CRUISE RESULTS
NOAA Fisheries Research Vessel ALBATROSS IV
Cruise No. AL 05-07
Late Summer Ecosystem Monitoring Survey/EPA National Coastal Assessment Survey

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CRUISE PERIOD AND AREA

The cruise period was 13 to 25 August 2005. The NOAA fisheries research vessel ALBATROSS IV sampled 90 stratified random ecosystem monitoring stations located in the southern New England, Georges Bank and Gulf of Maine, plus 5 fixed stations in the Gulf of Maine region. The fixed stations were in the Wilkinson, Jordan and Georges basins, in the Northeast Channel and east of Boston Harbor, (Figure 1).

OBJECTIVES

The primary objective of the cruise was to assess changing biological and physical properties which influence the sustainable productivity of the living marine resources of the southern New England, Gulf of Maine and Georges Bank portions of the northeast continental shelf ecosystem. A secondary objective of this cruise was data and sample collecting for the EPA National Coastal Assessment (NCA) Program.
Key parameters measured for the Ecosystem Monitoring Program included water column temperature, salinity, and chlorophyll-a fluorescence, and ichthyoplankton and zooplankton composition, abundance and distribution. Key parameters measured for the EPA/NCA Program included chemical concentrations and benthic infaunal assemblages in sediments and nutrient levels, chlorophyll a and total suspended solids in the water column.

Other secondary objectives of this cruise involved the following:

- Bongo tows to within 5 meters of the bottom in deep basin areas of the Gulf of Maine to provide plankton samples to compare with standard 200 meter tows at the same location to assess the difference in zooplankton volumes and composition. These tows also provided CTD data detailing the incursion of Labrador Current water into the Gulf of Maine, as did a CTD drop in the Northeast Channel.
- Sampling at the site of a proposed Liquefied Natural Gas (LNG) terminal east of Boston Harbor, to collect baseline data.
- Collection of samples for zooplankton genetics (genome) studies.
- Examination of plankton samples for concentrations of Calanus finmarchicus to correlate with

right whale sightings.

- Deployment of a drifter buoy to provide current movement and sea surface data for a NOAA database and website.

METHODS

The survey consisted of 95 stations at which the vessel stopped to lower instruments over the side. Ninety randomly stratified stations were planned for the cruise, with 30 in Southern New England, 30 on Georges Bank, and 30 in the Gulf of Maine. Three additional non-random stations were completed in the Gulf of Maine area to perform comparison tows of 200 meters and a second tow at the same coordinates to within 5 meters of the bottom. These comparison tows were made to determine if standard 200 meter bongo tows miss a portion of the zooplankton biomass in deep basin areas. These tows also document the incursion of Labrador Current water from the CTD data. An additional deepwater CTD cast made in the Northeast Channel provided further data to document this incursion. A fifth station east of Boston Harbor, provided baseline environmental data at the site of a proposed offshore LNG terminal.

Zooplankton genetics (zoogen) samples were collected at five randomly designated stations in each of the three regions, yielding a total of 15 samples.

Near-surface along-track chlorophyll-a fluorescence, water temperature and salinity were measured while underway with the vessel's flow-through sampling system.

Double oblique tows using the 61-cm Bongo sampler and a Seabird CTD with a fluorometer were made at 94 stations (one station was a CTD-cast-only). The tows were made to approximately 5 meters above the bottom, or to a maximum depth of 200 meters. All plankton tows were conducted at a ship speed of 1.5 knots. Plankton sampling gear consisted of a 61-centimeter diameter aluminum Bongo frame with two 335-micron nylon mesh nets. At the randomly designated zoogen stations a 20-cm diameter PVC Bongo frame fitted with paired 165-micron nylon mesh nets was put on the towing wire one half meter above the Seabird CTD with a wire stop. A 45-kilogram lead ball was attached by an 80-centimeter length of 3/8-inch diameter chain below the aluminum Bongo frame to depress the sampler. A digital flowmeter was suspended within the mouth of each sampler to determine the amount of water filtered by each net. No flowmeters were used in the 20-cm bongos. The plankton sampling gear was deployed over the port side of the vessel by means of a power boom. Upon retrieval, the bongo frame was placed in the checker, a wooden table used to hold the fish catch from trawl surveys. The checker allowed for easier wash-down of the large sampling nets, and when a 20 cm bongo frame was deployed, it was carried forward to the sheltered work area so both sampling arrays could be washed down simultaneously after retrieval by placing the large frame in the checker and the small frame in the protected work area. The 61-centimeter bongo plankton samples were preserved in a 5 % solution of formalin in seawater. The zooplankton genetics samples were preserved in 95 % ethanol, which was changed once 24 hours after the initial preservation. Tow depth was monitored in real time with a Seabird CTD profiler. The Seabird CTD profiler was hard-wired to the conductive towing cable, providing simultaneous depth, temperature, salinity and chlorophyll-a fluorescence data for each plankton tow. A CTD cast was made in Wilkinson, Jordan, and Georges Basins and near the northern wall of the Northeast Channel.

The EPA sampled at every fifth station, depending on time constraints and/or conditions, for a total of 21 sites (see Table 1). The sequence of events on the NOAA/EPA stations was to do a standard Ecosystem Monitoring bongo tow first, then use the power boom to do a bottle cast involving two 5-liter Niskin bottles, one just above the CTD unit (which was lowered to 5 meters above the bottom) and a second at a mid-water depth. A surface water sample was collected simultaneously from the salt-water hose. The bongo nets were washed down and the plankton samples removed and preserved in 5% formalin during the water cast. The water samples from all three depths of the bottle cast were filtered using low vacuum pressure, through 47mm diameter Whatman GFF filters which were subsequently frozen for shore-side analysis of total suspended solids, chlorophyll a, and dissolved and particulate forms of nitrogen and phosphorus. After completion of the bottle cast, a double Van Veen Grab was deployed from the starboard side of the vessel, using the J-frame (Figure 2). The grab was deployed and retrieved and if it did not sample properly, one additional deployment was made. No more than two deployment attempts were made at any station in the interest of saving time for the primary mission. The top two cm of sediment was collected from one of the Van Veen grabs and homogenized for characterization of the sediment. Aliquots of the homogenized sediment were collected and refrigerated for subsequent shore-side chemical analysis (PCB's, PAHs, pesticides, trace and major elements, organic carbon content and grain size determination. The entire contents of the second grab were removed, sieved through a 0.5 mm sieve and preserved in Rose Bengal 10% formalin for benthic infaunal analysis ashore.

After the cruise, stations with large amounts of Calanus finmarchicus were measured for settled volumes (Table 1.) and the data forwarded to Tim Cole, of the NEFSC Protected Species Branch, Large Whale Group.

Continuous monitoring of the seawater salinity, temperature and chlorophyll-a level, was done at a depth of 2.1 meters along the entire cruise track by means of a thermosalinograph, and a flow-through fluorometer. The Scientific Computer System (SCS) recorded the output from both the thermosalinograph, and the fluorometer at 10-second intervals. The data records were given a time-date stamp by the GPS unit.

Samples for Seabird CTD salinity data and fluorometer chlorophyll-a calibration were obtained on the 12-6 watch using a 1.7 liter Niskin bottle taking a water sample from 30 or more meters depth at an isohaline portion of the water column. Calibration of the CTD salinities and chlorophyll from the surface flow-through system was undertaken on the 6-12 watch. Sample analysis for these calibrations followed the protocol outlined in the Ecosystem Monitoring Program Operations Manual

RESULTS

A summary of routine survey activities is presented in Table 1. Areal coverage for the cruise is shown in Figure 1. The ALBATROSS IV sailed at 1500 hours on Saturday, 13 August 2005, and started work in the southern New England area. It had been decided to drop the mid-Atlantic Bight region because of a loss of cruise time when the scallop survey was delayed due to vessel problems. With light winds and favorable weather rapid progress was made, even with the addition of EPA sampling, which took place on every fifth station, and by Wednesday, 17 August the Albatross was starting to work its way east across Georges Bank. On Thursday, 18 August, while crossing the shoal area of Georges Bank, a drifter buoy was deployed as part of the NOAA Adopt-a-Drifter Program. This program is designed to provide teachers an opportunity for incorporating marine environmental data into their curriculum. NOAA Teachers-at-Sea volunteering on NOAA cruises are able to deploy these buoys, and then have their students track their movement from a website. The buoys in this program are equipped with a sub-surface drogue, and a float housing a thermistor to record surface water temperature, a transmitter for

relaying their position and temperature data, and a battery pack to power the unit for approximately 400 days. Two teachers, one from the NOAA Teacher-at-Sea program and one from the University of Rhode Island ARMADA program, were on board to deploy the buoy. Joan Raybourn from the Greenbrier Intermediate School in Chesapeake, VA and Julie Long from Farnsworth Middle School in Guilderland, NY respectively put their school's name and sticker on the buoy and deployed it over the port side of the vessel at station number 48 (Figure 3). The buoy, whose World Meteorological Organization (WMO) id # is 44902, can be tracked online at: http://osmc.noaa.gov/OSMC/adopt_a_drifter.html.

On Friday, 19 August, the Albatross proceeded west along the northern edge of Georges Bank picking up stations on its way towards Chatham, MA for a Saturday morning rendezvous with the Coast Guard to exchange personnel. The exchange was made on Saturday at 1100 hrs EDT under calm conditions, after which the vessel proceeded north and then east on across the southern Gulf of Maine (GOM) to begin work on the last region of this survey. The commanding officer, Jim Illg, worked out a strategy where the southernmost GOM stations were done first as the vessel steamed east, followed by the central part of the region and finally the inshore stations were done while steaming west back towards Woods Hole.

Sampling operations were completed east of Boston very early on Thursday morning. One of these stations, consecutive number 94, was on the site of a proposed LNG terminal. This station presented some sampling challenges since it was listed as an explosives dumpsite on the nautical chart. For this reason, only CTD, plankton and water sampling was carried out, but no bottom grabs, as had been originally planned. After sampling operations were completed the vessel returned to Woods Hole via the Cape Cod Canal. It tied up at the NMFS dock in Woods Hole at 1200 hours on Thursday, 25 August 2005, marking the end of the Late Summer Ecosystem Monitoring Cruise AL0507.

DISPOSITION OF SAMPLES AND DATA

All samples and data, except for the zooplankton genetics samples, the EPA samples and data and the Seabird CTD data, were delivered to the Ecosystem Monitoring Group of the NEFSC, Narragansett, RI, for quality control processing and further analysis. The zooplankton genetics samples were taken from the vessel by Nancy Copley of the Woods Hole Oceanographic Institute. The EPA samples and data were taken to the US Environmental Protection Agency, Atlantic Ecology Division, located in Narragansett, Rhode Island. The CTD data were delivered to the Oceanography Branch of the NEFSC, Woods Hole, MA. Copies of the CTD logs were retained by the Ecosystems Monitoring Group in Narragansett. Calanus volume information was forwarded to Tim Cole after the cruise report was completed.

SCIENTIFIC PERSONNEL

National Marine Fisheries Service, NEFSC, Narragansett, RI

Jerome Prezioso[1,2] Chief Scientist
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Joseph Kane[1]

URI Graduate School of Oceanography, Narragansett, RI

Peter DiMilla[2]

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Don Cobb[1,2]
Nora Sturgeon[1,2]

Greenbrier Intermediate School, Chesapeake, VA (NOAA Teacher-at-Sea)

Joan Raybourn[1,2]

Farnsworth Middle School, Guilderland, NY, (URI/ARMADA Program Teacher)

Julie Long[1,2]

[1,2] Legs on which personnel participated.

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Table 1. STATION OPERATION REPORT FOR CRUISE AL0507

CAST	STA.	Date(GMT) mm	dd	yy	TIME(GMT) hr	min	LAT	LONG	DEPTH m	OPERATION B=bongo W=water Z=zoogen E=EPA V=vertical cast (CTD only) D=deep tow CO=Calanus observed/vol
1	1	8	13	2005	22	57	4123.6	7114.4	26	B
2	2	8	14	2005	0	39	4108.6	7112.9	35	B
3	3	8	14	2005	1	48	4106	7102.8	36	B
4	4	8	14	2005	5	18	4036.4	7118.6	64	B, CO/293cc
5	5	8	14	2005	6	55	4024.6	7107.2	84	B, CO/299cc
6	6	8	14	2005	9	42	4001.4	7122.5	125	B, E, CO/305cc
7	7	8	14	2005	14	7	4006.3	7208.6	69	B, Z, CO/206cc
8	8	8	14	2005	16	57	3944.5	7152.8	251	W
9	8	8	14	2005	17	5	3944.6	7153.5	242	B
10	8	8	14	2005	17	27	3944.5	7153.5	235	V
11	9	8	14	2005	21	23	3933.9	7238.1	76	B,Z, CO/336cc
12	10	8	14	2005	22	56	3944	7244.5	69	B,E
13	11	8	14	2005	23	46	3944.1	7246.1	68	B, CO/423cc
14	12	8	15	2005	3	11	3948.7	7326.3	37	B, CO/509cc
15	13	8	15	2005	6	59	4021	7350.9	25	B
16	14	8	15	2005	10	28	4024.1	7306.8	35	B,Z
17	15	8	15	2005	12	59	4016.4	7244.2	52	B,E, CO/355cc
18	16	8	15	2005	14	33	4018.8	7236.8	50	B, CO/379cc
19	17	8	15	2005	16	56	4035.9	7219.2	48	W
20	17	8	15	2005	17	3	4035.8	7219.1	49	B, CO/336cc
21	18	8	15	2005	19	15	4023.3	7159	67	B, CO/361cc
22	19	8	16	2005	1	30	4038.8	7045	63	B, CO/416cc
23	20	8	16	2005	3	1	4050.9	7043	52	B, E, CO/305cc
24	21	8	16	2005	7	12	4106.3	7009.3	24	W
25	21	8	16	2005	7	19	4106.5	7009.3	24	B
26	22	8	16	2005	9	33	4055.2	6958.9	28	B
27	23	8	16	2005	11	35	4044	7006.7	40	B, CO/534cc
28	24	8	16	2005	13	51	4028.8	7024.4	68	B,Z, CO/355cc
29	25	8	16	2005	16	4	4016.3	7008	91	B
30	25	8	16	2005	16	18	4016.4	7007.6	91	W,E
31	26	8	16	2005	19	17	4026.1	6941.9	71	B, CO/330cc
32	27	8	16	2005	22	58	3958.5	6914.6	257	B,Z
33	28	8	17	2005	1	37	4015.7	6857.4	105	B
34	29	8	17	2005	2	48	4021	6905.1	87	B, CO/565cc
35	30	8	17	2005	7	22	4033.1	6815.2	95	B, CO/373cc
36	30	8	17	2005	7	43	4033.4	6815.8	94	W,E
37	31	8	17	2005	9	9	4043.1	6815.3	66	B, CO/324cc
38	32	8	17	2005	10	33	4052.3	6830.4	58	B
39	33	8	17	2005	12	11	4059.3	6813.1	54	B
40	34	8	17	2005	14	48	4111.3	6740.9	49	B,Z
41	35	8	17	2005	17	6	4049.2	6745.3	66	B, CO/429cc
42	35	8	17	2005	17	22	4049	6745.9	66	W,E
43	36	8	17	2005	18	43	4041.7	6737.1	79	B
44	37	8	17	2005	19	42	4043.9	6729	88	B

45	38	8	17	2005	21	7	4039.3	6717.5	100	B, CO/398cc

Table 1. (cont.) STATION OPERATION REPORT FOR CRUISE AL0507

CAST	STA.	Date(GMT)			TIME(GMT)		LAT	LONG	DEPTH	OPERATION
		mm	dd	yy	hr	min			m	B=bongo W=water Z=zoogen E=EPA V=vertical cast (CTD only) D=deep tow CO=Calanus observed/vol
46	39	8	17	2005	22	26	4031.6	6724.8	138	B,Z
47	40	8	17	2005	23	38	4025.9	6725.8	453	B
48	40	8	18	2005	0	39	4026.3	6726.9	215	V,E
49	41	8	18	2005	5	31	4048.5	6647.3	114	B
50	42	8	18	2005	6	5	4051	6647.2	100	B, CO/243cc
51	43	8	18	2005	6	52	4052.9	6652.3	92	B, CO/262cc
52	44	8	18	2005	8	40	4059.1	6643	79	B
53	45	8	18	2005	11	2	4111.7	6708.5	62	B
54	45	8	18	2005	11	18	4112.1	6708.6	60	V,E
55	46	8	18	2005	12	37	4123.7	6710.7	51	B,Z
56	47	8	18	2005	14	26	4138.8	6711	54	B
57	48	8	18	2005	15	59	4137	6727.7	45	W
58	48	8	18	2005	16	18	4136.5	6727.4	46	B
59	49	8	18	2005	17	48	4145.9	6720.4	48	B
60	50	8	18	2005	19	46	4151.2	6657.1	62	B
61	50	8	18	2005	20	0	4151.3	6657	62	V,E
62	51	8	18	2005	22	51	4156.2	6629.5	84	B,Z
63	52	8	19	2005	0	32	4153.9	6613.1	84	B
64	53	8	19	2005	2	57	4153.8	6542.9	438	V
65	53	8	19	2005	3	29	4154.2	6542.3	347	B
66	54	8	19	2005	5	59	4200.7	6606.1	94	W
67	54	8	19	2005	6	16	4200.4	6606.3	94	B, CO/200cc
68	55	8	19	2005	7	14	4205.9	6607	99	B,E, CO/286cc
69	56	8	19	2005	10	53	4210.9	6616.1	196	B
70	57	8	19	2005	15	40	4211.2	6720.5	199	B,Z, CO/95cc
71	58	8	19	2005	17	26	4158.6	6730.2	45	W
72	58	8	19	2005	17	33	4158.3	6729.9	44	B
73	59	8	19	2005	19	44	4146.1	6753.2	33	B
74	60	8	19	2005	21	45	4140.3	6817.6	42	B,E
75	61	8	20	2005	1	50	4118.6	6856.6	136	B
76	62	8	20	2005	4	26	4101.2	6910.2	59	B
77	63	8	20	2005	5	28	4052.2	6916.2	52	W
78	63	8	20	2005	5	37	4051.7	6916.2	52	B
79	64	8	20	2005	17	42	4151	6935.1	191	W
80	64	8	20	2005	17	54	4150.8	6935	188	B, CO/447cc
81	65	8	20	2005	22	18	4230.1	6939.7	239	B, (Wilkinson Basin) CO/218cc
82	65	8	20	2005	22	51	4230	6939.9	246	B,D, (Wilkinson Basin) CO/423cc
83	65	8	20	2005	23	21	4229.5	6939.1	238	V,E
84	66	8	21	2005	2	42	4226.2	6906.9	227	V
85	66	8	21	2005	3	2	4226.2	6907.2	226	B,Z, CO/342cc
86	67	8	21	2005	5	56	4221.3	6837.3	181	W
87	67	8	21	2005	6	10	4221.3	6837.3	179	B, CO/181cc

88	68	8	21	2005	8	22	4208.7	6816.8	194	B, CO/175cc

Table 1. (cont.) STATION OPERATION REPORT FOR CRUISE AL0507

CAST	STA.	Date(GMT)			TIME(GMT)		LAT	LONG	DEPTH	OPERATION
		mm	dd	yy	hr	min			m	B=bongo W=water Z=zoogen E=EPA V=vertical cast (CTD only) D=deep tow CO=Calanus observed/vol
89	69	8	21	2005	10	24	4223.8	6804.9	180	B. CO/206cc
90	70	8	21	2005	15	25	4233.9	6710.9	300	V
91	70	8	21	2005	15	43	4234	6710.9	298	B,Z, CO/280cc
92	71	8	21	2005	18	0	4225.4	6700	360	W,E
93	71	8	21	2005	18	21	4225.4	6700	360	B (Georges Basin)
94	71	8	21	2005	19	0	4225.3	6700.4	360	B (Georges Basin) D, CO/398cc
95	72	8	22	2005	0	49	4213.3	6546.6	219	V
96	73	8	22	2005	2	15	4226.3	6540.7	92	B,Z
97	74	8	22	2005	4	36	4250.8	6541.1	123	B
98	75	8	22	2005	6	18	4303.7	6534.1	119	W,E
99	75	8	22	2005	6	27	4303.7	6534.1	121	B, CO/299cc
100	76	8	22	2005	14	21	4259.1	6706.7	196	B, CO/491cc
101	77	8	22	2005	17	20	4254.1	6739.9	206	W
102	77	8	22	2005	17	32	4254.3	6739.7	203	B, CO/330cc
103	78	8	22	2005	22	7	4246.4	6831.7	177	B,Z, CO/237cc
104	79	8	22	2005	23	45	4248.6	6848.2	185	B, CO/274cc
105	80	8	23	2005	3	28	4321.3	6848.9	123	B
106	80	8	23	2005	3	52	4321.9	6849.1	113	V,E
107	80	8	23	2005	4	5	4321.7	6849	119	W
108	81	8	23	2005	6	49	4319	6815	186	B, CO/342cc
109	82	8	23	2005	9	32	4324	6741.9	244	V,E
110	82	8	23	2005	9	57	4323.5	6741.6	244	B, (Jordan Basin) CO/392cc
111	82	8	23	2005	10	35	4323.5	6741.8	244	B,D, (Jordan Basin) CO/385cc
112	83	8	23	2005	12	41	4328.5	6727	215	B, CO/336cc
113	84	8	23	2005	17	3	4323.7	6633.6	103	B
114	85	8	23	2005	17	49	4328.3	6636.3	99	B, CO/299cc
115	85	8	23	2005	18	2	4328.7	6636.4	100	W,E
116	86	8	23	2005	20	11	4342.9	6638.3	107	B, CO/553cc
117	87	8	24	2005	1	6	4421.7	6636.8	213	B,Z, CO/491cc
118	88	8	24	2005	8	3	4356.3	6756.7	156	W
119	88	8	24	2005	8	16	4356.4	6756.9	155	B
120	89	8	24	2005	11	7	4358.5	6833.1	86	B
121	90	8	24	2005	17	30	4338.7	6954.6	46	B
122	90	8	24	2005	17	42	4338.7	6955	61	W,E
123	91	8	24	2005	21	48	4258.7	6954.6	233	V
124	91	8	24	2005	22	4	4258.5	6954.6	229	B, CO/218cc
125	92	8	25	2005	0	34	4251.3	7020.4	52	B
126	93	8	25	2005	1	24	4246.3	7022.7	90	B
127	94	8	25	2005	3	53	4225.4	7035.6	86	V,E (LNG site)
128	94	8	25	2005	4	10	4225.3	7035.7	86	B (LNG site)
129	95	8	25	2005	5	8	4221.5	7044.9	25	B
130	95	8	25	2005	5	21	4221.8	7044.9	35	V,E

Table 1. (cont.) STATION OPERATION REPORT FOR CRUISE AL0507

TOTALS:	Bongo Casts	= 97
	Bongo 6B3Z Samples	= 97
	Bongo 6B3I Samples	= 97
	Water Samples	= 19
	Vertical Casts	= 12
	EPA Stations	= 21
	CTD Casts	= 130
	Zoogen samples	= 15
	Calanus observations	= 48

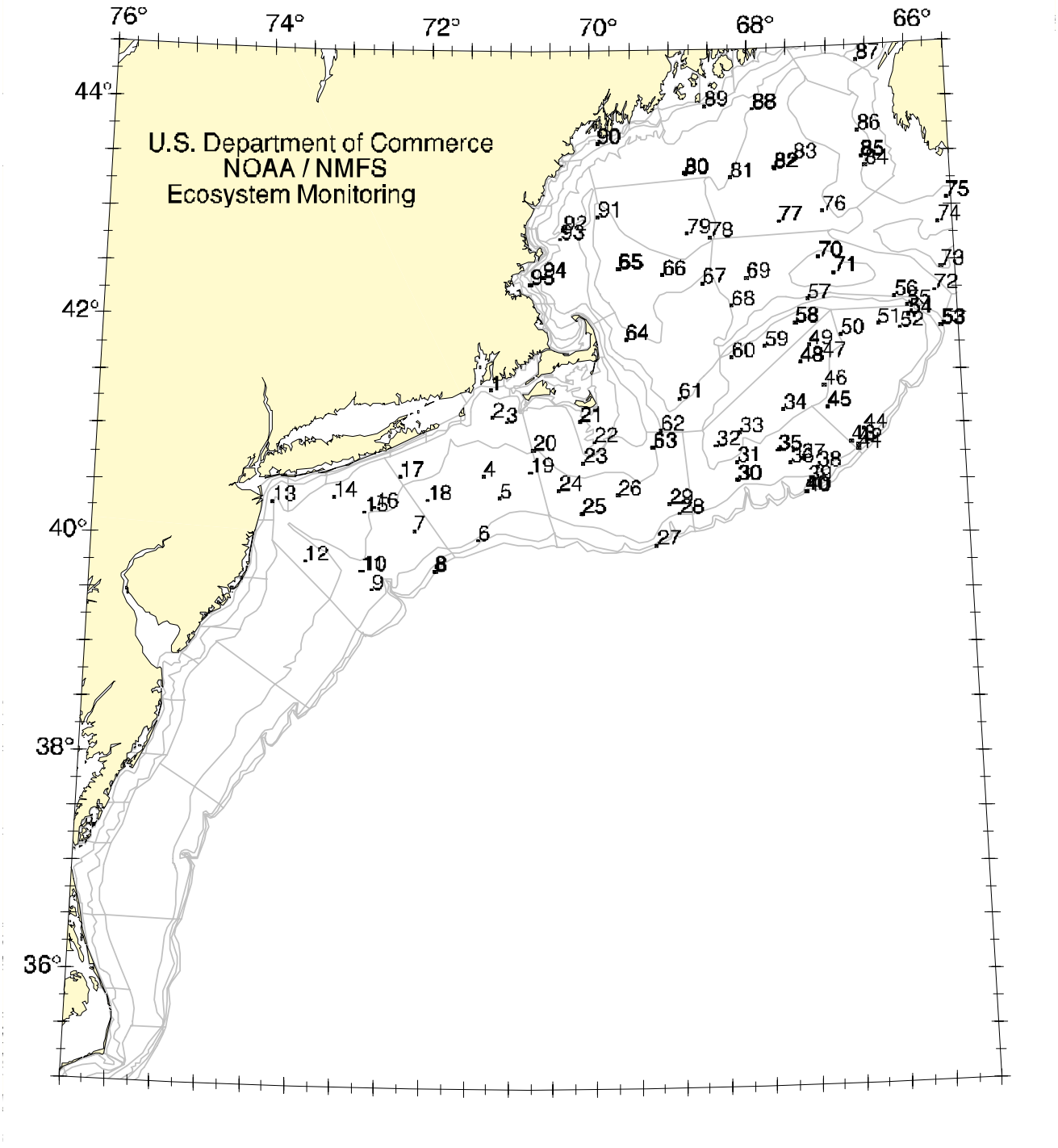

Figure 1. Station locations numbered consecutively for Late Summer Ecosystem Monitoring Cruise AL0507, 13 – 25 August 2005.

Figure 2. EPA scientists Don Cobb and Nora Sturgeon prepare to deploy a double Van Veen grab from the ALBATROSS IV.

Figure 3. Teachers Julie Long and Joan Raybourn prepare to deploy NOAA Drifter Buoy # 44902 from the ALBATROSS IV on Georges Bank for the Adopt-a-Drifter Program.