CRUISE RESULTS
NOAA Fisheries Research Vessel ALBATROSS IV
Cruise No. AL 05-09
Late Autumn Ecosystem Monitoring SurveyHabitat

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CRUISE PERIOD AND AREA

The cruise period was 5 to 18 November 2005. The NOAA fisheries research vessel ALBATROSS IV sampled 108 stratified random ecosystem monitoring stations located in the Mid-Atlantic Bight, Southern New England, Georges Bank and Gulf of Maine, plus 3 non-random stations in Southern New England, 4 non-random stations in the Gulf of Maine, and 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, at the site of a proposed liquefied natural gas (LNG) terminal (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 Mid-Atlantic Bight, Southern New England, Gulf of Maine and Georges Bank portions of the northeast continental shelf ecosystem. Key parameters measured for the Ecosystem Monitoring Program included ichthyoplankton and zooplankton composition, abundance and distribution, plus water column temperature, salinity, and chlorophyll-a fluorescence. Secondary objectives of this cruise involved the following:

- Vertical CTD casts to within 5 meters of the bottom in Gulf of Maine deep basin areas and the Northeast Channel to provide hydrographic data detailing the incursion of Labrador Current water into this region.
- 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.
- Collection of neuston samples for a study of larval squid distribution.
- Collection of phytoplankton samples from the ship's flow-through seawater system for nitrogen stable isotope ratio analysis.

METHODS

The survey consisted of 120 stations at which the vessel stopped to lower instruments over the side. Ninety randomly stratified stations were planned for the cruise, with 30 in the Mid-Atlantic Bight, 30 in Southern New England and 30 on Georges Bank Three additional non-random stations were completed in the Southern New England region to improve geographic coverage. With too little time left in the schedule for sampling the entire Gulf of Maine, priority was given to deeper stations to document the incursion of Labrador Current water into this region. Accordingly, three deep basins (Jordan, Georges and Wilkinson) were sampled with the bongo nets and CTD, the Northeast Channel was sampled with the CTD unit, and a fifth station east of Boston Harbor provided baseline environmental data at the site of a proposed offshore LNG terminal. Stations between these points were also sampled, bringing the total number of Gulf of Maine stations sampled to 28, with the majority of these stations being from the southern half of this region.

Zooplankton genetics (zoogen) samples were collected at 5 randomly designated stations in the Mid-Atlantic Bight region, 4 in the Southern New England region, 4 in the Georges Bank region and 5 in the Gulf of Maine region, yielding a total of 18 samples.

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, and salinity for each plankton tow. A CTD cast to within 5 meters of the bottom was made in Wilkinson, Jordan, and Georges basins and near the northern wall of the Northeast Channel.

A 10 minute neuston tow using a ½ by 1 meter neuston frame equipped with a 500 micron mesh net was made at 8 stations for William Macy, a researcher at the URI Graduate School of Oceanography. These tows were made from the same power boom used for deploying the bongo net plankton sampler. Neuston tows were conducted after completion of the bongo tow at the same speed and heading that the bongo tow was taken at. The purpose of these tows was to locate distributions of larval squid. Six of these stations were in the Mid-Atlantic Bight region and 2 were from the Southern New England region.

During the cruise, settled plankton heights were measured to determine the volume of zooplankton

present. Stations with large amounts of Calanus finmarchicus were noted and the volumes (Table 1.) for these stations were forwarded to Tim Cole, of the NEFSC Protected Species Branch, Large Whale Group.

Continuous monitoring of the seawater salinity, temperature and chlorophyll-a level, from a depth of 2.1 meters along the entire cruise track was done by means of a thermosalinograph, and a flow-through fluorometer hooked up to the ship's flow-through seawater system.. 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 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-a 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.

Nitrogen isotope samples for the US EPA Atlantic Ecology Laboratory were taken at 18 sites along the cruise track. Seven were from the Mid-Atlantic Bight, 3 were from Southern New England, 4 were from Georges Bank and 4 were from the Gulf of Maine. These samples were collected from the discharge water of the near-surface flow-through system. Samples of 800 to 1000 milliliters of seawater were pre-filtered through a 300 micron mesh nitex gauze to remove most zooplankton, then filtered through a Whatman glass-fiber filter (GFF) and flash frozen for analysis ashore.

Three extra bongo tows were made using the 61 cm bongo sampler to provide samples for testing a bench-mounted video plankton recorder. These samples were taken from Georges Bank and the Gulf of Maine. They were not part of the Ecosystem Monitoring Program.

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 1000 hours on Saturday, 5 November 2005, and started work in the southernmost part of the Southern New England area, then continued on into the Mid-Atlantic Bight. It had been decided to drop the Gulf of Maine (GOM) region because of a loss of cruise time when the previous cruise, the fall trawl survey, was extended due to weather problems. With light winds and favorable weather, rapid progress was made, and by Thursday, 10 November the ALBATROSS IV had completed sampling the Mid-Atlantic Bight region, and part of the Southern New England region, and returned to Woods Hole to exchange scientific personnel and take on fuel. On the way in, the scientists and crew aboard the ALBATROSS IV were filmed lowering a CTD and bucket thermometer over the side. The filming was done by a crew from the TV program NOVA, located aboard the Delaware II, and the purpose of this footage was to provide a scene representing the span of progress in the technology of sampling seawater temperature.

After a brief 2 ½ hour port call, the ALBATROSS IV returned to sea. Sampling was completed in the Southern New England area by Sunday, 13 November, after which the vessel crossed the Great South Channel and proceeded to work its way eastward across Georges Bank. Good weather allowed sampling to continue at a brisk pace, and by Tuesday, 15 November, almost all stations on Georges Bank had been sampled, and the ALBATROSS IV headed into the Gulf of Maine. From group discussions made prior to the cruise, sampling in the Gulf of Maine was focused primarily on the deep Basin areas, since it had been anticipated that there would not be enough time to obtain representative coverage of the entire region. Accordingly, the ALBATROSS IV sampled the Northeast Channel, the Jordan, Georges, and

Wilkinson basins, and the proposed LNG terminal site east of Boston Harbor, plus random stations encountered as the vessel steamed between these points. The vessel traveled in a counterclockwise loop from the Northeast Channel to Jordan Basin and back to the northern edge of Georges Bank before heading west towards Wilkinson Basin and the LNG site.

Sampling operations were completed east of Boston late Thursday night. 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 0730 on Friday, 18 November 2005, marking the end of the Late Autumn Ecosystem Monitoring Cruise AL0509.

DISPOSITION OF SAMPLES AND DATA

All samples and data, except for the zooplankton genetics samples, the EPA nitrogen isotope samples and the University of Rhode Island/Graduate School of Oceanography (URI/GSO) neuston samples 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 were taken to the US Environmental Protection Agency, Atlantic Ecology Division, located in Narragansett, Rhode Island. The neuston samples were delivered to the URI/GSO lab in Narragansett. 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
Joseph Kane[1,2]
Carolyn Griswold[2]
Jacquelyn Anderson[2]

National Marine Fisheries Service, NEFSC, Woods Hole, MA

Maureen Taylor[1]
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[1,2] Legs on which personnel participated.

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Table 1. STATION OPERATION REPORT FOR CRUISE AL0509

CAST	STA.	Date(GMT)			TIME(GMT)		LAT	LONG	DEPTH	OPERATION
		mm	did	yy	hr	min			m	B=bongo W=water Z=zoogen V=vertical cast (CTD only) D=deep tow CO=Calanus observed/vol NEU=neuston N=nitrogen isotope
1	1	11	6	2005	4	45	3932.4	7211.9	150	B
2	2	11	6	2005	8	48	3921.4	7256.2	72	B
3	2	11	6	2005	8	58	3921.3	7256.5	72	W
4	3	11	6	2005	10	33	3909	7246.7	109	B, NEU 1, N 1
5	4	11	6	2005	12	13	3909.1	7303.7	71	B, Z 1
6	5	11	6	2005	14	50	3841.6	7304.3	280	B, N 2
7	6	11	6	2005	18	55	3843.8	7352.4	45	B
8	7	11	6	2005	19	52	3839.1	7344.6	57	B
9	7	11	6	2005	20	5	3838.7	7344.8	57	W
10	8	11	7	2005	0	42	3803.9	7430.3	45	B
11	9	11	7	2005	1	6	3803.5	7429.1	41	B
12	10	11	7	2005	3	32	3754.5	7405.3	147	B
13	11	11	7	2005	9	48	3701.1	7448.3	60	B, NEU 2, N 3
14	11	11	7	2005	10	11	3701.7	7449.2	58	W
15	12	11	7	2005	12	27	3641.8	7502.4	29	B, Z 2
16	13	11	7	2005	16	29	3558.9	7452.7	89	B, N 4
17	14	11	7	2005	20	33	3521.3	7520.5	25	B, NEU 3, N 5
18	14	11	7	2005	20	57	3521.5	7519.5	26	W
19	15	11	7	2005	23	48	3548.1	7511.7	36	B
20	16	11	8	2005	0	9	3550.3	7511	33	B, Z 3
21	17	11	8	2005	4	1	3621	7538.5	21	B
22	18	11	8	2005	8	8	3658.9	7550.4	12	B, NEU 4, N 6
23	18	11	8	2005	8	32	3659.6	7549.7	13	W
24	19	11	8	2005	10	13	3714.6	7541.5	11	B
25	20	11	8	2005	12	35	3726.4	7517.3	27	B, Z 4
26	21	11	8	2005	14	46	3741.4	7458.9	30	B
27	22	11	8	2005	15	39	3746.4	7452.6	32	B
28	23	11	8	2005	16	45	3748.3	7504.1	27	B
29	24	11	8	2005	20	16	3823.8	7453.5	18	B
30	24	11	8	2005	20	34	3824.1	7453.8	19	W
31	25	11	8	2005	23	46	3843.3	7418.9	35	B, Z 5, NEU 5
32	26	11	9	2005	2	26	3903.7	7432.4	14	B, N 7
33	27	11	9	2005	6	32	3908.7	7338.7	38	B
34	27	11	9	2005	6	40	3908.6	7338.3	39	W
35	28	11	9	2005	8	3	3916.3	7352.6	35	B
36	29	11	9	2005	9	49	3930.9	7401.2	23	B
37	30	11	9	2005	11	32	3945.9	7402.7	14	B
38	31	11	9	2005	12	38	3938.8	7352.8	26	B
39	32	11	9	2005	14	13	3936.1	7334.9	35	B, NEU 6
40	33	11	9	2005	15	48	3943.5	7323	36	B
41	34	11	9	2005	21	22	4015.6	7224.6	56	B
42	34	11	9	2005	21	34	4015.3	7224.5	56	W
43	35	11	10	2005	0	50	4033.5	7150.9	62	B
44	36	11	10	2005	20	8	4121.5	7104.8	25	B
45	36	11	10	2005	20	20	4121.9	7105.1	26	W

Table 1. (cont.) STATION OPERATION REPORT FOR CRUISE AL0509

CAST	STA.	Date(GMT)			TIME(GMT)		LAT	LONG	DEPTH	OPERATION
		mm	dd	yy	hr	min			m	B=bongo W=water Z=zoogen V=vertical cast (CTD only) D=deep tow CO=Calanus observed/vol NEU=neuston N=nitrogen isotope
46	37	11	10	2005	22	29	4108.9	7124.7	44	B, N 8
47	38	11	11	2005	0	38	4053.8	7136.7	52	B
48	39	11	11	2005	4	50	4043.1	7225.9	33	B
49	40	11	11	2005	8	31	4033.1	7311.6	26	B
50	40	11	11	2005	8	43	4033.5	7311.8	25	W
51	41	11	11	2005	12	1	4023.5	7354.2	20	B, N 9
52	42	11	11	2005	14	5	4011.2	7332.8	38	B, Z 6
53	43	11	11	2005	15	40	4003.3	7316.9	41	B
54	44	11	11	2005	18	12	3954.3	7247.1	56	B, NEU 7
55	44	11	11	2005	18	34	3955.1	7247.7	55	W
56	45	11	11	2005	19	55	3956.3	7230.8	68	B
57	46	11	11	2005	21	50	3949.2	7208.9	88	B
58	47	11	11	2005	23	49	4003.9	7153.3	79	B, NEU 8
59	48	11	12	2005	2	1	4005.9	7132.7	86	B, N10, Z 7
60	49	11	12	2005	4	27	4026.2	7127	72	B
61	50	11	12	2005	7	18	4016.5	7052.8	117	B, CO/165cc
62	50	11	12	2005	7	34	4017	7053	115	W
63	51	11	12	2005	8	53	4026.4	7043.2	81	B
64	52	11	12	2005	10	42	4014.3	7030.8	111	B
65	53	11	12	2005	12	23	4011.6	7013	102	B, Z 8
66	54	11	12	2005	14	30	4030.9	7014.8	61	B, CO/122cc
67	55	11	12	2005	17	48	4051.6	7050.3	52	B
68	55	11	12	2005	18	3	4051.6	7050.5	53	W
69	56	11	12	2005	20	36	4111.4	7025	31	B
70	57	11	12	2005	22	34	4109.1	6958.9	13	B
71	58	11	13	2005	1	17	4050.5	6948.9	33	B
72	59	11	13	2005	2	52	4038.7	6937.3	51	B, Z 9
73	60	11	13	2005	5	3	4034	6912.8	67	B
74	60	11	13	2005	5	22	4035.1	6913.2	67	W
75	61	11	13	2005	6	59	4048.8	6905	72	B
76	62	11	13	2005	7	38	4051.4	6911	66	B
77	63	11	13	2005	8	35	4058.6	6917.2	40	B
78	64	11	13	2005	12	13	4108.5	6829.3	52	B
79	65	11	13	2005	13	8	4104.2	6822.4	34	B
80	66	11	13	2005	13	57	4101.4	6814.6	38	B
81	67	11	13	2005	14	49	4053.6	6816.5	47	B
82	68	11	13	2005	17	10	4031.4	6832.3	81	B
83	68	11	13	2005	17	24	4030.7	6832.5	83	W
84	69	11	13	2005	18	57	4021	6838.5	94	B
85	70	11	13	2005	20	26	4024.2	6823.4	106	B
86	71	11	13	2005	22	22	4021.3	6805.9	210	B
87	72	11	14	2005	1	18	4040.9	6744.9	76	B, Z10
88	73	11	14	2005	3	26	4043.3	6718.9	95	B
89	74	11	14	2005	5	11	4043.4	6659.4	119	B, N11
90	74	11	14	2005	5	24	4043.4	6659.4	119	W

Table 1. (cont.) STATION OPERATION REPORT FOR CRUISE AL0509

CAST	STA.	Date(GMT) mm	dd	yy	TIME(GMT) hr	min	LAT	LONG	DEPTH m	OPERATION B=bongo W=water Z=zoogen V=vertical cast (CTD only) D=deep tow CO=Calanus observed/vol NEU=neuston N=nitrogen isotope
91	75	11	14	2005	7	37	4058.7	6638.9	86	B
92	76	11	14	2005	10	28	4126.4	6643.4	79	B
93	77	11	14	2005	11	2	4123.9	6646.4	75	B
94	78	11	14	2005	12	12	4116.3	6651.9	71	B
95	79	11	14	2005	13	52	4108.8	6708.7	65	B
96	80	11	14	2005	14	52	4103.7	6716.5	65	B
97	81	11	14	2005	16	32	4108.3	6732.2	54	B, Z11
98	82	11	14	2005	19	28	4133.8	6731.9	38	B
99	82	11	14	2005	19	38	4133.7	6732.5	35	W
100	82	11	14	2005	19	45	4133.7	6732.5	37	W
101	83	11	14	2005	22	18	4136.5	6701.1	60	B, N12
102	84	11	14	2005	23	34	4143.9	6716.4	57	B
103	85	11	15	2005	0	23	4151.5	6713.3	55	B
104	86	11	15	2005	1	21	4200.5	6709.2	55	B
105	87	11	15	2005	2	49	4151.6	6658.5	70	B, Z12
106	88	11	15	2005	5	12	4208.8	6636.2	97	B
107	88	11	15	2005	5	27	4208.8	6635.3	96	W
108	89	11	15	2005	7	13	4156.3	6612.6	82	B
109	90	11	15	2005	9	26	4147.9	6546.1	148	B
110	91	11	15	2005	10	2	4147.8	6543.3	348	B, N13
111	91	11	15	2005	10	23	4148.1	6543.2	355	V
112	92	11	15	2005	13	4	4213.7	6546.1	224	V, N14
113	93	11	15	2005	14	59	4213.8	6604.8	251	B
114	93	11	15	2005	15	29	4213	6603.6	248	V
115	94	11	15	2005	17	10	4225.8	6549.1	116	B
116	94	11	15	2005	17	36	4224.7	6547.4	113	W
117	95	11	15	2005	19	58	4226.2	6616.6	242	B
118	95	11	15	2005	20	21	4225.7	6615.8	242	V
119	96	11	15	2005	22	45	4248.5	6614.6	49	B
120	97	11	15	2005	23	47	4256	6610.9	112	B,N15,Z13,CO/141cc
121	98	11	16	2005	2	9	4309	6638.5	125	B, CO/73cc
122	99	11	16	2005	4	34	4318.9	6704.6	203	B, Z14, CO/85cc
123	100	11	16	2005	6	19	4328.7	6714.7	211	B, N16, CO/209cc
124	100	11	16	2005	6	43	4327.8	6714.1	209	W
125	101	11	16	2005	8	49	4324	6741.6	244	B, CO/258cc
126	101	11	16	2005	9	15	4323.3	6741.9	245	V
127	102	11	16	2005	11	31	4304.3	6750.3	194	B, Z15, CO/190cc
128	103	11	16	2005	14	30	4244.1	6725.8	202	B, CO/54cc
129	104	11	16	2005	17	21	4225.7	6700.1	360	B
130	104	11	16	2005	17	44	4225.2	6700.5	360	W
131	105	11	16	2005	19	28	4213.9	6710.3	210	B, CO/29cc
132	106	11	16	2005	20	59	4211.3	6724.6	225	B, CO/85cc
133	106	11	16	2005	21	18	4211	6724.8	221	V
134	107	11	16	2005	23	2	4200.2	6736.7	49	B, video test sample
135	108	11	17	2005	0	48	4149.2	6748.5	36	B, Z16

Table 1. (cont.) STATION OPERATION REPORT FOR CRUISE AL0509

CAST	STA.	Date(GMT) mm	dd	yy	TIME(GMT) hr	min	LAT	LONG	DEPTH m	OPERATION B=bongo W=water Z=zoogen V=vertical cast (CTD only) D=deep tow CO=Calanus observed/vol NEU=neuston N=nitrogen isotope
136	109	11	17	2005	3	25	4153.3	6820.5	203	B, CO/221cc
137	110	11	17	2005	6	22	4158.4	6852.8	132	B
138	110	11	17	2005	6	37	4157.9	6853	131	W
139	111	11	17	2005	7	55	4208.8	6856.8	148	B, CO/147cc
140	112	11	17	2005	9	11	4215.9	6902.1	190	B, CO/147cc
141	113	11	17	2005	11	44	4200	6924.3	208	B, CO/438cc
142	114	11	17	2005	14	16	4159.8	6955.4	53	B
143	114	11	17	2005	14	32	4200.4	6955.7	56	B. video test sample
144	115	11	17	2005	16	32	4218.6	6950.6	226	B, Z17, CO/203cc
145	115	11	17	2005	16	54	4219.3	6950.6	227	W
146	116	11	17	2005	18	18	4224	6935.3	243	B, CO/234cc
147	116	11	17	2005	18	39	4224.3	6935.2	243	V
148	117	11	17	2005	19	34	4229.7	6939.9	250	B, N17, CO/277cc
149	117	11	17	2005	20	0	4230.5	6939.8	239	V
150	118	11	17	2005	22	2	4238.8	7000.6	126	B
151	119	11	17	2005	23	2	4241	7009.7	97	B
152	119	11	17	2005	23	25	4241.6	7010.1	104	B,Z18, video test sample
153	120	11	18	2005	2	6	4225.2	7035.4	86	B, N18
154	121	11	18	2005	3	14	4221.2	7045.7	28	B

TOTALS:

Bongo Casts	= 120
Bongo 6B3Z Samples	= 119
Bongo 6B3I Samples	= 119
Water Samples	= 23
Vertical Casts	= 7
CTD Casts	= 154
Zoogen samples	= 18
Neuston samples	= 8
Nitrogen isotope samples	= 18
Calanus observations	= 18
Video test samples	= 3

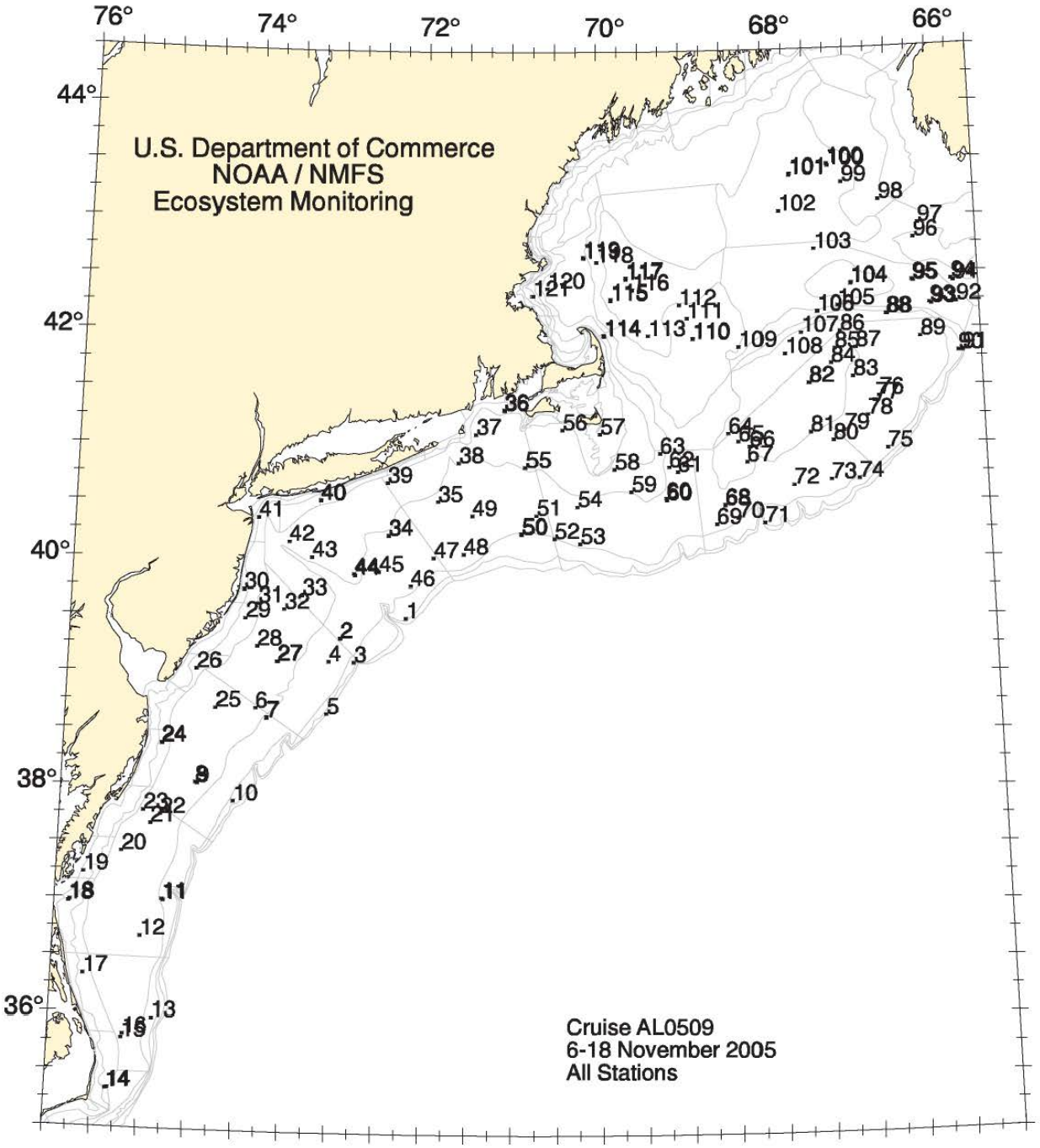

Figure 1. Station locations numbered consecutively for Late Summer Ecosystem Monitoring Cruise AL0509, 5 - 18 November 2005.