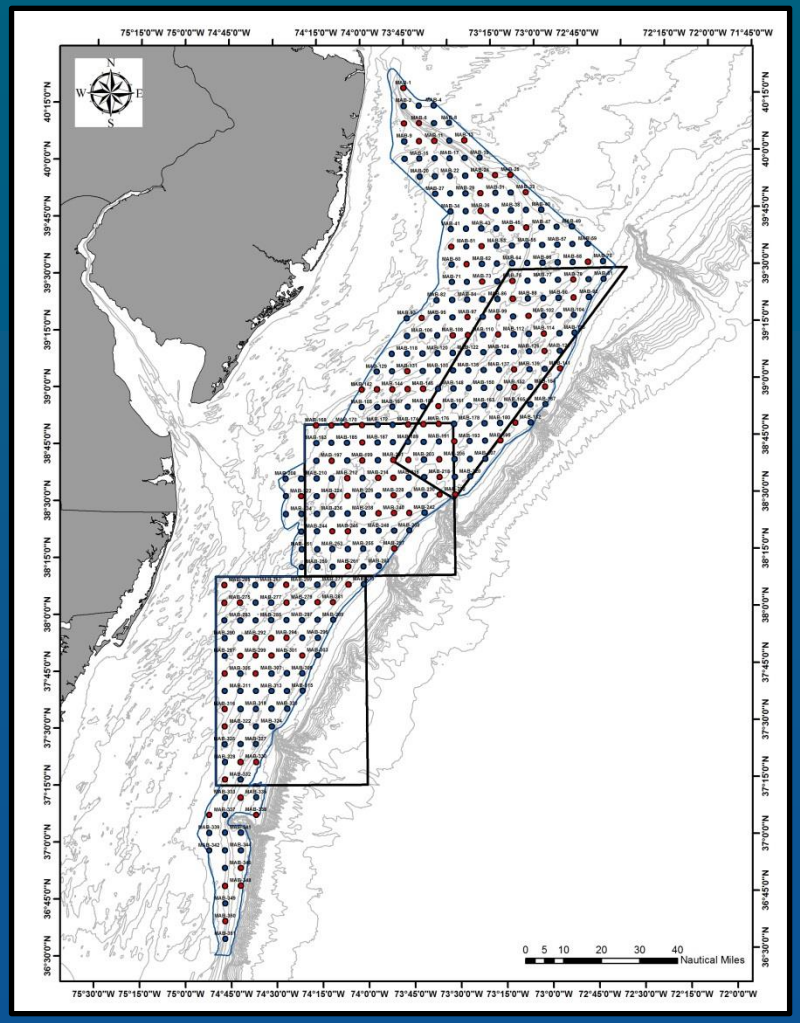
Survey Design



- **Stations:**
  - Systematic design (grid) with random start point
  - Constrained by depth (offshore), NMFS strata and prior survey information.
- **15 minute tow time**
- **3.8-4.0 kt. tow speed**
- **3:1 scope**

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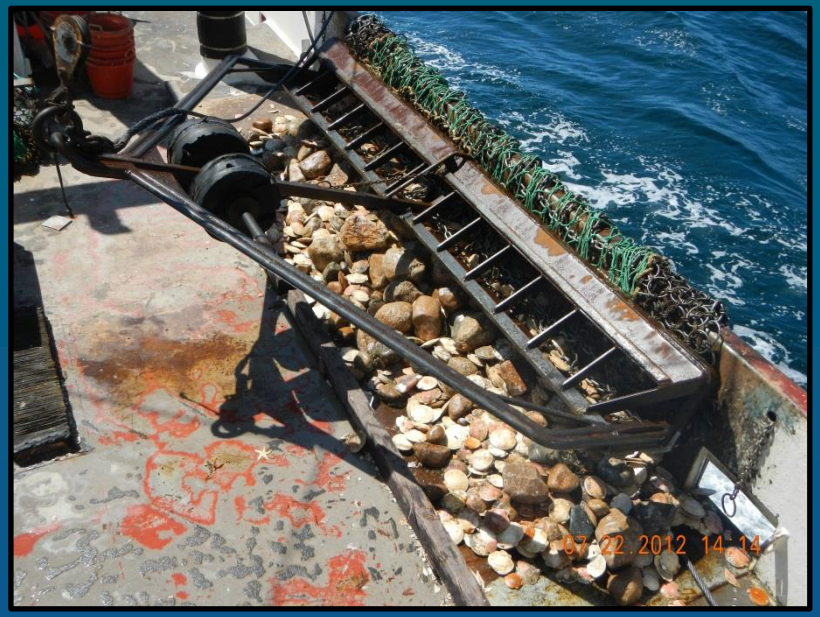
Sampling Gear



Coonamessett Farm Turtle Deflector Dredge

- 15 ft. or 14 ft. width
- 4 inch rings
- No liner
- 10 inch twine top

NMFS Sea Scallop Survey Dredge

- 8 ft. width
- 2 inch rings
- 1.5 inch liner
- 3.5 inch twine top
- No chains in the areas surveyed

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Sampling Protocol

- Standard sampling protocol
- Sample scallops for length frequency 1 mm resolution (sub-sample depending upon total volume)
- Sample finfish for length frequency
- Volumetric measure of trash
- Samples for SH:MW
- Assessment of product quality parameters and MAB shell disease.

2014 VIMS-Industry Cooperative Surveys
Analytical Framework

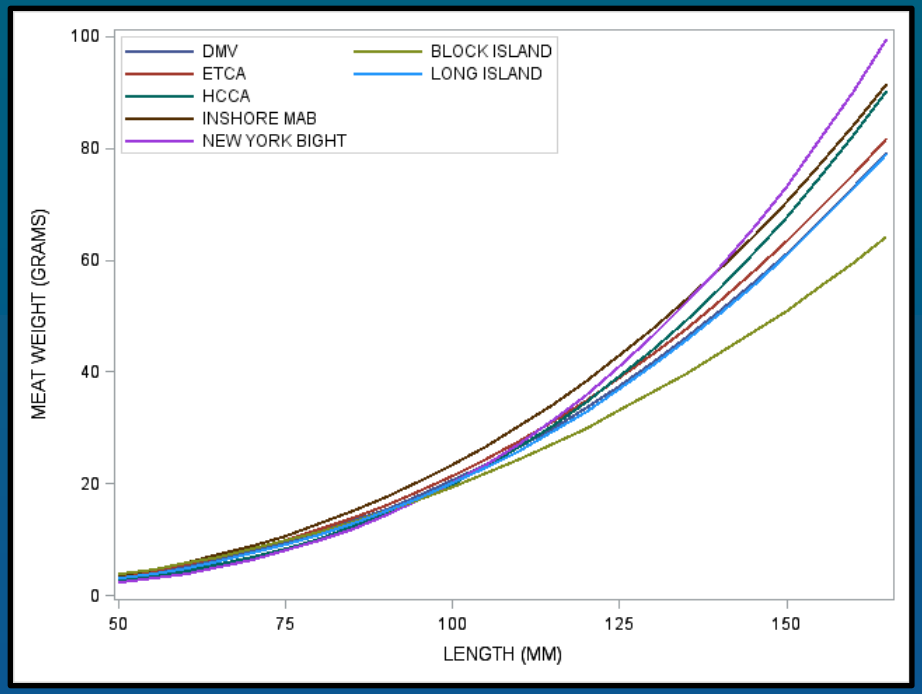
- **Area swept per tow**
  - Navigational info
  - Tilt sensor
- **Catch weight per tow**
  - Length frequencies
  - Length-weight relationship (for this analysis regional SARC 50).
  - Selectivity (Yochum and DuPaul, 2008)
- **Efficiency (constant)**
  - Values from SARC 2014
    - 65%Commercial Dredge
    - 41% NMFS Survey Dredge
- **Sub-Area (constant)**
  - HCCA - 4,201 km^2 (<50 fathoms)
  - DMV - 4,462 km^2 (<50 fathoms)
  - ETCA - 4,527 km^2 (<50 fathoms)
  - Block Island- 962 km^2
  - Inshore MAB – 2,939 km^2
  - Long Island – 13,786 km^2
  - New York Bight – 4,929 km^2
  - Virginia – 747 km^2
  - Stratum 12– 563 km^2

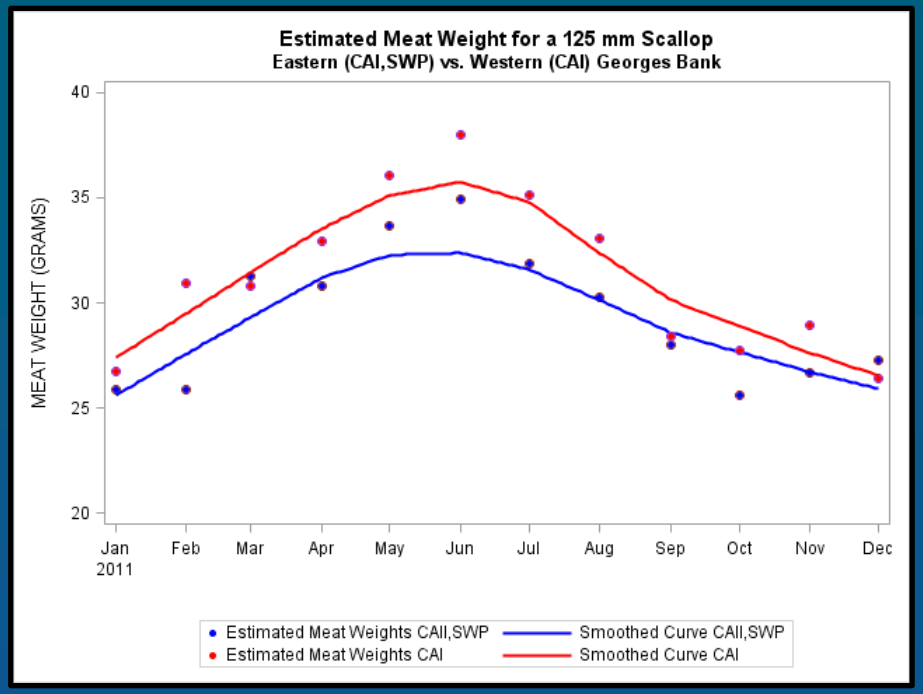
$$TotalBiomass = \sum_{j} \left(\frac{\left(\frac{CatchWtperTowinSubarea_{j}}{AreaSweptperTow} \right)}{Efficiency} \right) SubArea_{j}$$

2014 VIMS-Industry Cooperative Surveys
SH:MW Relationship

- 1375 SH:MW samples were taken from randomly selected stations. (~10/station).
- 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…).
- Average depth was calculated for each tow from tilt sensor
- A GLMM was used to fit model (Gamma distribution, log link, random effect at the station level) with SAS PROC GLIMMIX.

2014 VIMS-Industry Cooperative Surveys
SH:MW Results





- **MAB SAMS Areas**
  - **Significantly different relationships between areas.**
  - **Likely a function of average depths for each of subarea, as well as the temporal spread of the sampling**

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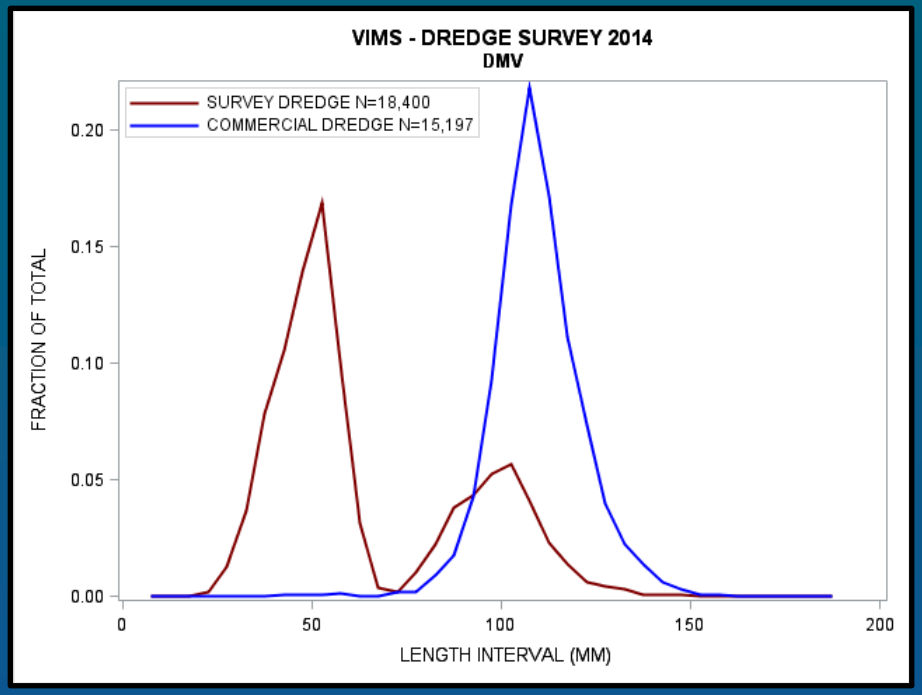
SH:MW Results – By Cruise and SAMS Area

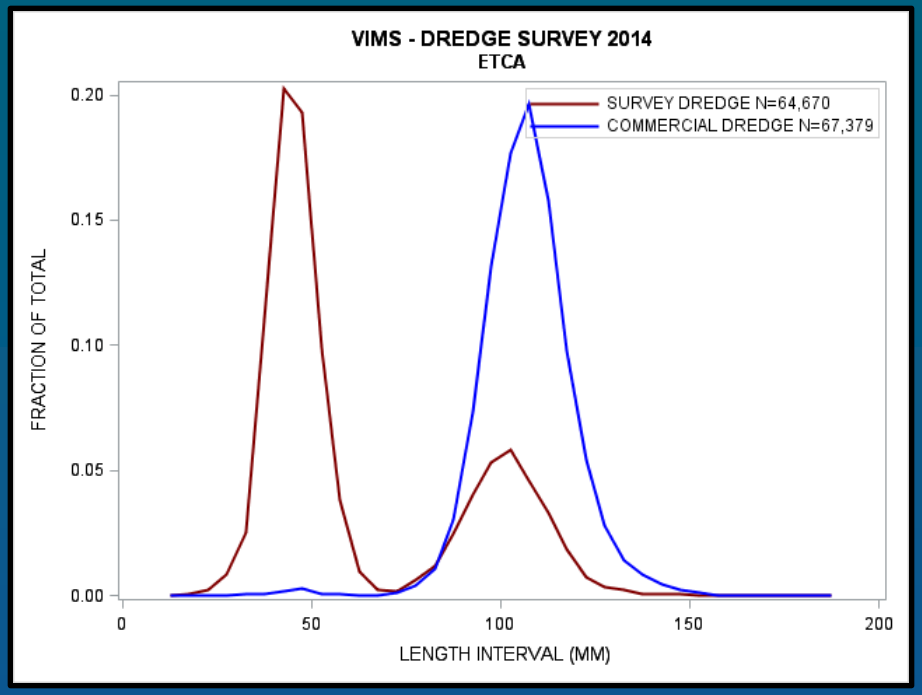
SAMS Area	Survey Date	Avg Depth (m)	VIMS Est@120mm	SARC 50 Est@120mm	% Difference
DMV	May, 2014	52.66	33.49	29.88	10.8%
ETCA	May, 2014	48.23	34.85	31.19	10.5%
Inshore MAB	June, 2014	40.14	38.33	34.12	11.0%
HCCA	June, 2014	56.74	34.38	28.81	16.2%
NYB	June, 2014	40.14	35.11	34.12	2.8%
Block Island	July, 2014	50.6	29.93	30.47	-1.8%
Long Island	July, 2014	49.01	32.95	30.95	6.1%

- **These results highlight the spatial and temporal variability in the SH:MW relationship.**
- **There was also an indication the in some cases this year, depth was not a strong predictor of MW especially early in the season.**
- **Biomass of an area is a dynamic process that has significant spatial and temporal components that warrant consideration in the specification process.**

2014 VIMS-Industry Cooperative Surveys

Length Frequency- Cruise 1

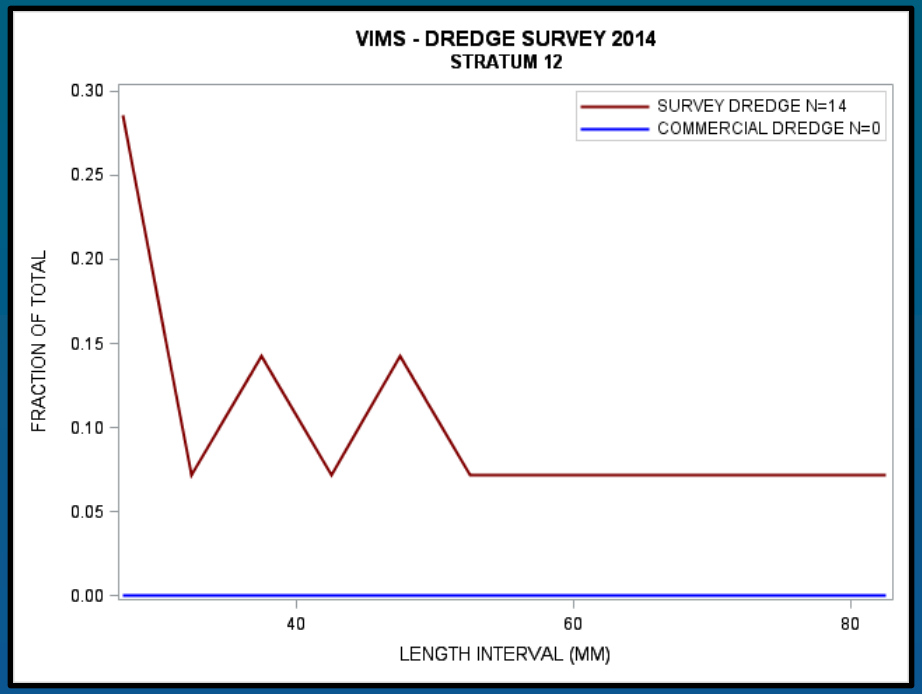


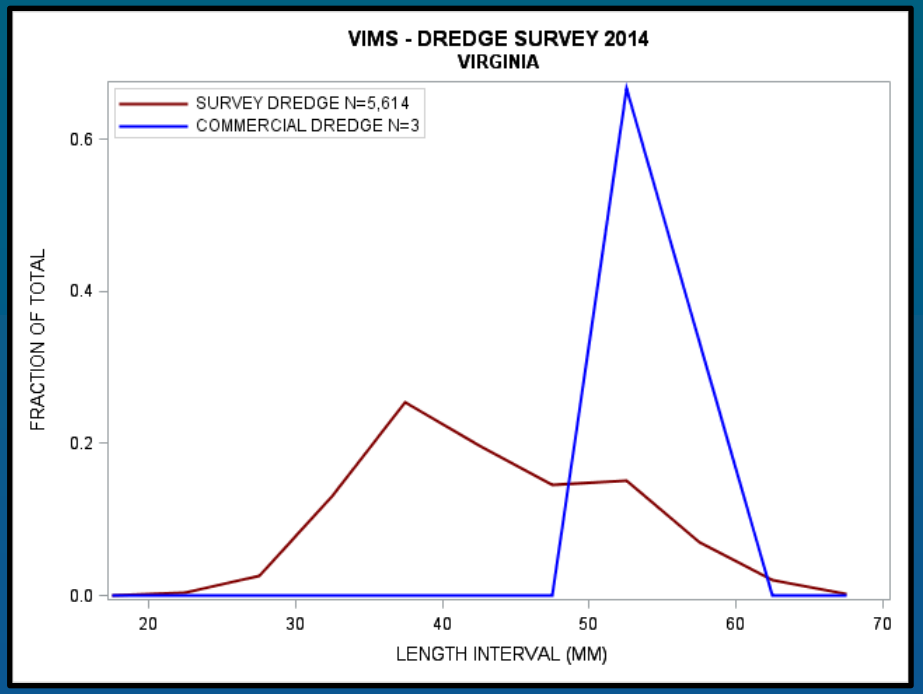


- DelMarVa and Elephant Trunk Closed Areas
  - Adult animals dominated by 2010 year class now at 100-110 mm
  - Evidence of a solid recruiting class of 2 year old animals with a broad and somewhat atypical spatial distribution.
  - sampled roughly 35,000 scallops (HCCA) and 130,000 scallops (ETCA).

2014 VIMS-Industry Cooperative Surveys

Length Frequency- Cruise 1

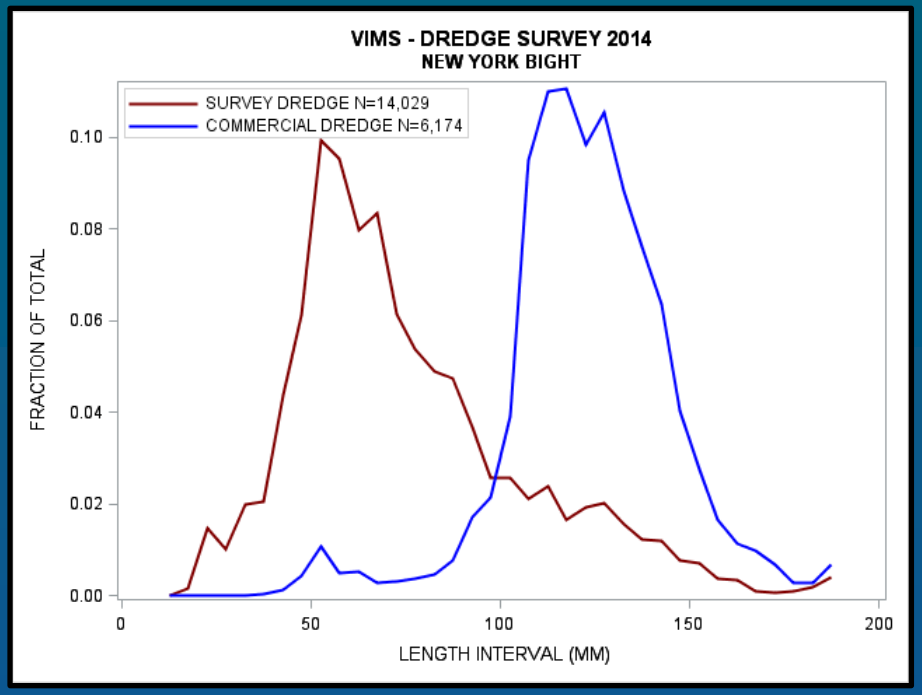


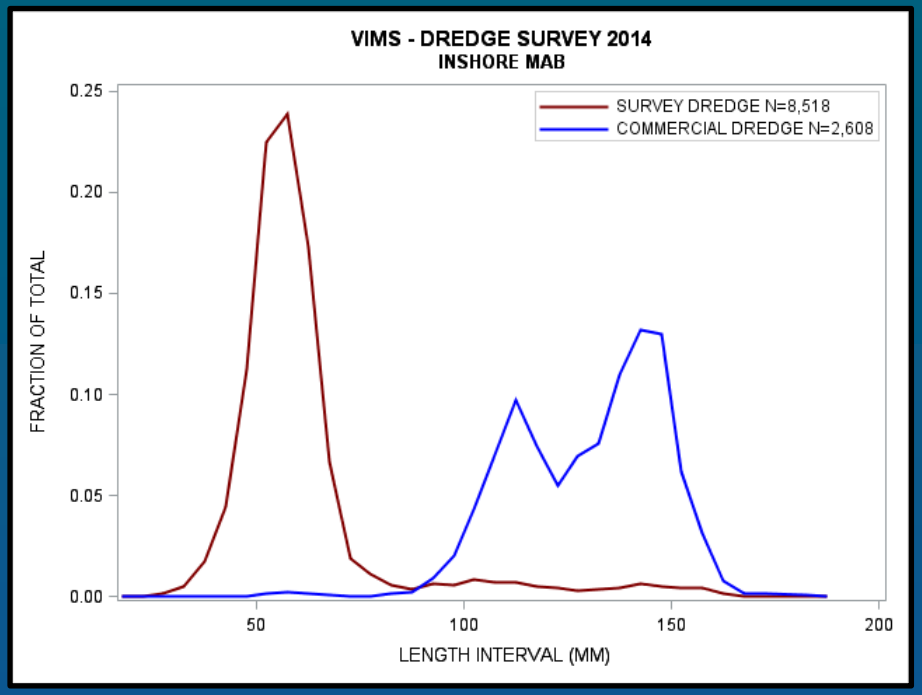


- Virginia SAMS and Stratum 12
  - Very low abundance of adult animals
  - Modest numbers of pre-recruit animals in Virginia SAMS area.
  - sampled roughly 14 scallops (Stratum 12) and 5,600 scallops (Virginia).

2014 VIMS-Industry Cooperative Surveys

Length Frequency- Cruise 1

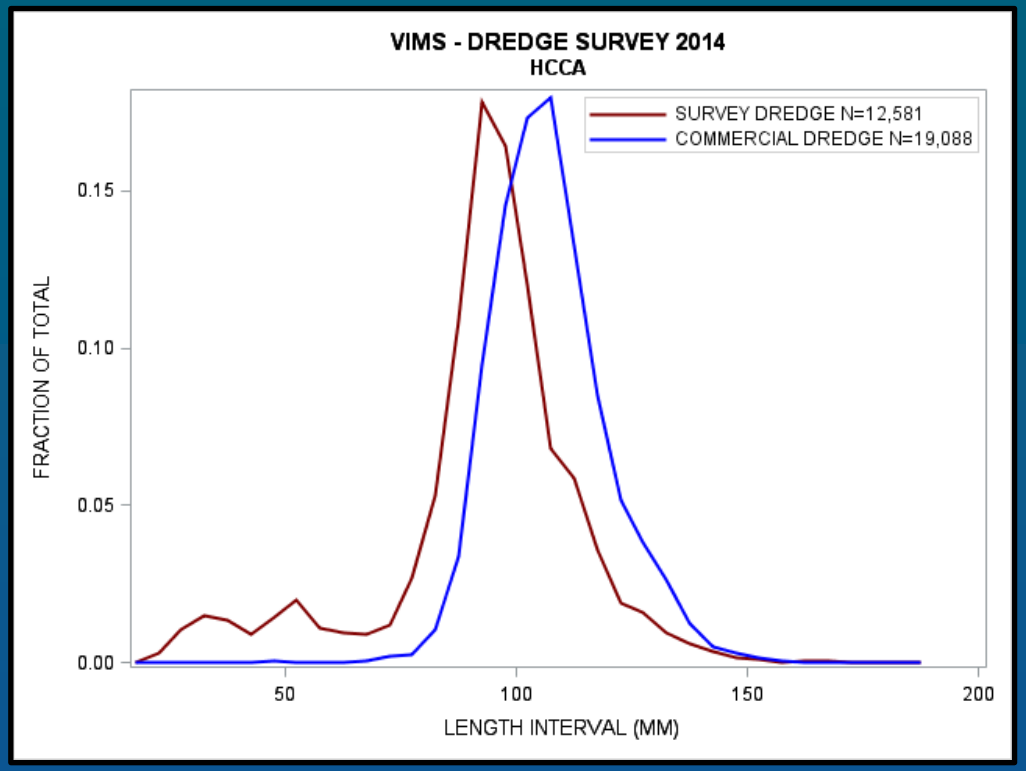




- New York Bight and Inshore MAB SAMS Area
  - Across the areas there appear to be multiple year classes with adult animals as well as incoming recruits.
  - sampled roughly 20,000 scallops (NYB) and 13,000 scallops (Inshore MAB).

2014 VIMS-Industry Cooperative Surveys

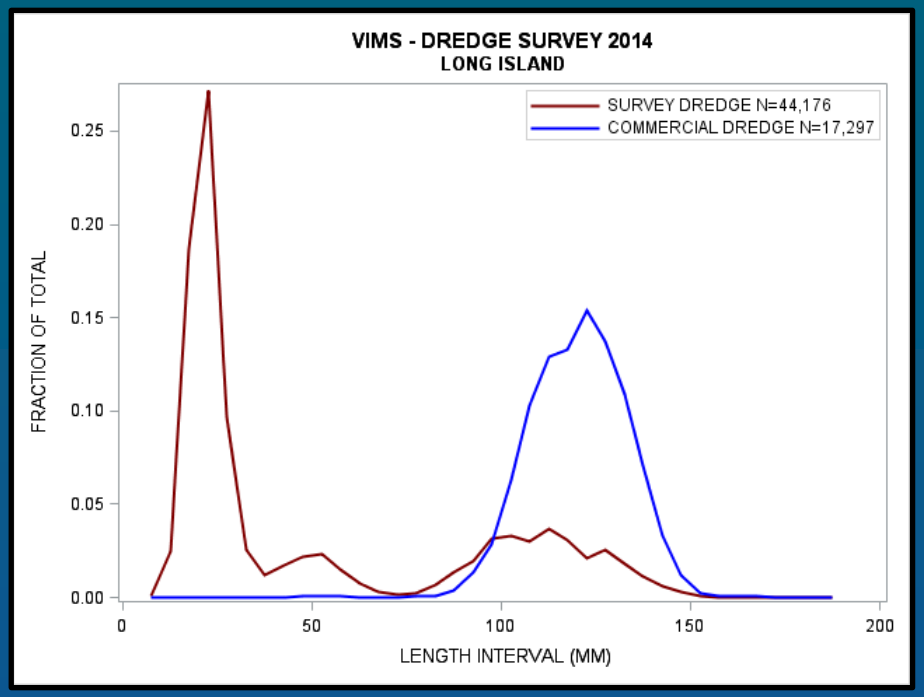
Length Frequency- Cruise 2

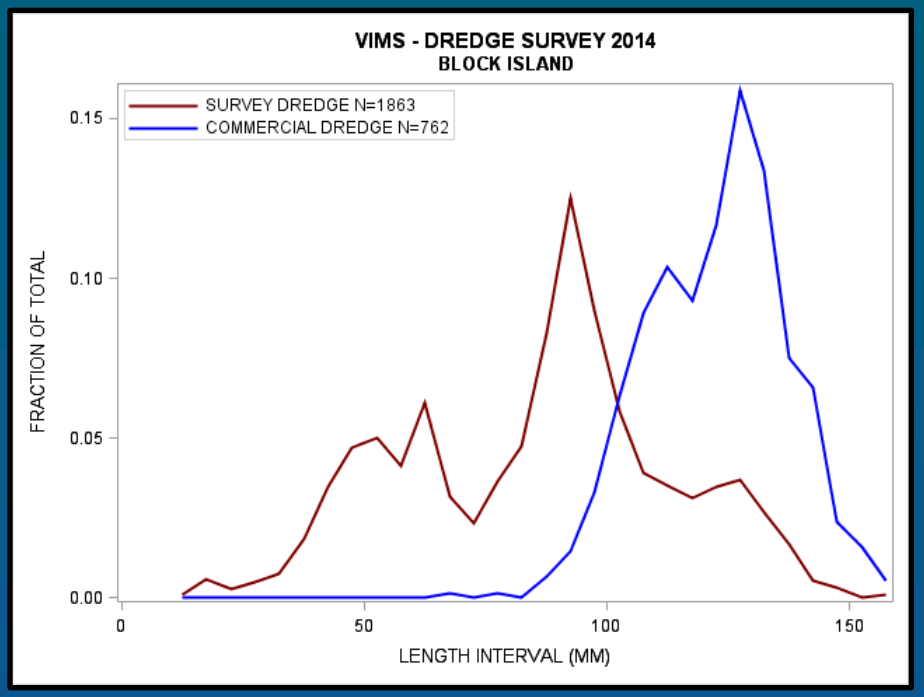


- Hudson Canyon and Elephant Trunk Closed Areas
  - Adult animals dominated by 2010 year class now at 100-110 mm
  - Modest numbers of pre-recruits
  - sampled roughly 30,000 scallops (HCCA).

2014 VIMS-Industry Cooperative Surveys

Length Frequency- Cruise 3

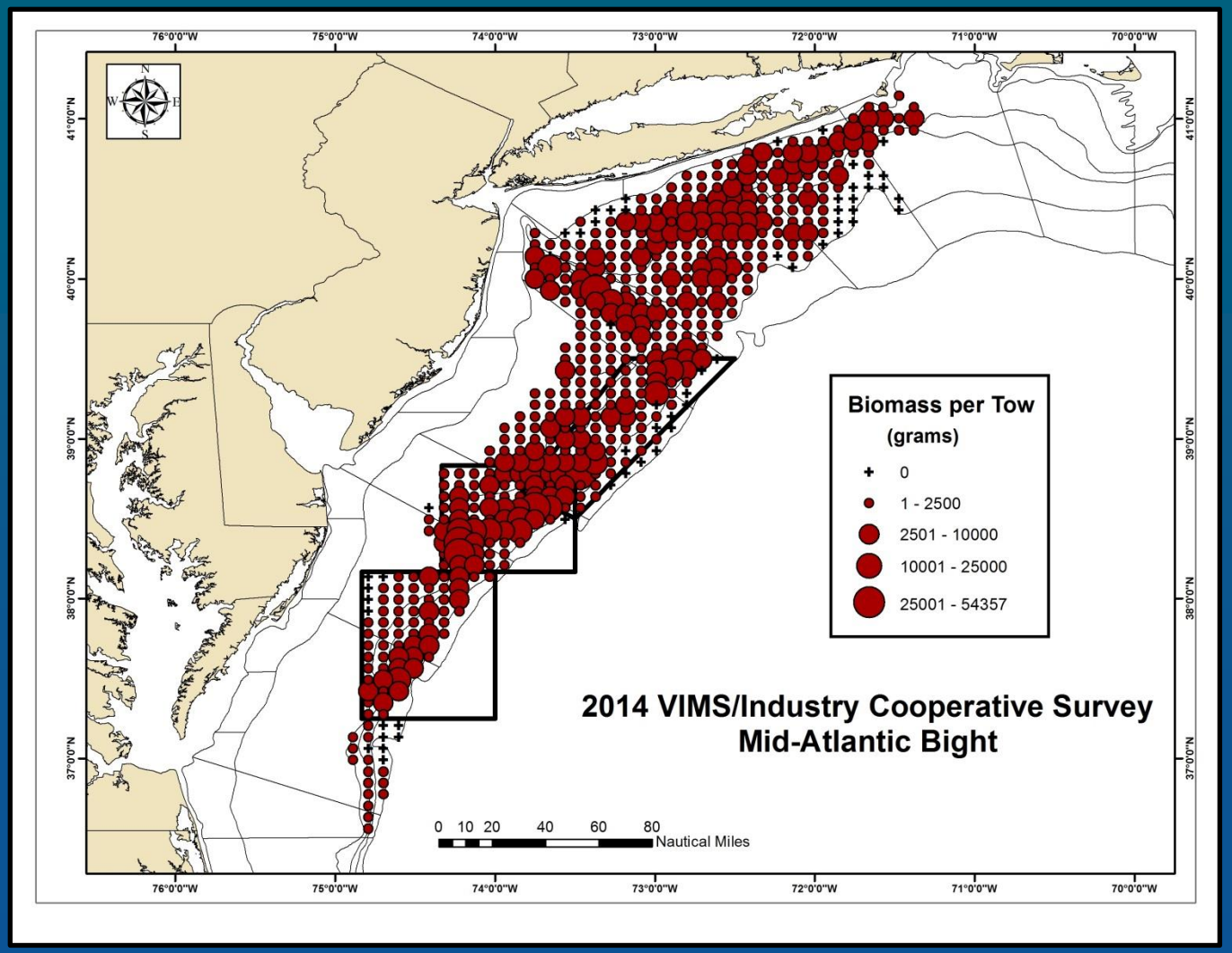




- **Long Island and Bllock Island SAMS Areas**
  - **Long Island had a large recruiting class of 1 YO animals in addition to a modest abundance of adults at ~120mm**
  - **Block Island was dominated by large adult animals with some evidence of pre-recruits.**
  - **sampled roughly 65,000 scallops (Long Island) and 2,500 scallops (Block Island).**

2014 VIMS-Industry Cooperative Surveys

Scallop Distribution-MAB



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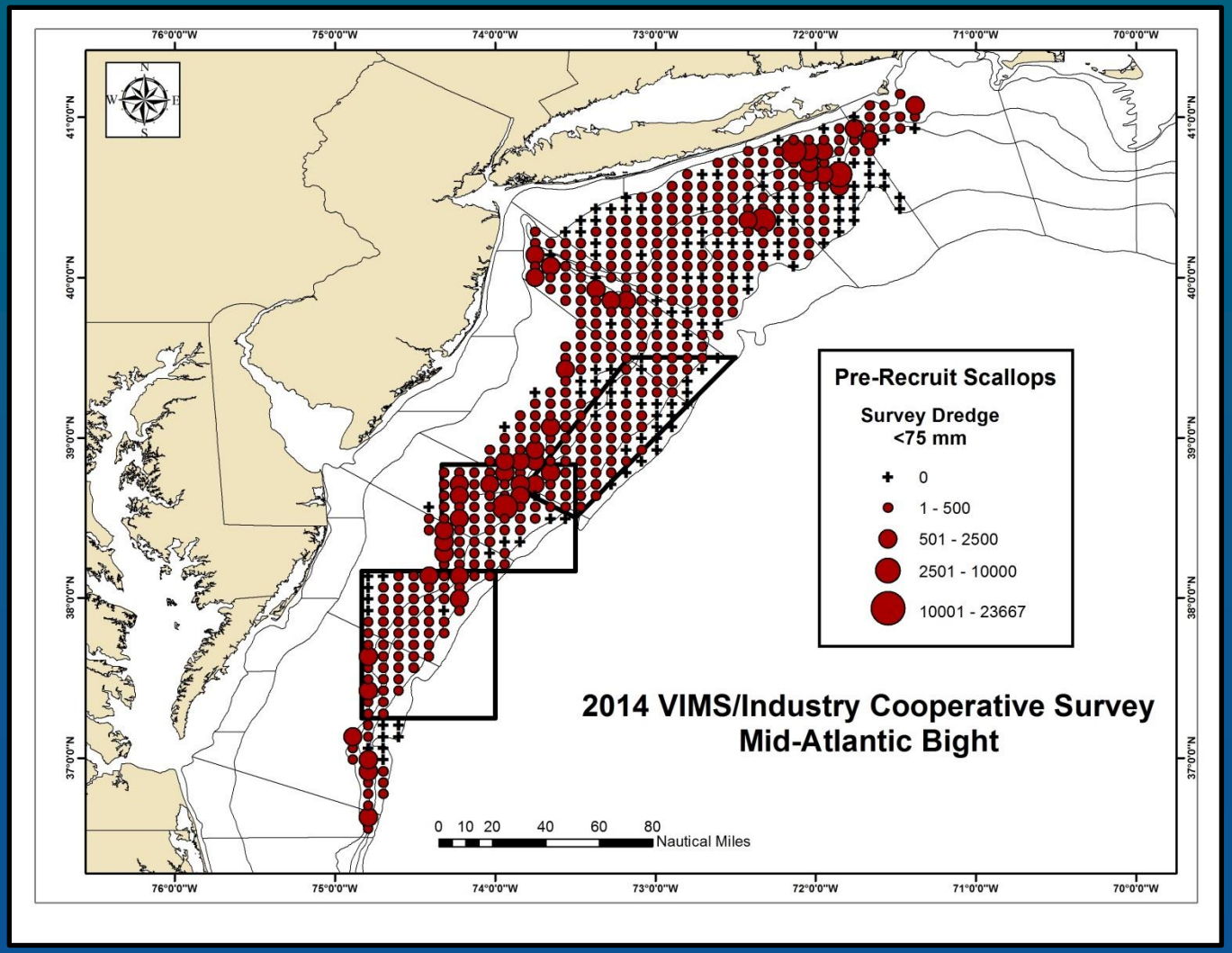
Pre-Recruit Distribution



2013 VIMS-Industry Cooperative Surveys
Recruitment

- **Long Island SAMS**
  - Recruitment (2013-14 YC) event observed in area SE of Montauk.
  - Recruitment was also scattered in modest amounts throughout the Long Island SAMS Area.
- **MAB Areas**
  - Modest amount of pre-recruit scallops observed in other areas. Distribution was inshore (45m)

2014 VIMS-Industry Cooperative Surveys
2010 Year Class

- The 2010 YC that was present in all of the rotational areas was observed to varying degrees.
- Persisted in DMV, ETCA but to a lesser extent in HCCA.
- Care projecting scale!!

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Virginia Institute of Marine Science

Press Release

VIMS reports record number of young scallops in mid-Atlantic

Results bode well for continued success of Virginia's top commercial fishery

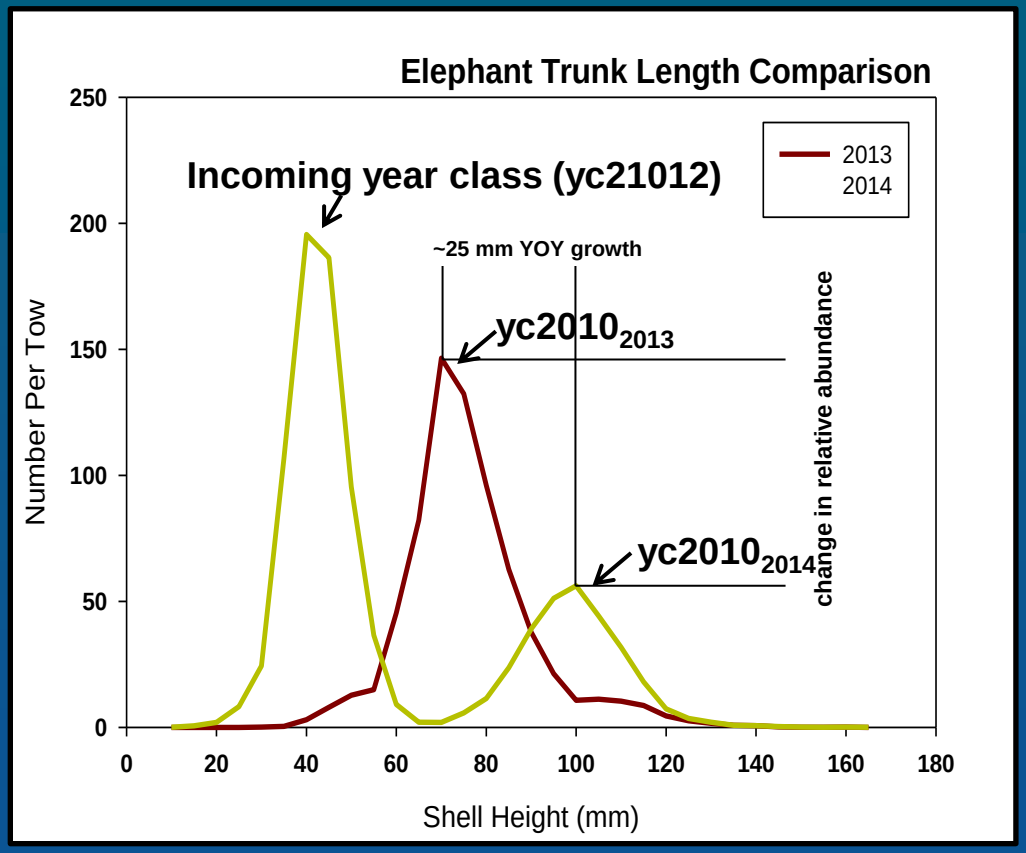
(May 23, 2012) Recent surveys by researchers at the Virginia Institute of Marine Science reveal an unprecedented number of young scallops in 2 fishery management areas off the mid-Atlantic coast. The high levels of scallop "seed" should generate significant commercial catches in 3 years, when the scallops are 5 years old.

That's good news for the continued success of the Atlantic sea scallop fishery, a model of effective collaboration among scientists, resource managers, and commercial fishing interests that now sustains the most valuable wild scallop fishery in the world.

U.S. scallop landings totaled $455.1 million in 2010 (latest available data), with 15% of those dollars accruing to Virginia. Scallopers in the Commonwealth landed $70.2 million worth of the tasty bivalves in 2010, 35% of the total value of Virginia's seafood landings for the year.

Seed Scallops: Because the smaller, year-old scallops are more susceptible to predation, their large numbers don't guarantee a corresponding increase in future adult populations. But the presence of large numbers of two-year-old scallops is encouraging, as these have a reasonable chance of growing to adult size.

2014 VIMS-Industry Cooperative Surveys
YOY Length comparisons



- Typical growth to 4 years of about 100mm
- Reduction of relative abundance could result from:
  - survey artifact
  - natural mortality
  - emigration
  - fishing

2014 VIMS-Industry Cooperative Surveys

Scallop Density

SAMS Area	Gear	Efficiency	Average Total Density (scal/m^2)	Standard Error	Average Exploitable Density (scal/m^2)	Standard Error
VIRGINIA	Comm	41%			0.000	0.000
VIRGINIA	Survey	65%	0.235	0.056	0.002	0.000
STRATUM 12	Comm	41%			0.000	0.000
STRATUM 12	Survey	65%	0.001	0.000	0.000	0.000
DMV	Comm	41%			0.043	0.009
DMV	Survey	65%	0.152	0.020	0.024	0.005
ETCA	Comm	41%			0.175	0.036
ETCA	Survey	65%	0.511	0.205	0.083	0.018
INSHORE MAB	Comm	41%			0.010	0.001
INSHORE MAB	Survey	65%	0.100	0.029	0.008	0.001
HCCA	Comm	41%			0.050	0.012
HCCA	Survey	65%	0.098	0.021	0.038	0.008
NEW YORK BIGHT	Comm	41%			0.016	0.002
NEW YORK BIGHT	Survey	65%	0.111	0.034	0.025	0.005
LONG ISLAND	Comm	41%			0.015	0.001
LONG ISLAND	Survey	65%	0.113	0.027	0.021	0.001
BLOCK ISLAND	Comm	41%			0.009	0.002
BLOCK ISLAND	Survey	65%	0.066	0.016	0.021	0.004

2014 VIMS-Industry Cooperative Surveys

Estimated Total Number

SAMS Area	Gear	Efficiency	Estimated Total	Estimated Total Exploitable
VIRGINIA	Comm	41%		31,548
VIRGINIA	Survey	65%	175,890,711	1,125,771
STRATUM 12	Comm	41%		-
STRATUM 12	Survey	65%	468,167	11,378
DMV	Comm	41%		190,491,477
DMV	Survey	65%	679,664,008	107,892,253
ETCA	Comm	41%		792,011,748
ETCA	Survey	65%	2,312,012,041	377,870,196
INSHORE MAB	Comm	41%		29,722,014
INSHORE MAB	Survey	65%	295,319,451	22,262,886
HCCA	Comm	41%		211,758,401
HCCA	Survey	65%	409,977,319	160,254,270
NEW YORK BIGHT	Comm	41%		81,325,318
NEW YORK BIGHT	Survey	65%	545,090,131	122,396,033
LONG ISLAND	Comm	41%		207,461,054
LONG ISLAND	Survey	65%	1,556,976,539	293,220,193
BLOCK ISLAND	Comm	41%		8,849,530
BLOCK ISLAND	Survey	65%	63,802,511	20,433,857

2014 VIMS-Industry Cooperative Surveys

Mean Scallop Weight

SAMS Area	GEAR	Average Weight Total Scallops (g)	Average Weight Exploitable Scallops (g)
VIRGINIA	Comm		2.76
VIRGINIA	Survey	1.60	2.37
STRATUM 12	Comm		
STRATUM 12	Survey	2.24	7.02
DMV	Comm		22.52
DMV	Survey	6.96	19.48
ETCA	Comm		22.30
ETCA	Survey	7.13	21.29
INSHORE MAB	Comm		44.59
INSHORE MAB	Survey	6.11	34.25
HCCA	Comm		20.51
HCCA	Survey	14.38	19.38
NEW YORK BIGHT	Comm		36.54
NEW YORK BIGHT	Survey	12.45	33.77
LONG ISLAND	Comm		30.55
LONG ISLAND	Survey	7.63	28.58
BLOCK ISLAND	Comm		33.27
BLOCK ISLAND	Survey	14.08	25.20

2014 VIMS-Industry Cooperative Surveys
Total Biomass

SAMS Area	Gear	Domain (km^2)	Samples	Biomass (mt)	95% CI Lower Bound	95% CI Upper Bound
VIRGINIA	Survey	747	13	279.27	179.47	379.08
STRATUM 12	Survey	563	9	1.05	0.17	1.94
DMV	Survey	4,462	66	4,707.21	3,730.98	5,683.44
ETCA	Survey	4,527	67	16,392.73	12,172.42	20,613.03
INSHORE MAB	Survey	2,939	46	1,766.40	1,349.44	2,183.36
HCCA	Survey	4,201	69	5,804.73	4,291.44	7,318.03
NEW YORK BIGHT	Survey	4,929	68	6,821.68	4,743.63	8,899.74
LONG ISLAND	Survey	13,786	209	11,965.55	10,941.14	12,989.96
BLOCK ISLAND	Survey	962	14	939.48	680.97	1,198.00

2014 VIMS-Industry Cooperative Surveys

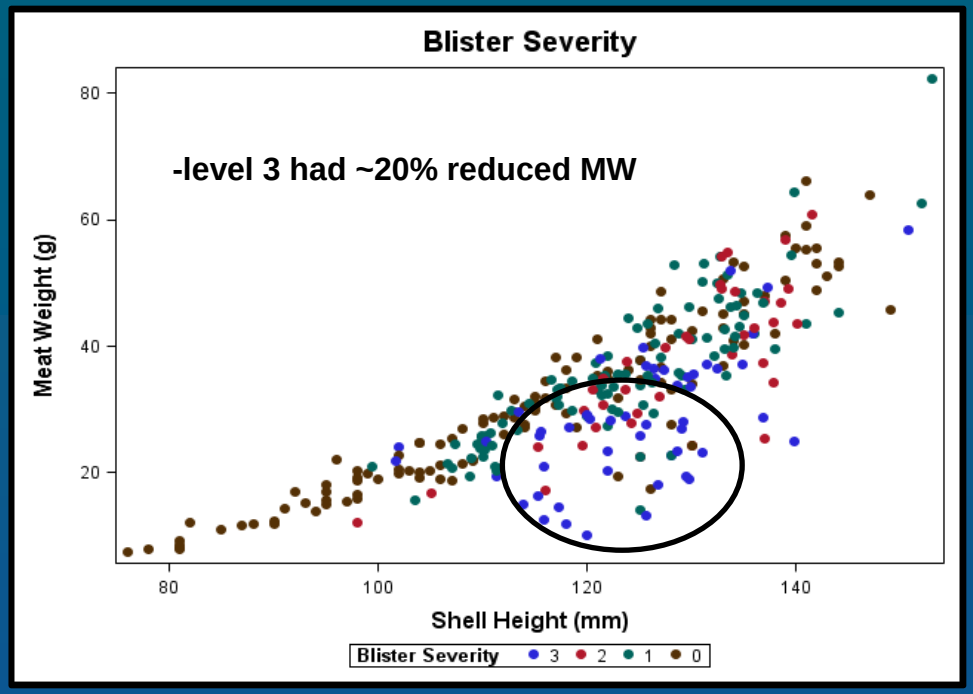
Exploitable Biomass

SAMS Area	Gear	Domain	Samples	Biomass (mt)	95% CI Lower Bound	95% CI Upper Bound
VIRGINIA	Comm	747	13	0.09	0.01	0.16
VIRGINIA	Survey	747	13	2.65	1.37	3.93
STRATUM 12	Comm	563	8	-	-	-
STRATUM 12	Survey	563	9	0.08	0.01	0.15
DMV	Comm	4,462	66	4,234.98	2,868.73	5,601.23
DMV	Survey	4,462	66	2,080.40	1,544.54	2,616.26
ETCA	Comm	4,527	68	17,714.10	12,402.97	23,025.24
ETCA	Survey	4,527	67	8,067.25	5,946.95	10,187.55
INSHORE MAB	Comm	2,939	46	1,328.45	1,103.04	1,553.87
INSHORE MAB	Survey	2,939	46	757.31	601.45	913.17
HCCA	Comm	4,201	69	4,224.21	2,850.24	5,598.18
HCCA	Survey	4,201	69	3,043.64	2,385.92	3,701.36
NEW YORK BIGHT	Comm	4,929	68	2,964.39	2,422.39	3,506.38
NEW YORK BIGHT	Survey	4,929	68	4,139.51	2,942.92	5,336.11
LONG ISLAND	Comm	13,786	207	6,367.68	5,810.34	6,925.01
LONG ISLAND	Survey	13,786	209	8,438.29	7,734.51	9,142.07
BLOCK ISLAND	Comm	962	14	305.49	178.06	432.91
BLOCK ISLAND	Survey	962	14	535.27	402.55	668.00

2014 VIMS-Industry Cooperative Surveys
Product Quality/Animal Health

- Qualitative assessment with 4 categories (0-3).
  - Texture, color, marketability, disease
- Component of the SH:MW protocol
- Given an overall marketability score as well as individual texture and color scores.
- Addl info: SH, sex, tow level info.

2014 VIMS-Industry Cooperative Surveys
Conchiolin Blisters

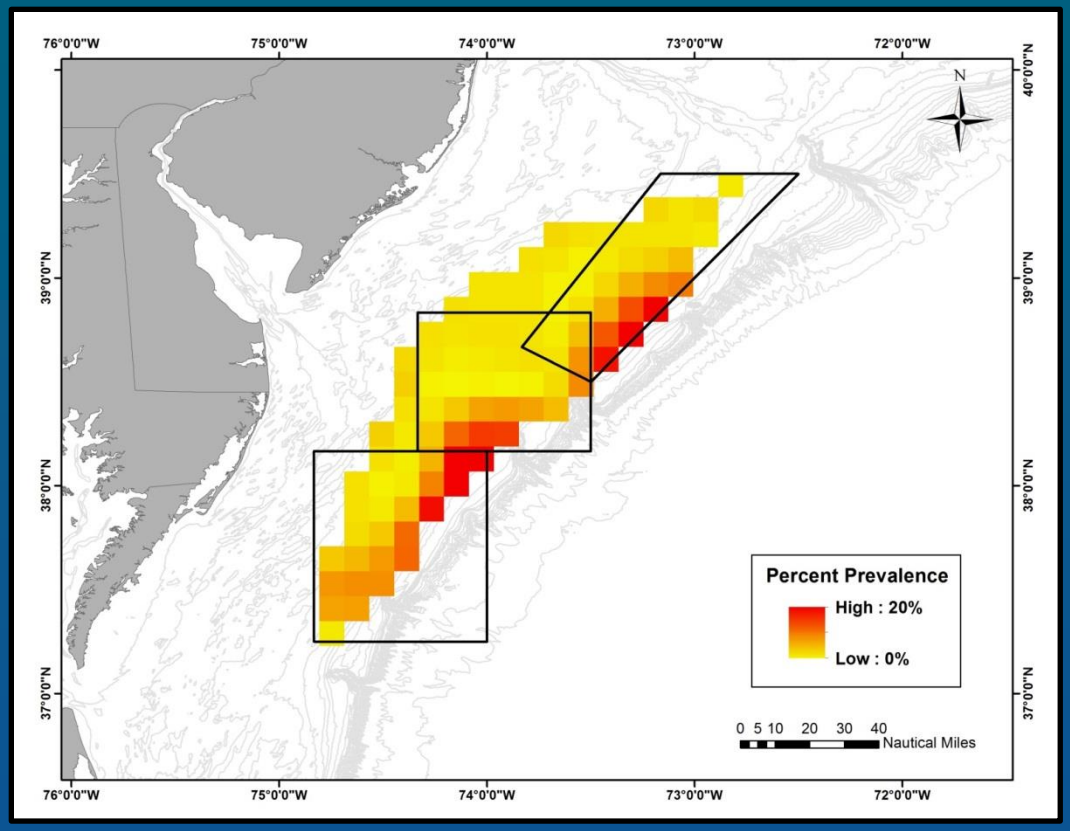


- Preliminary work done in 2013 to examine causative agent(s) as well as characterize the effect on scallops both individually and at the resource level.

2014 VIMS-Industry Cooperative Surveys
Conchiolin Blisters

Survey data can be used to:

1. **Characterize the spatial extent and intensity of blisters**
2. **Create a model to predict the probability of occurrence of the blisters based on a suite of biologic and abiotic factors.**



Acknowledgements

- The owners, captains and crews;
  - F/V *Carolina Boy* (MAB Leg 1)
  - F/V *Kathy Ann* (MAB Leg2)
  - F/V *Celtic* (SNE/LI)
- Crystal Vaughn
- Support from NMFS NEFSC: Dvora Hart, Russ Brown, Vic Nordahl.
- Scientific staff that participated on the cruises.
- Funding through Sea Scallop RSA program.