UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northeast Fisheries Science Center
166 Water Street
Woods Hole, MA 02543-1026

June 9, 2016

CRUISE RESULTS

UNOLS R/V *Hugh R. Sharp*
Cruise No. S1 15-01 (Parts I –III)
Sea Scallop Survey

CRUISE PERIOD AND AREA

The cruise period was 15 May – 21 June 2015 and was conducted in three parts: Part I was from 16 – 25 May, Part II was from 27 May – 9 June, and Part III was from 11 - 21 June. The area surveyed was from the Mid-Atlantic Bight to Georges Bank, and average sampling depths ranged from approximately 29 to 118 meters (16 to 65 fathoms). Approximate station locations are shown in Figure 1.

OBJECTIVES

The objectives of the survey were to: 1) determine the distribution and relative abundance of sea scallops (*Placopecten magellanicus*) and associated fauna utilizing two sampling devices: the 8-foot wide, standardized sea scallop dredge and the stereo-optic towed camera array (HabCam V4); 2) collect biological samples; 3) determine the most economical and valid methodology for consecutive sampling of the dredge and HabCam.

METHODS

Operations and gear for cruise S1 15-01 Parts I – III conformed with the Cruise Instructions for the Sea Scallop Survey, dated April 24, 2015. Exceptions to the Cruise Instructions were that Part I was delayed two days due to mechanical issues with the vessel, and Part II was interrupted due to inclement weather.

Pre-selected, random stations were sampled using a modified 2.44 m (8-foot) wide, New Bedford-type scallop dredge rigged with 5.1 cm (2 inch) diameter rings and lined with at 3.8 cm (1½ inch) polyethylene stretched mesh liner. Tow duration was 15 minutes, tow speed was 3.8 knots, and the dredge was fished using a 3.5:1 wire out to depth scope. Tow distance was recorded using differential GPS, and a recording inclinometer was mounted on the dredge to collect bottom-contact time data.

All catch and biological data were recorded using the shipboard, automated, data-entry system,

Fisheries Scientific Computing System (FSCS). This system uses digital scales, electronic measuring boards, and touch-screen monitors to record data on deck.

After each dredge tow of the scallop survey, the entire catch was sorted into biological and habitat components. Live whole and clapper shells of various scallop species, including sea and Icelandic, were weighed using the motion-compensated, digital scales. Representative length frequencies for all scallop species were collected to the nearest millimeter using electronic measuring boards (Icthystick); selected fish species incidentally caught in the dredge were also measured to the nearest millimeter. Weights and total numbers were recorded for all other fish species at each station. Furthermore, the weights and total numbers of cancer crabs and starfish were recorded at selected stations. Habitat portions were estimated by basket volume, converted into number of liters (where one basket = 46 liters), recorded into the FSCS system, and then finally discarded.

Surface temperatures were measured using the R/V *Hugh R. Sharp*'s hull-mounted temperature sensor and logged by the Scientific Computer System (SCS) at all stations. Temperature and conductivity profiles were made at approximately every fourth dredge station using a conductivity, temperature, and depth instrument (CTD). A bottom salinity sample was obtained twice a day, when applicable, to calibrate the CTD.

Additionally, cooperative work was conducted throughout all legs of the sea scallop survey to determine the most economical and valid methodology for consecutive sampling of the dredge and the Habitat Camera system (HabCam) as a surveying tool, or part of the suite of survey tools, for future NOAA scallop surveys. Developed by a group of researchers associated with Woods Hole Oceanographic Institute (WHOI), as well as in conjunction with particular members of the commercial fishing industry, HabCam is a towed, seafloor-imaging camera system with the following capabilities: 1) acquisition of stereo-optical and acoustic imagery, which can be viewed in "real time"; 2) the ability to count and measure scallops and groundfish; 3) measurement of biodiversity and community structure; 4) characterization of substrate; and 5) measurement of oceanic properties (salinity, temperature, nutrients).

The system is designed to operate over the range of the continental shelf and, while at sea, is able to image a track of over 100 nautical miles each 24 hour day. The current Northeast Fisheries Science Center's 8-foot wide scallop dredge can make approximately 24, 15-minute tows at 3.8 knots per day, covering about 4,500 square meters (m^2) per tow and 106,704 m^2 per day. Continuous operation with HabCam towing at about six knots covers over 260,000 m^2 per day. Thus, the spatial coverage of HabCam is over 2.5 times the area covered by the survey dredge.

The HabCam system was mounted in a ten-foot long by three-foot wide steel frame and towed one to three meters off the ocean floor at a speed of approximately six knots. An operator controlled the system by means of the R/V *Hugh R. Sharp*'s winch-driven, fiber optic cable, which allowed for real-time data collection and provided power to the unit.

RESULTS

The survey sampled at 194 dredge stations, with 0, 115, and 79 dredge hauls made on Parts I, II and III, respectively; 171 of those stations were representative. The dredge flipped 7 times and stations were re-towed in some flip cases. Bottom temperatures were collected at 54 stations using the CTD system, while bottom water samples for CTD calibration were taken at 23 stations.

A total of 3,307 samples were collected to support nine internal and external investigations (Table 1).

During the three legs of the survey, NOAA HabCam V4 was deployed concurrently throughout the scallop strata. HabCam V4 was towed for approximately 15 days over the course of the survey, capturing images along a cruise track of approximately 2,212 km in the Mid-Atlantic Bight (MAB) and 2,422 km on Georges Bank, including the Great South Channel. The HabCam track is shown in Figures 2 and 3. The total production of paired images was approximately 45 terabytes (TB) for raw tiff paired images. This translates into 7,906,000 image pairs; 4,250,000 image pairs were collected in the MAB and south, while 3,656,000 image pairs were collected on Georges Bank.

DISPOSITION OF DATA

Catch data and hydrographic data will be analyzed at the NEFSC Laboratory in Woods Hole, Massachusetts. The various collections were forwarded to researchers listed in Table 1. Resulting data will be audited, edited, and archived in an Oracle database.

HabCam images will be further analyzed for biological data both at the Woods Hole Oceanographic Institute and at NOAA's NMFS Woods Hole Lab.

SCIENTIFIC PERSONNEL

National Marine Fisheries Service, NEFSC, Woods Hole, MA
Larry Brady[1]
Jonathan Duquette, Chief Scientist[2]
Joseph Godlewski[2]
Dvora Hart[1]
Robert Johnston [3]
Charles Keith[2]
Victor Nordahl[3], Chief Scientist[1]
Eric Robillard[2]
Burton Shank[3]
Jiashen Tang[1,3]

National Marine Fisheries Service, Cape May, NJ
Joshua O'Connor[1]

National Marine Fisheries Service, Hampton, VA
Steven Ellis[1]

Contractors, Integrated Statistics, Woods Hole, MA
Michael Bergman[2,3]
Glenn Chamberlain[3]
Jui-Han Chang[2]
Nicole Charriere[1], Chief Scientist[3]
Catherine Fillo[2]
Christine Kircun[2]
Tasha O'Hara[2,3]
Jill Price[4]

NOAA Teacher At Sea Program

Trevor Hance[3]	Laurel Mtn. Elementary School, Austin, TX

WHOI, HabCam Group, Woods Hole, MA
Scott Gallager[1,3]
Amber York[1,2]

Volunteers

Emily Cheung[1]	Skidmore College, Saratoga Springs, NY
Wilmelie Cruz[1]	University of Maryland Eastern Shore, MD
Massimo DiStefano[3]	University of New Hampshire, Durham, NH
Zachary Hahn[1]	Bristol Community College, Fall River, MA
Katherine Kaplan[3]	Cornell University, Ithaca, NY
Sean Martin[2]	Rutgers University, New Brunswick, NJ
Anastasia Procaccini[2]	University of Vermont, Burlington, VT

[1] 15 - 25 May 2015
[2] 27 May – 9 June, 2015
[3] 11 – 21 June, 2015

For further information contact Robert Johnston, National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, MA 02543. Phone (508) 495-2061; FAX (508) 495-2115; Robert.Johnston@noaa.gov. The Resource Survey Report for this survey and the cruise results can be viewed at: NOAA NEFSC Ecosystems Survey Branch website main page.

Table 1. Special samples obtained for various investigators on UNOLS R/V *Hugh R. Sharp* Sea Scallop Survey, during 15 May – 21 June 2015.

Investigator and Affiliation	**Samples Saved**	**Approximate Number**
Galbraith, John NMFS, NEFSC, Woods Hole, MA	misc. fish	4 frozen
Hart, Dvora NMFS, NEFSC, Woods Hole, MA	sea scallop shells	532 shells frozen
	sea scallop meat weights	541 weights
	sea scallop gonad weights	545 weights
	sea scallop shell widths	548 weights
	sea scallop, diseased	16 frozen
	sea scallop, tagged	4 frozen
	Asterias sp. sea stars	498 examined
Martin, Sean Rutgers University, New Brunswick, NJ	waved whelk	614 individuals
Shank, Burton NMFS, NEFSC, Woods Hole, MA	American lobster	9 tagged
TOTAL		3,307 samples

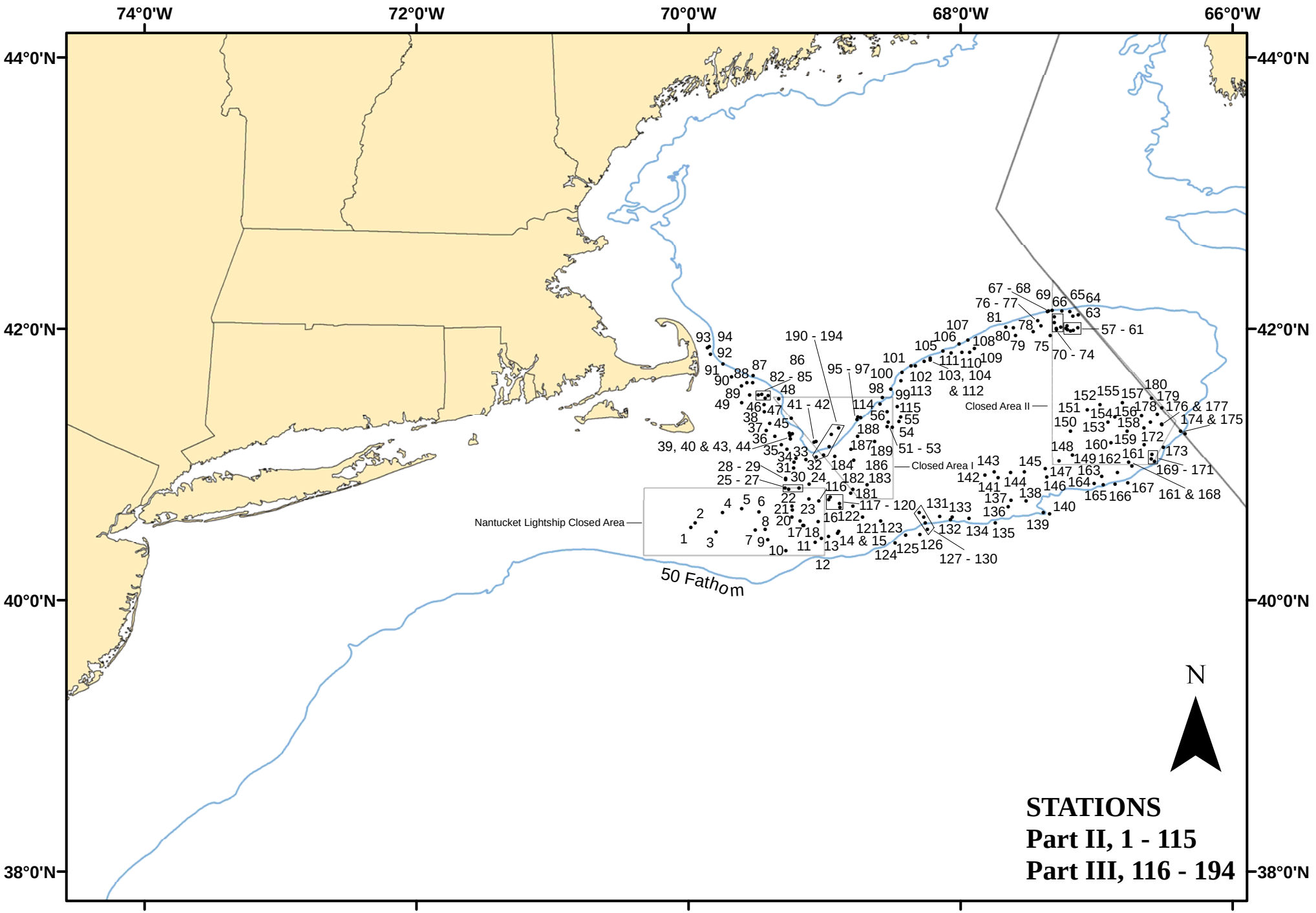

Figure 1. Dredge tows made from UNOLS R/V *Hugh R. Sharp*, during NOAA Fisheries Service, Northeast Fisheries Science Center's Sea Scallop Survey, 16 May - 21 June 2015.

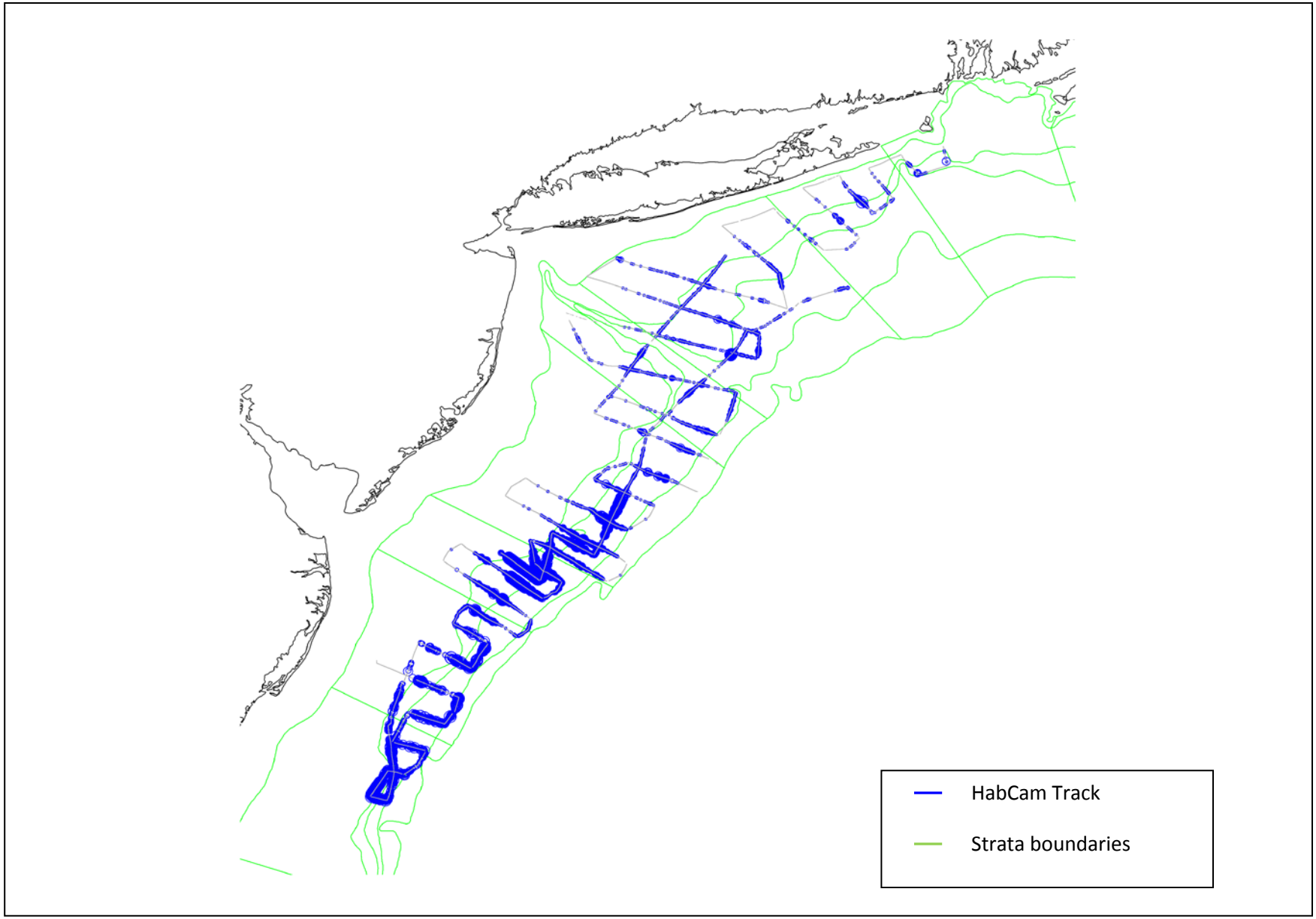

Figure 2: NOAA HabCam track through the Mid-Atlantic Bight, conducted by UNOLS R/V *Hugh R. Sharp* during NOAA Fisheries Service, Northeast Fisheries Science Center's Sea Scallop Survey, 16 May – 21 June 2015.

Figure 3: NOAA HabCam track on Georges Bank, conducted by UNOLS R/V *Hugh R. Sharp* during NOAA Fisheries Service, Northeast Fisheries Science Center's Sea Scallop Survey, 16 May – 21 June 2015.