Meeting Materials for Scallop RSA Priorities Agenda

1. Draft RSA Research Priorities with AP input in orange Page 3

Background Information

2. Summary of RSA projects recently funded (2010-2015) Page 6
3. Research Recommendations from SARC50 and SARC59 Page 17
4. General findings from Scallop Survey Methods Review Page 20

1. 2016 and 2017 Atlantic Sea Scallop Research Priorities

HIGHEST (listed in order of importance)

1. Survey Related Research (a, b, and c have equal priority)

1a. an intensive industry-based survey of each of the relevant scallop access areas (Closed Area I, Closed Area II, Nantucket Lightship, Delmarva, Elephant Trunk and Hudson Canyon) that will provide estimates of total and exploitable biomass to be used for setting fishery catch limits under the rotational area management program. To support these area management decisions, survey data and biomass estimates must be available by early August of the year in which the survey is conducted (e.g. survey results that would inform 2017 fishing area decisions must be available by August 2016). Areas scheduled to be open in the following fishing year generally have a higher priority than other areas. For 2016 the priority areas are likely to be: Elephant Trunk, Hudson Canyon, the access area in southern part of Closed Area II, and the access area in Nantucket Lightship including the extension to the west. For 2017 the priority areas are: Elephant Trunk, the access area in the southern part of Closed Area II, and the access area in Nantucket Lightship with extension to the west, and the original access area in Closed Area I (with the extension to the north). If boundaries of scallop access areas change as a result of a future Council action, then applicants may be requested to adjust their survey to be consistent with new or modified access area boundaries. Additionally, applicants should note that the priority areas listed here may change based on results of 2015 surveys and/or feedback from the scallop fishing industry. Therefore, applicants may be requested to adjust their proposed survey to meet these emergent survey needs.

1b. an intensive industry-based survey of areas that may be candidate access areas in the future (i.e., open areas with high scallop recruitment or closed areas that may open to fishing). Examples areas include the Northern Edge of Georges Bank in and around Closed Area II, the northern part of Closed Area I that is currently part of an essential fish habitat (EFH) closed area, east and west of the Nantucket Lightship scallop Access Area, south of Closed Area II, and south of Nantucket Lightship along the 40 fathom curve to Hudson Canyon. Seasonal monitoring of candidate access areas will be considered to monitor the survival of small scallops.

1c. a broad, resource wide industry-based survey of scallops within Georges Bank and/or Mid-Atlantic resource areas. The survey or surveys do not need to be carried out by a single grant recipient. The primary objective of these surveys would be to provide an additional broadscale biomass index to improve the overall precision of the scallop biomass estimate produced by the Scallop Plan Development Team. Survey results must be available by early August of the year in which the survey is conducted (e.g. survey results that would inform 2017 fishing effort decisions must be available by early August 2016).

2. Bycatch research

Identification and evaluation of methods to reduce the impacts of the scallop fishery with respect to bycatch. This would include projects that determine seasonal bycatch rates, characterize spatial and temporal distribution patterns, gear modifications to reduce bycatch and avoid fishery conflicts, as well as the associated discard mortality rates of yellowtail flounder, windowpane flounder, lobster, and other key bycatch species. Research efforts should be targeted to provide results that would help the scallop industry avoid pending or potential implementation of accountability measures.

3. Scallop and area management research (note: modified to only include seeding and disease)

Such research would include, but would not be limited to, research to actively manage spat collection and seeding of sea scallops; and research aimed at describing the occurrence, as well as understanding the mechanisms, of processes that affect scallop product quality (i.e., scallops with grey meats or evidence of disease/parasites).

MEDIUM (not listed in order of importance):

4. Research on scallop predation and ways to mitigate predation impacts (e.g. starfish, crab and dogfish).

5. Research to support the investigation of loggerhead turtle behavior in the Mid-Atlantic (via satellite tagging or other means) to understand their seasonal movements, vertical habitat utilization, and how and where interactions with scallop dredge gear are occurring. This includes monitoring of scallop dredge and scallop trawl operations, and the development of further gear modifications if monitoring should indicate current designs are not eliminating the threat or harm to sea turtles or are resulting in unacceptable reductions in scallop catch.

OTHER (not listed in order of importance):

6. Habitat characterization research including (but not limited to): before after control impact (BACI) dredge studies; identification of nursery and over-wintering habitats of species that are vulnerable to habitat alteration by scallop fishing (e.g. list important species?); evaluation of long-term or chronic effects of scallop fishing on the ecosystem; and habitat recovery potential from fine scale fishing effort. In particular, projects that would evaluate present and candidate EFH closures to assess whether these areas are accomplishing their stated purposes and to assist better definition of the complex ecosystem processes that occur in these areas. Finally, investigation of variability in dredging efficiency across habitats, times, areas, and gear designs to allow for more accurate quantitative estimates of scallop dredge impacts on the seabed and development of practicable methods to minimize or mitigate those impacts.

7. Longer term research projects designed to either 1) examine whether chemicals, water quality, and other environmental stressors affect reproduction and growth of scallops (e.g. jet fuel, pesticides, ocean acidification, etc.); or 2) research other scallop biology projects, including studies aimed at understanding recruitment processes (reproduction, timing of spawning, larval and early post-settlement stages), and seasonal growth patterns of scallop shell height and meat and gonad weight (which could include analysis of Northeast Fisheries Science Center archived scallop shells from the 1980s and 1990s) .

8. Discard mortality of scallops. The assumed discard mortality rate used in the scallop stock assessment is very uncertain. Research that would improve the understandings of discard mortality and refine the assumed discard mortality rate would be useful, especially if projects are able to assess variability due to habitat, season, and gears, as well as the magnitude scallops discarded at sea and not landed due to meat quality issues. Lastly, if projects are able to address additional impacts of highgrading (targeting only large scallops and discarding small and medium sized scallops) as a factor of overall discard mortality that would also be useful.

9. Incidental mortality of scallops. The assumed incidental mortality rate used in the scallop stock assessment is very uncertain. Research that would evaluate the effect of the four-inch rings and mesh twine tops on incidental mortality would be useful.

10. Other resource surveys to expand and/or enhance survey coverage in areas that have the potential to be important resource areas, but which currently lack comprehensive survey coverage (e.g. inshore areas east of the current NOAA Fisheries survey strata or deeper than the surveyed area, Northern Gulf of Maine resource, etc.).

11. Develop methodologies or alternative ways for the scallop fleet to collect and analyze catch and bycatch data on a near real-time basis (i.e., collection of scallop meat weight and quality data, specific bycatch information, etc. Potential ideas include, but are not limited to: concepts like a scallop "Study Fleet", electronic monitoring, dockside monitors, scallop bag tags, etc.).
[Note to Committee – based on presentation on May 13 it seems that the methodology has been developed through previous RSA efforts – challenge now is how to integrate use among the fleet. Therefore, Cmte may want to consider modifying this priority].

By consensus the AP recommends that the observer program collect more specific information on the reasons scallops are discarded at sea to help understand the reasons why scallops are discarded at sea.

By consensus the AP recommends that somewhere in the FFO a note be added that if feasible all Scallop RSA field work should include the collection of basic ocean data (i.e. temperature, salinity, pH, etc). These data should be combined and used in general ecosystem monitoring research.

By consensus the AP recommends that the Scallop Committee forward the items below as research priorities to be added to an overall list of research priorities (not Scallop RSA): 1) assess where juvenile cod hot spot are; 2) survey of WP flounder to improve assessment; 3) identify winter flounder spawning areas; and 4) use commercial vessels to collect basic ocean data (temperature, salinity, pH, etc).

2. Summary of Scallop RSA Projects – 2010-2015

2015	Total of 16 projects funded - 10 with 2015 RSA Awards and 6 from 2014 RSA Announcement (6 survey and 10 other topics)					
Year	Primary Project Category	Title	Principal Investigator	Organization	Funding	Used by Council
2015b	Bycatch	Optimizing the Georges Bank Scallop Fishery by Maximizing Meat Yield and Minimizing Bycatch	Carl Huntsberger, Farrell Davis, Shea Miller, Chris Parkins	Coonamessett Farm Foundation	$1,999,832	
2015b	Ecosystem/ Habitat	Habitat Characterization and Sea Scallop Resource Enhancement Study in a Proposed Habitat Research Area –Year Three	Daniel Ward, Liese Siemann, Christopher Parkins	Coonamessett Farm Foundation	$979,680	
2015b	Bycatch	Determination of the Impacts of Dredge Speed on Bycatch Reduction and Scallop Selectivity Weights of NW Atlantic Sea Scallops via Paired Field Surveys and Laboratory Experiments	Farrell Davis, Christopher Parkins, Daniel Ward	Coonamessett Farm Foundation	$950,112	
2015b	Turtle	Understanding Impacts of the Sea Scallop Fishery on Loggerhead Sea Turtles through Satellite Tagging	Shea Miller	Coonamessett Farm Foundation	$797,040	
2015b	Bycatch	Determining the Impacts of Dredge Bag Modifications on Flatfish Bycatch in the LAGC Scallop Fishery	Christopher Parkins and Farrell Davis	Coonamessett Farm Foundation	$308,200	
2015b	Survey	Optical Survey of the Resource in the Elephant Trunk Scallop Access Area	Paul Rosonina, Karen Bolles Hopkins, Norman Vine, Jui-Han Chang, Richard Taylor	Arnie's Fisheries, Inc	$629,328	
2015b	Survey	Optical Survey of Recent Scallop Settlement Areas Along the Southern New England Shelf Including the Southern Portion of the Nantucket Lightship Scallop Access Area	Paul Rosonina, Karen Bolles Hopkins, Norman Vine, Jui-Han Chang, Richard Taylor	Arnie's Fisheries, Inc	$808,560	
2015b	Survey	Broadscale Video Survey of Georges Bank Scallop Open Areas	Kevin D. E. Stokesbury	SMAST	$1,994,248	
2015b	Bycatch	Scallop Fishery Bycatch Avoidance System 2015	Catherine E. O'Keefe	SMAST	$732,252	
2015b	Survey	Development and Implementation of a High Precision Resource Wide Dredge Survey of the Mid-Atlantic Scallop Resource Area	David B. Rudders	VIMS	$966,472	
2015a	Discard/ Inc. Mortality	Discard Mortality of Sea Scallops Following Capture and Handling in the Sea Scallops Dredge Fishery	David Rudders, James Sulikowski, James Mandelman	VIMS, UNE, NE Aquarium	$693,200	Ongoing Today
2015a	Discard/ Inc. Mortality	Incidental Mortality Estimates of Sea Scallops from AUV based BACI Surveys	Art Trembanis, Douglas Miller, David Rudders	University of Deleware, VIMS	$508,545	Ongoing-Results expected in 2016
2015a	Discard/ Inc. Mortality	Estimating Incidental Mortality in the Sea Scallop Fishery	Ron Smolowitz	Coonamessett Farm Foundation	$429,755	Ongoing Today
2015a	Ecosystem/ Habitat	Investigating the Effects of Ocean Acidification and Warming on the Shell Properties and Meat Weights of NW Atlantic Sea Scallops Via Paired Field Surveys and Laboratory Experiments	Justin Ries, Jonathan Grabowski, Brad Harris, Kevin Stokesbury	Northeastern University, Alaska Pacific U., SMAST	$801,465	Ongoing-Results expected in 2016
2015a	Survey	Assessment of Sea Scallop Distribution in Federal and Adjacent State Waters of the Gulf of Maine	Kevin Kelly	Maine DMR	$372,344	Survey in Summer 2016
2015a	Survey	Broadscale Video Survey of the Open Areas of George's Bank	Kevin Stokesbury	SMAST	$1,368,126	Survey in Summer 2015

2014	Total of 15 projects funded (6 survey and 9 other topics)					
Year	Primary Project Category	Title	Principal Investigator	Organization	Funding	Used by Council
2014	Discard/ Inc. Mortality	Incidental Mortality Estimates of Sea Scallops from AUV based BACI Surveys	Art Trembanis, Douglas Miller, and David Rudders	University of Deleware	$1,147,794	Ongoing- Results expected in 2016
2014	Discard/ Inc. Mortality	Estimating Incidental Mortality in the Sea Scallop Fishery	Ron Smolowitz	Coonamessett Farm Foundation	$306,565	Ongoing Today
2014	Discard/ Inc. Mortality	Determining Incidental Discard Mortality of Atlantic Sea Scallops, Placopecten magellanicus	Eleanor Bochenek and Jason Morson	National Fisheries Institute	$366,588	Ongoing- Results Next year
2014	Discard/ Inc. Mortality	Discard Mortality of Sea Scallops Following Capture and Handling in the Sea Scallops Dredge Fishery	David Rudders	VIMS	$963,981	Ongoing Today
2014	Ecosystem/ Habitat	Tracking the Occurrence of grey meat in Atlantic Sea Scallops	Kevin Stokesbury	SMAST	$572,123	Ongoing Today
2014	Ecosystem/ Habitat	Habitat Characterization and Sea Scallop Resource Enhancement Study in Proposed Habitat Research Area-Year 2	Katherine Thompson, Daniel Ward, and Ron Smolowitz, Kevin Stokesbury	Coonamessett Farm Foundation and SMAST	$770,852	Ongoing- Results in 2016
2014	Ecosystem/ Habitat	Investigating the Effects of Ocean Acidification and Warming on the Shell Properties and Meat Weights of NW Atlantic Sea Scallops Via Paired Field Surveys and Laboratory Experiments	Justin Ries and Jonathan Grabowski	Northeastern University	$919,277	Ongoing- Results Next year
2014	Bycatch	Scallop Bycatch Avoidance System	Steven Cadrin	SMAST	$678,955	Ongoing Today
2014	Survey	Assessment of Sea Scallop Distribution in Federal and Adjacent State Waters of the Gulf of Maine	Kevin Kelly	Maine DMR	$558,515	Survey in Summer 2016
2014	Survey	An Assessment of Sea Scallop Abundance and Distribution in the Long Island/Southern New England Area	David Rudders	VIMS	$456,346	Used in FW26
2014	Survey	Broadscale Video Survey of the Open Areas of George's Bank	Kevin Stokesbury	SMAST	$1,368,126	Used in FW26
2014	Survey	Optical Survey of Recent Scallop Settlement Areas Along the Southern New England Continental Shelf	Richard Taylor	Arnie's Fisheries	$894,360	Used in FW26
2014	Survey	High-Resolution Video Survey and Biological Sampling of the Northern Area of Closed Area I	Kevin Stokesbury	SMAST	$438,898	Used in FW26
2014	Survey	Optical Survey of Scallop Resource in the Elephant Trunk Scallop Access Area	Richard Taylor	Arnie's Fisheries	$895,320	Used in FW26
2014	Turtle	Understanding Impacts of the Sea Scallop Fishery on Loggerhead Sea Turtles	Daniel Ward and Brianna Valenti	Coonamessett Farm	$919,360	Used in FW26 for AE - more today

2013	Total of 14 projects funded (6 survey and 8 other topics)					
Year	Primary Project Category	Title	Principal Investigator	Organization	Funding	Used by Council
2013	Bycatch	Preventing Bycatch of Yellowtail Flounder in the Scallop Fishery	Thomas Grothues, Eleanor Bochenek, & Kenneth Roma	National Fisheries Institute	$338,931	Ongoing Today
2013	Bycatch	Testing of Scallop Dredge Bag Design Changes For Flatfish Bycatch Reduction	Ronald Smolowitz	Coonamessett Farm	$995,712	Used in FW25
2013	Survey	A Synoptic Survey of the Sea Scallop Resource in the Mid-Atlantic	David Rudders	VIMS	$1,592,471	Used in FW25
2013	Ecosystem/ Habitat	Identifying Source Sink Dynamics in Sea Scallop Populations of the Northwest Atlantic	Jonathan Grabowski, Bradley Harris, & Steve Vollmer	Northeastern University	$1,107,448	Presented in 2014- more in 2016
2013	Ecosystem/ Habitat	Habitat Characterization and Sea Scallop Resource Enhancement Study in a Proposed Habitat Research Area	Ronald Smolowitz	Coonamessett Farm	$806,436	Presented in 2014 - more in 2016
2013	Bycatch	Scallop Fishery Bycatch Avoidance System	Steven Cadrin	SMAST	$637,417	Presented in 2014
2013	Turtle	Understanding Impacts of the Sea Scallop Fishery on Loggerhead Sea Turtles through Satellite Tagging	Ronald Smolowitz	Coonamessett Farm	$404,592	Presented in 2014
2013	Bycatch	Seasonal Bycatch Survey of the Georges Bank Scallop Fishery	Ronald Smolowitz	Coonamessett Farm	$2,522,307	Used in FW25
2013	Other	Survey of Persistent Scallop Aggregations and an Examination of Their Influence on Recruitment Using the FVCOM Oceanographic Model	Kevin Stokesbury, Changsheng Chen, Pingguo He, & Bradley Harris	SMAST	$993,844	Presented in 2014- more in 2016
2013	Survey	Combined High-Resolution Video Survey and Biological Sampling Using a Modified Sled Dredge of the Sea Scallop Resource in Nantucket Lightship Access Area	Kevin Stokesbury	SMAST	$628,653	Used in FW25
2013	Survey	Optical Survey of Scallop Resource Areas: Closed Area I, Closed Area II HAPC, & Contiguous Areas	Richard Taylor	Arnie's Fisheries	$995,894	Used in FW25 and OHA2
2013	Survey	High-Resolution Video Survey of the Sea Scallop Resource in Georges Bank Closed Area II (South) and Delmarva	Kevin Stokesbury	SMAST	$866,849	Used in FW25
2013	Survey	An Assessment of Sea Scallop Abundance and Distribution in the Northeast Georges Bank Area	David Rudders	VIMS	$347,122	Used in FW25 and OHA2
2013	Survey	An Assessment of Sea Scallop Abundance and Distribution in the Access Area of the Nantucket Lightship Closed Area	David Rudders	VIMS	$314,628	Used in FW25

2012	Total of 13 projects funded (4 survey and 9 other topics)					
Year	Primary Project Category	Title	Principal Investigator	Organization	Funding	Used by Council
2012	Bycatch	Bycatch Characterization in the Southern New England Sea Scallop Fishery	Kathleen Castro	Fisheries Specialists	$584,375	Presented in 2014
2012	Other	Evaluating the Condition and Discard Mortality of Skates Following Capture and Handling in the Sea Scallop Dredge Fishery	Dave Rudders	VIMS	$1,092,642	Presented in 2014
2012	Bycatch	Design and Test of a Hydrodynamic Scallop Dredge to Reduce Bycatch, Minimize Bottom Impact and Improve Fuel Efficiency	Pingguo He	SMAST	$836,854	Presented in 2014
2012	Bycatch	Testing of Scallop Dredge Bag Design Changes For Flatfish Bycatch Reduction	Ron Smolowitz	Coonamessett Farm	$888,132	Used in FW25
2012	Bycatch	Real-Time Electronic Bycatch Reporting Pilot Project	Ron Smolowitz	Coonamessett Farm	$711,720	Presented in 2014 - more today
2012	Bycatch	Expansion of the Yellowtail Bycatch System	Steven Cadrin	SMAST	$426,729	Presented in 2014
2012	Turtle	Understanding Impacts of the Sea Scallop Fishery on Loggerhead Sea Turtles Through Satellite Tagging	Ron Smolowitz	Coonamessett Farm	$798,240	Used in FW25 for AE
2012	Survey	High-resolution Video Survey of the Sea Scallop Resource in the Nantucket Lightship and Closed Area I Access Areas	Kevin Stokesbury	SMAST	$926,964	Used in FW24
2012	Other	What Causes Gray Meat in the Atlantic Sea Scallop Placopecten Magellanicus in Georges Bank Closed Areas?	Kevin Stokesbury	SMAST	$379,843	Presented in 2014
2012	Survey	Optical Survey of Closed Area II Scallop Access Area and the Nothern Edge Habitat Area of Particular Concern and Contiguous Areas	Richard Taylor	Arnie's Fisheries	$1,297,656	Used in FW24 and OHA2
2012	Bycatch	Seasonal Bycatch Survey of the George's Bank Scallop Fishery	Ron Smolowitz	Coonamessett Farm	$2,538,554	Used in FW25
2012	Survey	An Assessment of Sea Scallop Abundance and Distribution in the Hudson Canyon Closed Area and Adjacent Inshore Areas	Dave Rudders	VIMS	$678,016	Used in FW24
2012	Survey	An Inventory of the Sea Scallop Resource in the Georges Bank Closed Area II and Surrounds	Dave Rudders	VIMS	$364,498	Used in FW24 and OHA2

2011	Total of 14 projects funded (9 survey and 5 other topics)					
Year	Primary Project Category	Title	Principal Investigator	Organization	Funding	Used by Council
2011	Bycatch	Testing of a low profile scallop dredge for bycatch reduction	Ronald Smolowitz	Coonamessett Farm	$836,800	Presented in 2014
2011	Ecosystem/ Habitat	Effects of Mobile Fishing Gear on Geological and Biological Structure: a Georges Bank Closed Versus Open Area Comparison	Bradley Harris and Kevin Stokesbury	SMAST	$650,953	Presented in 2014
2011	Bycatch	Optimizing the George's Bank Scallop Fishery by Maximizing Meat Yield and Minimizing Bycatch	Ronald Smolowitz	Coonamessett Farm	$1,847,700	Used in FW24, 25
2011	Turtle	Understanding Impacts of the Sea Scallop Fishery on Loggerheads through Satellite Tagging	Ronald Smolowitz	Coonamessett Farm	$734,000	Used in FW23
2011	Survey	Assessment of Sea Scallop Distribution and Abundance in Federal and Adjacent State Waters of the Gulf of Maine	Kevin Kelly	Maine DMR	$589,314	Used in FW24
2011	Other	Developing Tools to Evaluate Spawning and Fertilization Dynamics of the Giant Sea Scallop Phase II: Field Trials in Experimental Populations	Richard Wahle and Peter Jumars	University of Maine Systems	$712,455	Presented in 2014 - more in 2016
2011	Survey	Scallop Biomass, Bycatch and Substrate Distribution in the Hudson Canyon and Closed Area I Scallop Access Areas--DROP Hudson Canyon	Richard Taylor	Arnie's Fisheries	$998,000	Used in FW24
2011	Survey	Extension of the SMAST Video Survey in the Western Portion of the Mid-Atlantic	Kevin Stokesbury	SMAST	$409,820	Used in FW24
2011	Survey	A Descriptive Sea Scallop Survey of the Federal Inshore Areas of the New York Bight Using a Camera Mounted Autonomous Underwater Vehicle	Arthur C. Trembanis	Phoel Associates, Inc.	$799,600	Presented in 2012
2011	Survey	High-Resolution Video Survey of the Sea Scallop Resource in the HC and Delmarva Area-----DROP Delmarva	Kevin Stokesbury	SMAST	$424,011	Used in FW24
2011	Survey	An Assessment of Sea Scallop Abundance and Distribution in Selected Closed Areas: New York Bight and the Southern New England Area	Dave Rudders	VIMS	$690,010	Used in FW24
2011	Survey	An Assessment of Sea Scallop Abundance and Distribution in Selected Closed Areas: DelMarVa Closed Area	Dave Rudders	VIMS	$353,353	Used in FW24
2011	Survey	An Assessment of Sea Scallop Abundance and Distribution in Selected Closed Areas: Georges Bank Closed Area II	Dave Rudders	VIMS	$353,353	Used in FW24
2011	Survey	An Assessment of Sea Scallop Abundance and Distribution in Selected Closed Areas: Nantucket Lightship Closed Area	Dave Rudders	VIMS	$353,353	Used in FW24

2010	Total of 8 projects funded (3 survey and 5 other topics)					
Year	Primary Project Category	Title	Principal Investigator	Organization	Funding	Used by Council
2010	Bycatch	Real-Time Electronic Bycatch Reporting Pilot Project	Ron Smolowitz	Coonamessett Farm	$484,250	Presented in 2014
2010	Turtle	Loggerhead Sea Turtle Ecology on the Sea Scallop Grounds	Ron Smolowitz	Coonamessett Farm	$863,962	Used in FW23
2010	Turtle	Testing of Modifications to the Cfarm Turtle Excluder Dredge for Bycatch Reduction	Ron Smolowitz	Coonamessett Farm	$918,184	Used in FW23, 24
2010	Survey	Tracking a Large Sea Scallop Recruitment Event with High-Resolution Video Survey in the Gulf of Maine	Kevin D. E. Stokesbury, Ph.D. and Bradley P.	SMAST	$775,206	Used in FW23
2010	Survey	Scallop, Yellowtail Flounder, and Substrate Distribution in the Closed Area II Scallop Access Area and the Western Side of the Great South Channel	Richard Taylor	Arnie's Fisheries	$1,706,300	Used in FW22
2010	Survey	High-Resolution Video Survey of the Sea Scallop Resource, Recruitment Patterns, and Habitat of the Hudson Canyon and Delmarva Closed Area	Kevin D. E. Stokesbury and Bradley P. Harris	SMAST	$1,065,305	Used in FW22
2010	Survey	An Assessment of Sea Scallop Abundance and Distribution in Selected Closed Areas: Hudson Canyon Closed Area	David B. Rudders and William D. DuPaul	VIMS	$348,855	Used in FW22
2010	Survey	An Assessment of Sea Scallop Abundance and Distribution in Selected Closed Areas: Georges Bank Closed Area 1	David B. Rudders and William D. DuPaul	VIMS	$428,840	Used in FW22

Summary of RSA Awards – 2010-2015

Number of RSA Projects Awarded by Research Priority

Research Priority	2010	2011	2012	2013	2014	2015	Grand Total
Bycatch	1	2	6	4	1	4	18
Discard/ Inc. Mortality					4	3	7
Ecosystem/ Habitat		1		2	3	2	8
Other		1	2	1			4
Survey	5	9	4	6	6	6	36
Turtle	2	1	1	1	1	1	7
Grand Total	8	14	13	14	15	16	80

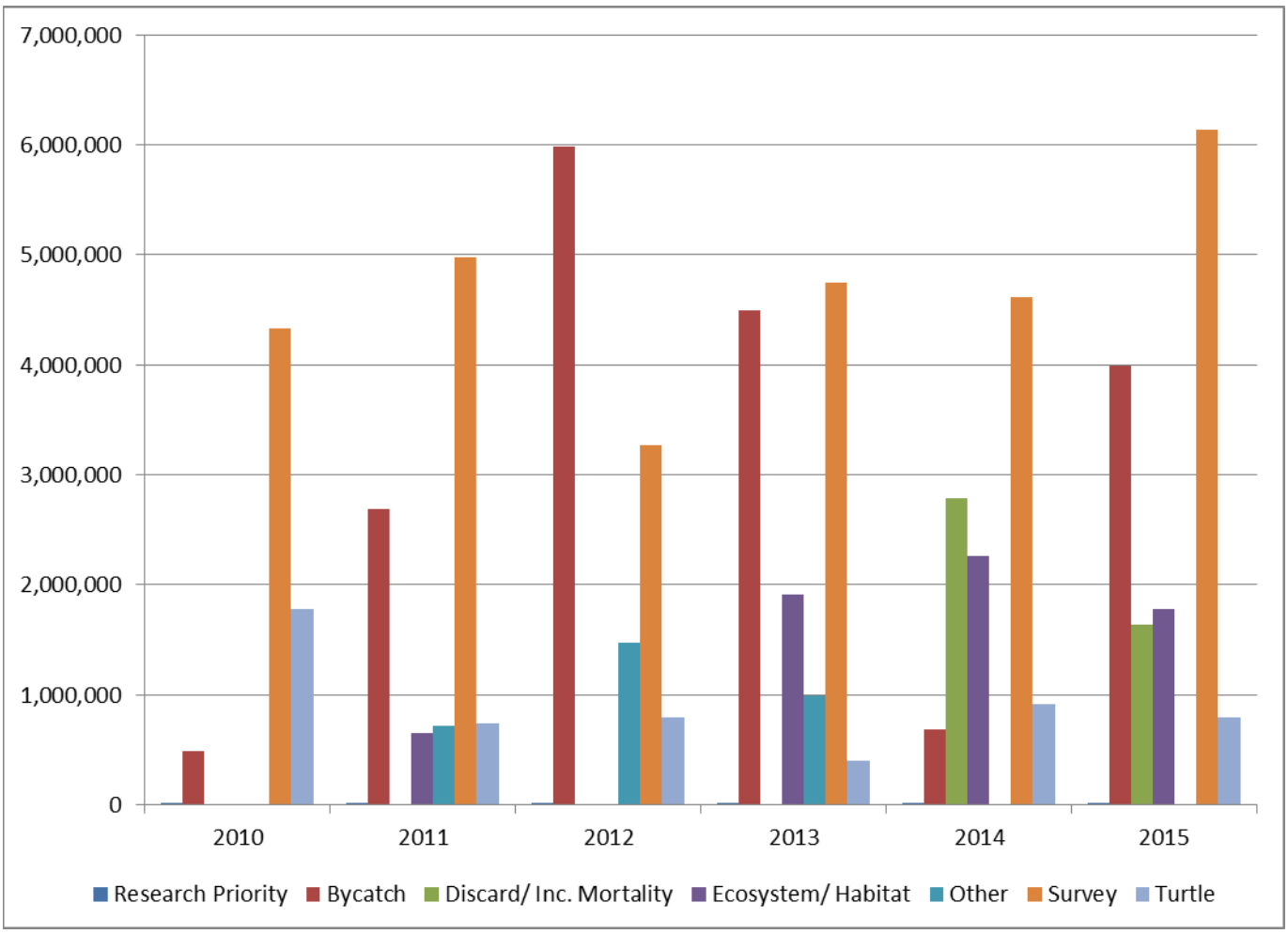
RSA Allocated by Research Priority (in Dollars)

Research Priority	2010	2011	2012	2013	2014	2015	Grand Total
Bycatch	484,250	2,684,500	5,986,364	4,494,367	678,955	3,990,396	18,318,832
Discard/ Inc. Mortality					2,784,928	1,631,500	4,416,428
Ecosystem/ Habitat		650,953		1,913,884	2,262,252	1,781,145	6,608,234
Other		712,455	1,472,485	993,844			3,178,784
Survey	4,324,506	4,970,814	3,267,134	4,745,617	4,611,565	6,139,078	28,058,714
Turtle	1,782,146	734,000	798,240	404,592	919,360	797,040	5,435,378
Grand Total	6,590,902	9,752,722	11,524,223	12,552,304	11,257,060	14,339,159	66,016,370

Percentage of RSA Allocated by Research Priority (based on dollars)

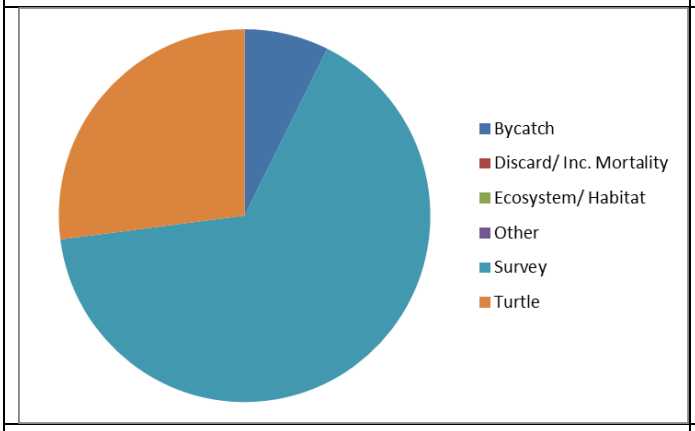
Research Priority	2010	2011	2012	2013	2014	2015	Grand Total
Bycatch	7.3%	27.5%	51.9%	35.8%	6.0%	27.8%	27.7%
Discard/ Inc. Mortality	0.0%	0.0%	0.0%	0.0%	24.7%	11.4%	6.7%
Ecosystem/ Habitat	0.0%	6.7%	0.0%	15.2%	20.1%	12.4%	10.0%
Other	0.0%	7.3%	12.8%	7.9%	0.0%	0.0%	4.8%
Survey	65.6%	51.0%	28.4%	37.8%	41.0%	42.8%	42.5%
Turtle	27.0%	7.5%	6.9%	3.2%	8.2%	5.6%	8.2%
Grand Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

RSA Allocation by Research Topic (in Dollars)

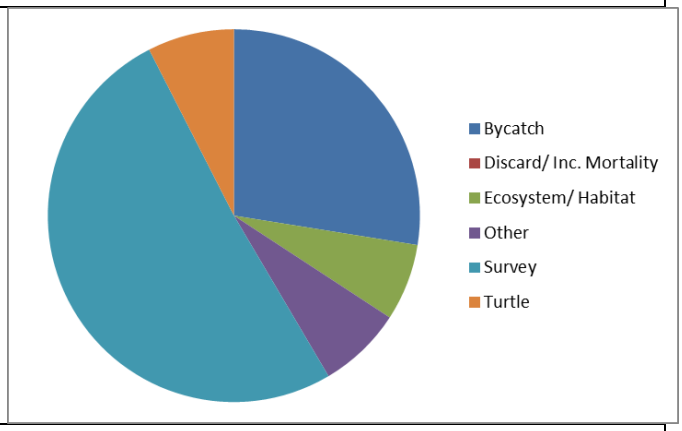


Percentage of RSA Allocated by Research Priority (2010-2015)

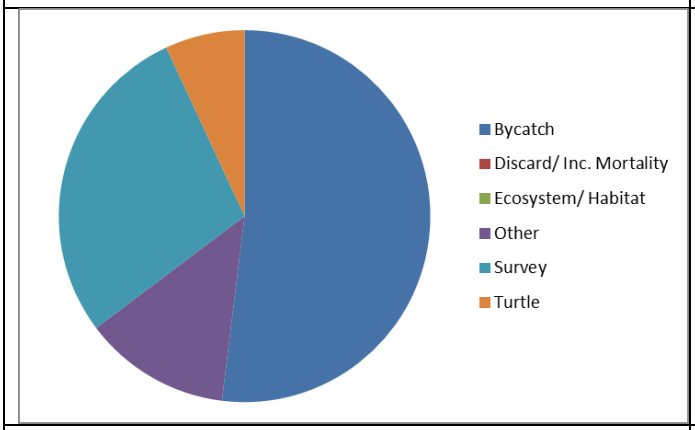
2010



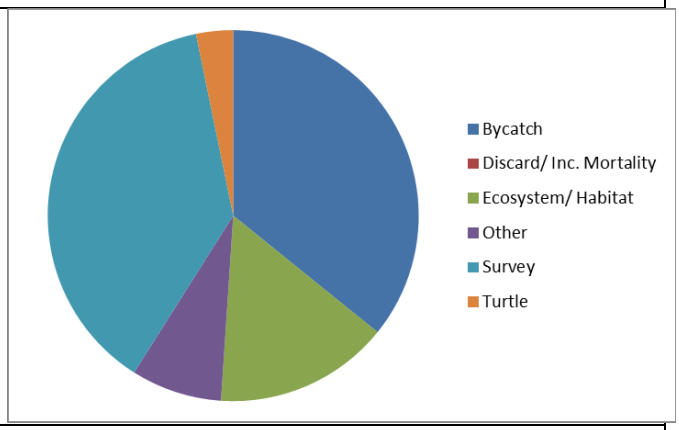
2011



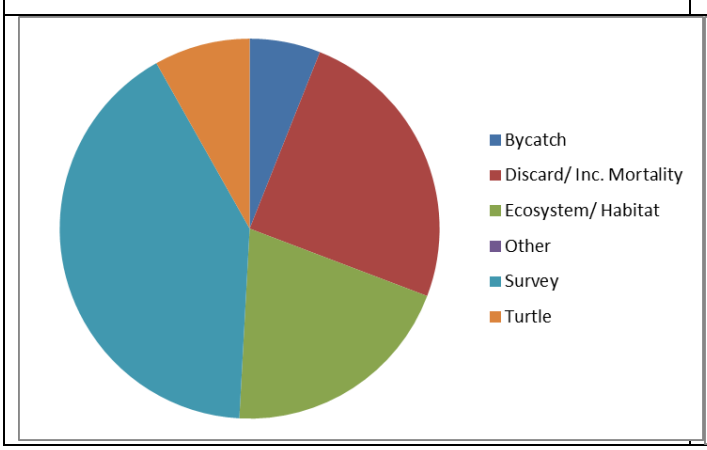
2012



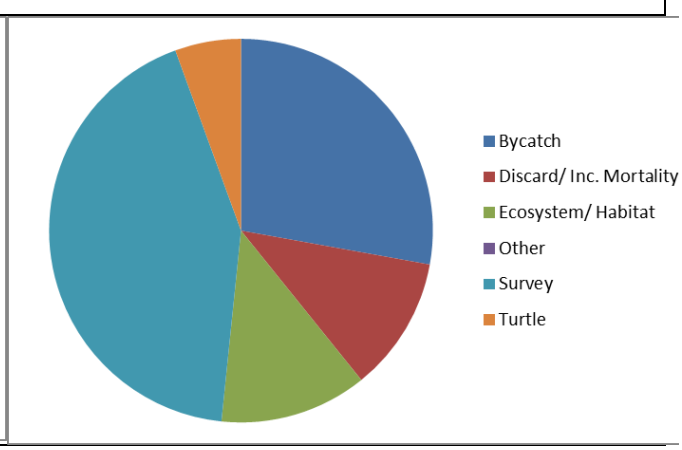
2013



2014



2015



Number of RSA Projects by Primary Organization (note some projects have multiple research organizations – this summary is based on primary organization provided only)

Research Organization	2010	2011	2012	2013	2014	2015	Grand Total
Arnies	1	1	1	1	2	2	8
CFF	3	3	4	4	3	6	23
DMR		1			1	1	3
Fisheries Specialist			1				1
NFI				1	1		2
NU				1	1	1	3
Phoel		1					1
SMAST	2	3	4	4	4	3	20
U Maine		1					1
UD					1	1	2
VIMS	2	4	3	3	2	2	16
Grand Total	8	14	13	14	15	16	80

RSA Allocation by Primary Organization (in Dollars)

Primary Organization	2010	2011	2012	2013	2014	2015	Grand Total
Arnies	1,706,300	998,000	1,297,656	995,894	1,789,680	1,437,888	8,225,418
CFF	2,266,396	3,418,500	4,936,646	4,729,047	1,996,777	5,464,619	22,811,985
DMR		589,314			558,515	372,344	1,520,173
Fisheries Specialist			584,375				584,375
NFI				338,931	366,588		705,519
NU				1,107,448	919,277	801,465	2,828,190
Phoel		799,600					799,600
SMAST	1,840,511	1,484,784	2,570,390	3,126,763	3,058,102	4,094,626	16,175,176
U Maine		712,455					712,455
UD					1,147,794	508,545	1,656,339
VIMS	777,695	1,750,069	2,135,156	2,254,221	1,420,327	1,659,672	9,997,140
Grand Total	6,590,902	9,752,722	11,524,223	12,552,304	11,257,060	14,339,159	66,016,370

Percentage of RSA Allocated by Primary Research Organization (based on dollars)

Primary Organization	2010	2011	2012	2013	2014	2015	Grand Total
Arnies	25.9%	10.2%	11.3%	7.9%	15.9%	10.0%	12.5%
CFF	34.4%	35.1%	42.8%	37.7%	17.7%	38.1%	34.6%
DMR	0.0%	6.0%	0.0%	0.0%	5.0%	2.6%	2.3%
Fisheries Specialist	0.0%	0.0%	5.1%	0.0%	0.0%	0.0%	0.9%
NFI	0.0%	0.0%	0.0%	2.7%	3.3%	0.0%	1.1%
NU	0.0%	0.0%	0.0%	8.8%	8.2%	5.6%	4.3%
Phoel	0.0%	8.2%	0.0%	0.0%	0.0%	0.0%	1.2%
SMAST	27.9%	15.2%	22.3%	24.9%	27.2%	28.6%	24.5%
U Maine	0.0%	7.3%	0.0%	0.0%	0.0%	0.0%	1.1%
UD	0.0%	0.0%	0.0%	0.0%	10.2%	3.5%	2.5%
VIMS	11.8%	17.9%	18.5%	18.0%	12.6%	11.6%	15.1%
Grand Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

3. SARC50 and SARC59 Research Recommendations

TOR8 from SARC59 included a review and evaluation of the status of research recommendations listed in SARC50 as well as new research recommendations. Staff has included notes in CAPS about status of each item.

B11 - RESEARCH RECOMMENDATIONS (TOR 8)

Progress on recommendations from SARC-50 (NEFSC 2010)
1. Look into a way to fit discarded scallops, which have a different length frequency from the rest of the population, into the model.
No progress.

NEFSC – NOT RSA

2. Evaluate the effect of the four-inch rings on incidental mortality. Now that a larger fraction of small scallops are traveling through the mesh, has incidental mortality increased or are the scallops relatively unscathed?
Incidental mortality calculations were improved for this assessment to account for fishery selectivity. Several field projects were funded in 2014 to investigate the extent of incidental mortality from the currently configured fishing gear.

REMAINS ON THE PRIORITY LIST UNDER OTHER – 3 SEPARATE PROJECTS FUNDED IN 2014 AND 2015

3. Consider finding a better way to express the variation in the HabCam abundance data (the data were kriged for this assessment, and the variance was calculated by summing the variance of each of the kriged grids).
Two-stage GAM/Kriging models and stratified mean methods were introduced in this assessment, and several methods for calculating variance were investigated and compared in this assessment by simulation and analysis of actual data.

NEFSC – NOT RSA

4. Look at the historical patterns of the "whole stock"; how the spatial patterns of scallops and the fishery have changed over time.
These topics are handled in the description of survey and fishery data to the extent they are relevant.

NEFSC – NOT RSA - COMPLETED

5. Estimate incidental mortality by running HabCam or an AUV along dredge tracks.
Several projects were funded this year to do work along these lines.

REMAINS ON THE PRIORITY LIST UNDER OTHER – 3 SEPARATE PROJECTS FUNDED IN 2014 AND 2015

6. Effort should be made to make sure the survey dredge is fitted with a camera at some point during the survey to record the movements of the dredge. This will help answer some questions about when the dredge starts and stops fishing, and the determination of tow times.
Five survey dredge tows were conducted with a camera mounted to the dredge that allowed improved interpretation of dredge sensor data.

NEFSC – NOT RSA - COMPLETED

7. Seasonal patterns in scallop shell growth need to be analyzed and this data incorporated into the model.
No progress; the assessment team did not feel this is a high priority.

8. Stock-recruit relationships should be calculated for various sub-sections of the stock, smaller areas than just MAB and GBK to look for possible patterns or relationships.
Appendix B8 examined the relationship between recruitment in the southern Mid-Atlantic and biomass in the entire stock.

NEFSC – NOT RSA - COMPLETED

9. Further refine the estimate of the extent of scallop habitat relative to that of the survey.
New VIMS dredge and HabCam and SMAST optical surveys were used to identify stock boundaries and improve understanding of the relationship between the dredge survey and stock areas.

COMPLETED

10. Age archived scallop shells from the 1980s and 1990s.
Archived shells from 1988 and 1993 were used to estimate growth matrices to represent growth when fishing mortality was high in the CASA models. However, additional years should be analyzed as described in a new research recommendation.

UNDER OTHER IN RSA PRIORITIES

11. Continue to look at patterns of seasonality in weight of the meats and gonads, and timing of spawning.
Annual meat weight anomalies used to adjust mean body weight of individual scallops in the fishery and to compute catch numbers were substantially improved. Shell height meat weight relationships based on survey data were updated.

COMPLETED

New recommendations in SARC59

The Invertebrate Subcommittee identified the following research topics while preparing this assessment. The topics listed below are all considered worthwhile and are not listed in order of priority. [Note: In the summary report, the Invertebrate Subcommittee commented that several topics would address some of the knowledge gaps and improve accuracy in the model outputs and assumptions, especially the first three in the list. The Scallop Survey Methods Review Panel identified the first two as general findings as well].

1. **Investigate methods for better survey coordination between the various survey programs.**
   SHOULD THIS BE ADDED AS RSA PRIORITY SOMEHOW?

2. **Evaluate effects of uncertainty in identifying dead scallops in optical surveys and improve procedures for identifying dead scallops.**
   SHOULD THIS BE ADDED AS RSA PRIORITY SOMEHOW?

3. **Collect data to refine estimates of incidental mortality. Analytical procedures were improved this assessment but further progress awaits collection of more data.**
   ALREADY UNDER "OTHER"

4. Improve training of annotators used in optical surveys to identify and count specimens. For example, develop and consistently apply criteria for identifying inexact shell height measurements. Formalize QA/QC procedures including revaluation of annotator accuracy. Develop and maintain reference images for training and testing.
   NEFSC – NOT RSA

5. Continue work to improve and simplify survey design and analytical procedures for HabCam. Ideally, procedures might be automated to the extent possible and integrated into routine survey operations.
   NEFSC – NOT RSA

6. Quantify and improve accuracy of SAMS projection models used to specify harvest levels. Recent projections appear to overestimate stock size to some extent.
   NEFSC – NOT RSA

7. Reduce uncertainty about stock size estimates from surveys and the CASA model. In particular, continue work on density dependent natural mortality for small scallops in stock assessment, reference point and projection models.
   NEFSC – NOT RSA

8. Collect additional biological data on a regional basis including growth increments from shells collected during historical dredge surveys, seasonality of spawning based on observer data, natural mortality on large scallops due to disease and senescence, and size specific reproductive output.
   SOME OF THESE ARE ALREADY INCLUDED IN RSA PRIORITIES BUT NOT ALL

9. Refine models that predict scallop recruitment based on chlorophyll and predator data in order to improve estimates from stock assessment and projection models. Investigate statistical approaches to estimating year class strength directly from survey data.
   NEFSC – NOT RSA

10. Investigate and quantify the utility of multiple scallop surveys.
    SOMEWHAT ADDRESSED IN RECENT SURVEY METHODS REVIEW (BUT NOT THE QUANTIFICATION PART)

4. General Findings from the Summary Report of the Review of Sea Scallop Survey Methodologies and Their Integrations for Stock Assessment and Fishery Management (April 9, 2015)

Meeting held on March 17-19, 2015 in New Bedford, MA to review sea scallop methodologies based on eight terms of reference. Lead scientists from each scallop survey group presented information for all eight terms of reference.

An independent review panel was convened to review and write a summary report. J.J Maguire served as the Chair and four additional scientists were selected from the Center for Independent Experts (CIE)" Noel Cadigan, Martin Cryer, Jon Helge Volstad and Brent Wise.

Council staff has summarized the general findings of the panel, but the complete reports should also be considered. All materials related to the survey methods meeting are available at: http://www.nefsc.noaa.gov/saw/scallop-2015/

Terms of Reference included below followed by general findings by the review panel.

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1. **Review the statistical design and data collection procedures for each survey system**
    a. **Dredge surveys conducted on research vessels**
    b. **Dredge surveys conducted on commercial vessels**
    c. **SMAST video drop camera system**
    d. **HabCam camera and sensor sled**

Panel Findings

1. All surveys have strengths and weaknesses.
2. All provide unbiased estimated of mean abundance in surveyed areas, but difficult to produce a design-unbiased estimator of the variance for grid design surveys.
3. Overall sampling intensity of drop camera and VIMS dredge are inefficient because sampling intensity is the same in areas of low and high abundance. Estimates would be more precise with more sampling in high abundance areas, but surveys have other objectives. Optimal design depends on primary purpose and compromises necessary if multiple objectives.
4. Federal Habcam has very detailed info along transect, but distance between transects seems wide and Industry Habcam has short distances between transects but for smaller parts of the stock area.
5. NEFSC dredge survey has reduced over time and this introduces risk that estimates are less reliable (less precision and potential bias). A stratification method for quasi-optimal allocation of tows was presented but insufficient details about specific sampling plans or analysis of its potential efficiency compared to stratified random sampling were available. However, federal survey is flexible and can take into account other surveys to achieve a comprehensive survey. Gear types have been calibrated so results can be combined.

6. Surveys with greater spatial coverage tend to reduce bias and provide more accurate estimates of stock size, especially for populations whose spatial distribution can vary.

7. Allocation of samples should ideally cover entire range of stock with more intense sampling in areas with higher abundance to increase overall precision.

8. Spatial management may require more detail sampling to achieve optimal use of resource.

2. For each survey, evaluate measurement error of observations including shell height measurement, detection of scallops, determination of live vs. dead scallops, selectivity of gear, and influence of confounding factors (*e.g.,* light, turbidity, sea state, tide etc.)

Panel Findings

1. Dredge surveys provide more accurate measurements of shell height compared to optical surveys (both drop and towed cameras).

2. Critical to have reliable estimates of length compositions for length based assessment model. Collection of physical samples is necessary to estimate spatio-temporal variation, also critical to assessment.

3. Optical surveys provide almost complete detection of exploitable scallops and better detection of recruitment compared to dredge surveys; however recruitment info is still only qualitative. Optical surveys used to estimate dredge efficiency – 40% on sand and 24% on gravel.

4. Drop camera edge-effect correction method inflates stapled area by including buffer around actual quadrat of width equal to half the average length of observed scallop. This underestimates abundance of small scallops because small scallops on edge not seen and overestimates abundance of large scallops. The latter bias particularly important for estimation of exploitable biomass. Panel recommends correcting for edge effect for individual scallops instead, and a method was offered.

5. In practice there also seems to be some differential detectability of scallops from drop camera, especially in corners, which probably leads to some negative bias. The panel also provided a potential method for correcting such bias that could be applied to existing data.

6. Optical surveys would produce less reliable estimates of the proportion of dead scallops (false alive or dead) but the magnitude of this was not quantified

7. There are many confounding factors (optical distortion, attenuation, etc.) for optical surveys and many of these have been addressed for both the drop and towed camera systems. The panel considers that the Habcam4 imaging processing procedures are more advanced and encourages further research.

3. **Review the biological sampling aspects of the surveys, including sub-sampling procedures and the ability to sample all size classes. For each survey, evaluate the utility of data to detect incoming recruitment, assess the potential ability to assess fine scale ecology (*e.g.,* Allee effect, predator-prey interactions, disturbance from fishing gear, etc.).**

Panel Findings

1. Both optical surveys provide potential info on predator-prey interactions. The panel thinks finfish avoidance may be more of a problem with towed camera because it is more likely detected earlier; however, towed camera provides a much larger sample size (images) that could be used to evaluate predator-prey distributions.

2. Panel agrees there is a magnitude of work involved in processing large amounts of data and encourages further development of automatic processing capabilities (HabCam4).

3. HabCam4 with side scan sonar is the only sampling procedure reviewed that could be used to detect the physical impacts of fishing gear.

4. To collect biological information such as disease, grey meat, etc. it is necessary to physically capture scallops. This is important for assessing potential future natural mortality, which can greatly affect the efficacy of management plans, growth rates and potential yield.

5. Optical surveys have higher detectability of scallops <20mm than dredge, but less accurate info on exploitable scallops because they introduce statistical noise – distributions of size are widened and cohorts are "smeared". However, there is some potential for dredges to have a dome-shaped selection pattern that can lead to underestimating proportion of very large scallops. These issues should be studied further.

6. Subsampling for meat weights is currently done on the federal dredge by selecting 5 scallops per station. Statistical sampling design should be developed and applied. Panel recommends the total # of baskets and fraction sampled be recorded and the between basket variation be recorded to estimate this source of variation.

7. Drop camera does not subsample. Subsampling of HabCam seemed reasonable but the within transect variation can be large and alternative sampling strategies may be required for other species or areas where scallop densities are low.

4. **Review methods for using survey data to estimate abundance indices. Evaluate accuracy (measures of bias) of indices as estimates of absolute abundance.**

Panel Findings

1. Commercial dredge – post stratified into 9 sub-areas and standard design-based methods used. Panel did not review estimates of efficiency in detail but methods seem appropriate. Potential biases in efficiency estimates over time or space will affect accuracy. Variance estimate has issues and survey is exploring changes to survey design to address those issues.

2. Drop camera – method seemed appropriate subject to probable positive bias associated with edge effects correction and probable negative bias associated with detectability of 100% of scallops in image. Uses the same statistical uniform systematic design method as VIMS with the same potential biases.

3. Both HabCam surveys use model based methods (kriging and GAM with kriging) and a design based method (stratified mean) – all 3 tested through simulations. Panel concluded that no single method consistently achieved low bias. The geostatistical modelling approach seems reasonable but the biomass variance estimates are likely underestimated. More work recommended.

4. Model based methods should be used with care. The Panel notes that in a few cases the model estimated highest abundance in areas with no samples and it is not clear why. This could be seriously misleading if models used in spatial management.

5. Evaluate any proposed methods for integrating and using surveys outside of a stock assessment model for management purposes.

Panel Findings

1. VIMS and NEFSC dredge survey results have been combined and this is appropriate because the same gear is being used; however, these two surveys are not at the same time and populations could be different due to growth and mortality.

2. Survey results are currently combined into one overall biomass estimate (VIMS and federal dredge, SMAST drop camera, HabCam2, and HabCam4). Two methods have been used: straight average and inverse variance weighting method. Combining surveys is only appropriate if the estimates are for the same area. Raw averaging does not account for different precision of estimates. However, inverse variance weighting is reliable only if there are reliable estimates of variance, which is uncertain for VIMS and SMAST, where variance is expected to be overestimated. An analysis that combines all surveys in a single model using co-kriging was presented, but it is still a work in progress.

3. Data from these surveys are used for other management purposes; the panel concludes that complementary surveys provide enhanced capabilities to achieve other objectives because no survey covers the complete stock area on a regular basis.

6. Comment on potential contribution of each survey to assessments for non-scallop species and use of data apart from assessment purposes such as characterizing species habitat, understanding sea scallop ecology, and ecosystem studies.

Panel Findings

1. All surveys have potential to contribute to other purposes and in many cases info is complementary or additive. Optical surveys have provided additional information on habitat, scallop ecology, and ecosystem studies.

2. All have provided information on changes in abundance of other species.

3. Panel considers that HabCam V4 has the greatest potential in providing info on habitat, gear impacts, species interactions and spatial structure on a continuously variable variety of scales.
4. Both dredge surveys sample less area, which limits their contribution to ecosystem studies.
5. Broad scale info is particularly useful when contributing to ecosystem studies. Panel encourages further research in those areas.

7. Comment on the current and/or any proposals for optimal frequency and combination of survey methods.

Panel Findings

1. No specific proposals for optimal frequency were evaluated but the panel agrees that annual surveys are required to support the management process. Yearly surveys also make it possible to detect and protect recruitment events and avoid under and over harvest of stock components.
2. To some extent the surveys are integrated because they cooperate to address survey gaps and standardize dredge catch rates. Panel recommends that survey efforts should be further integrated to provide a standard monitoring survey of the entire stock.
3. Optical and dredge surveys are complementary and both should be maintained and integrated.
4. Continuity of the time series should also be maintained to the fullest extent possible.
5. Panel recommends that all info be used to devise an optimal and integrated statistical survey design involving use of complementary methods for estimating stock size, spatial distribution, and other primary objectives. This may require simulation studies.

8. Identify future research and areas of collaboration among investigators and institutions.

Panel Findings

1. Panel recommends that all available information from all surveys be thoroughly analyzed, including an evaluation of the efficiency of using shorter tow durations.
2. Further investigation into the correlation between dredge tow catches and HabCam observations, and using model assisted regression estimators may be a simple way to combine and improve estimation of stock size while maintaining continuity of federal dredge survey.
3. In a survey design with increased dredge coverage, the panel found no compelling advantage in using both dredge and HabCam gears on the same vessel. However, a portion of dredge samples that overlap HabCam track are still required. Panel agreed that continuous sampling of HabCam is the best use of the technology (compared to taking the vehicle in and out of the water). A joint integrated survey using two vessels could result in a better survey with improved coverage.