CRUISE RESULTS
NOAA Fisheries Research Vessel DELAWARE II
Cruise No. DE 05-01
Ecosystems Monitoring Survey

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CRUISE PERIOD AND AREA

The cruise period was 25 January to 4 February 2005. The NOAA fisheries research vessel DELAWARE II sampled 59 stratified random ecosystem monitoring stations located in the Gulf of Maine and Georges Bank, plus three fixed stations in the Wilkinson, Jordan and Georges basins in the Gulf of Maine, and one hydrographic (CTD only) station in the Northeast Channel (Figure 1) for the Winter Ecosystem Monitoring Survey.

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 Gulf of Maine and Georges Bank portions of the northeast continental shelf ecosystem.

Secondary objectives of this cruise involved the following sampling:

- comparison plankton tows in deep basin areas of the Gulf of Maine to assess the difference in zooplankton volumes and composition between tows to 200 m and tows to within 5 meters of the basin bottom. These deep tows also provided hydrographic data detailing the incursion of Labrador Current Water into the Gulf of Maine.
- collection of samples for zooplankton genetics (genome) studies,
- examination of plankton samples for concentrations of Calanus finmarchicus to correlate with right whale sightings.

METHODS

The survey consisted of 59 randomly stratified stations at which the vessel stopped to lower instruments over the side. Sixty random stations were planned for the cruise, with 30 in the Gulf of Maine and 30 on Georges Bank, but one Georges Bank station was dropped due to high winds and seas. Four additional non-random stations were completed in the Gulf of Maine area to document characteristics of deep basin water transported in by the Labrador Current and quantify differences in plankton abundance between conventional 200 meter tows and tows to within 5 meters of the basin bottom. A total of sixty-three stations were sampled on the cruise. Key parameters measured included water column temperature, salinity, ichthyoplankton and zooplankton composition, abundance and distribution, and along-track chlorophyll-a fluorescence. Water column chlorophyll-a fluorescence was also measured but a problem with that CTD unit rendered the data unusable. Zooplankton genetics (zoogen) samples were collected at five stations in the Gulf of Maine, and two stations on Georges Bank. Three additional zoogen samples were planned for Georges Bank, but were not collected due to adverse weather conditions which made deployment of the zoogen samplers too hazardous.

Double oblique tows using the 61-centimeter Bongo sampler and a Seabird CTD with a fluorometer were made at 63 stations. The tows were made to approximately 5 meters above the bottom, or to a maximum depth of 200 meters, at the randomly located stations and to within 5 meters above the bottom to a depth of 246 meters in the Wilkinson Basin, 240 meters in the Jordan Basin and 354 meters in Georges Basin. All tows were conducted at a ship speed of 1.5 knots. At the basin stations, the ship conducted a deep tow, then returned to the same position that the deep tow had started at, to carry out the 200 meter tow.

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 starboard side of the vessel by means of a conducting-cable winch and a hydraulic A-frame. The A-frame was operated by one of the scientists, who worked with the winch operator and deck person in deploying and retrieving the sampling gear at each station. After each tow the CTD unit was left plugged in to the tow cable and brought into the heated sheltered work area of the aft deck. The Bongo frame and nets were also brought to this area for rinsing out the samples, and were left there until the subsequent station. This arrangement prevented the equipment from getting covered with sea-spray and icing up, and was also a much safer environment for the deck person retrieving the samples to work in. 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.

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

Continuous monitoring of the seawater salinity, and chlorophyll-a level, was done at a depth of 3.7 meters along all of the 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 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 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. No calibration samples of the surface flow-through fluorometer was done because the chlorophyll processing equipment was being used on the Winter Trawl Survey aboard the ALBATROSS IV.

RESULTS

A summary of routine survey activities is presented in Table 1. Areal coverage for the cruise is shown in Figure 1. The DELAWARE II was originally scheduled to depart on January 24, 2005, but sailing was postponed until January 25 due to a snowstorm which closed both the Narragansett and Woods Hole laboratories. The Woods Hole Laboratory remained closed until January 31, but the DELAWARE II sailed at 1800 hours EST on January 25. The vessel sailed through the Cape Cod Canal that evening and completed 5 stations in the Gulf of Maine before being forced to anchor near Provincetown by storm-force winds on the evening of January 26 at 2230 hours EST. The vessel remained at anchor until 0730 hours on January 28, after which it proceeded north to pick up two inshore western Gulf of Maine stations, and then, as the weather improved, moved offshore towards the eastern Gulf of Maine, completing coverage of that region (plus three northern-edge Georges Bank stations) by Tuesday Feb 1. Georges Bank was sampled next in a clockwise pattern, starting from the western end of the shoal area towards the northeast peak and then south and west through the southern well-mixed areas until sampling was completed on February 3. Increasing winds and seas on February 2 and 3 hampered work in the well-mixed area, making vertical casts too difficult and dangerous because of excessive vessel rolling in the large seas. It was also too difficult to deploy the 20-cm Bongos together with the 61-cm Bongos so that there were only two Georges Bank zooplankton genetics samples collected.

After sampling operations were completed on February 3 the DELAWARE II returned to Woods Hole via the Great Round Shoal Channel. It docked at the Woods Hole Oceanographic (WHOI) dock in Woods Hole at 0900 on Friday, February 4, 2005, marking the end of the Winter Ecosystems Monitoring Cruise DE0501. Docking took place at the WHOI facilities for calibration of the acoustic systems on the vessel for a hydro-acoustic survey later in the year.

DISPOSITION OF SAMPLES AND DATA

All samples and data, except for the zooplankton genetics samples and the Seabird CTD data, were delivered to the Ecosystems 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 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 Pat Gerrior and Tim Cole after the cruise was completed.

SCIENTIFIC PERSONNEL

National Marine Fisheries Service, NEFSC, Narragansett, RI

Jerome Prezioso, Chief Scientist
Joseph Kane

National Marine Fisheries Service, NEFSC, Sandy Hook, NJ
John Sibunka

A fourth person was scheduled to be on the cruise but was unable to come because of a last-minute scheduling change. This was a less-than-desirable situation, particularly for this vessel and this time of year, where there needed to be two scientists on each watch; one on deck to help deploy and retrieve the gear, and one inside monitoring the live CTD data stream and communicating with the winch operator during the tow. For reasons of safety and efficiency, there should be no less than two scientists per watch on Ecosystem Monitoring Cruises aboard the Delaware II during the colder months of the year.

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Table 1. STATION OPERATION REPORT FOR CRUISE DE0501

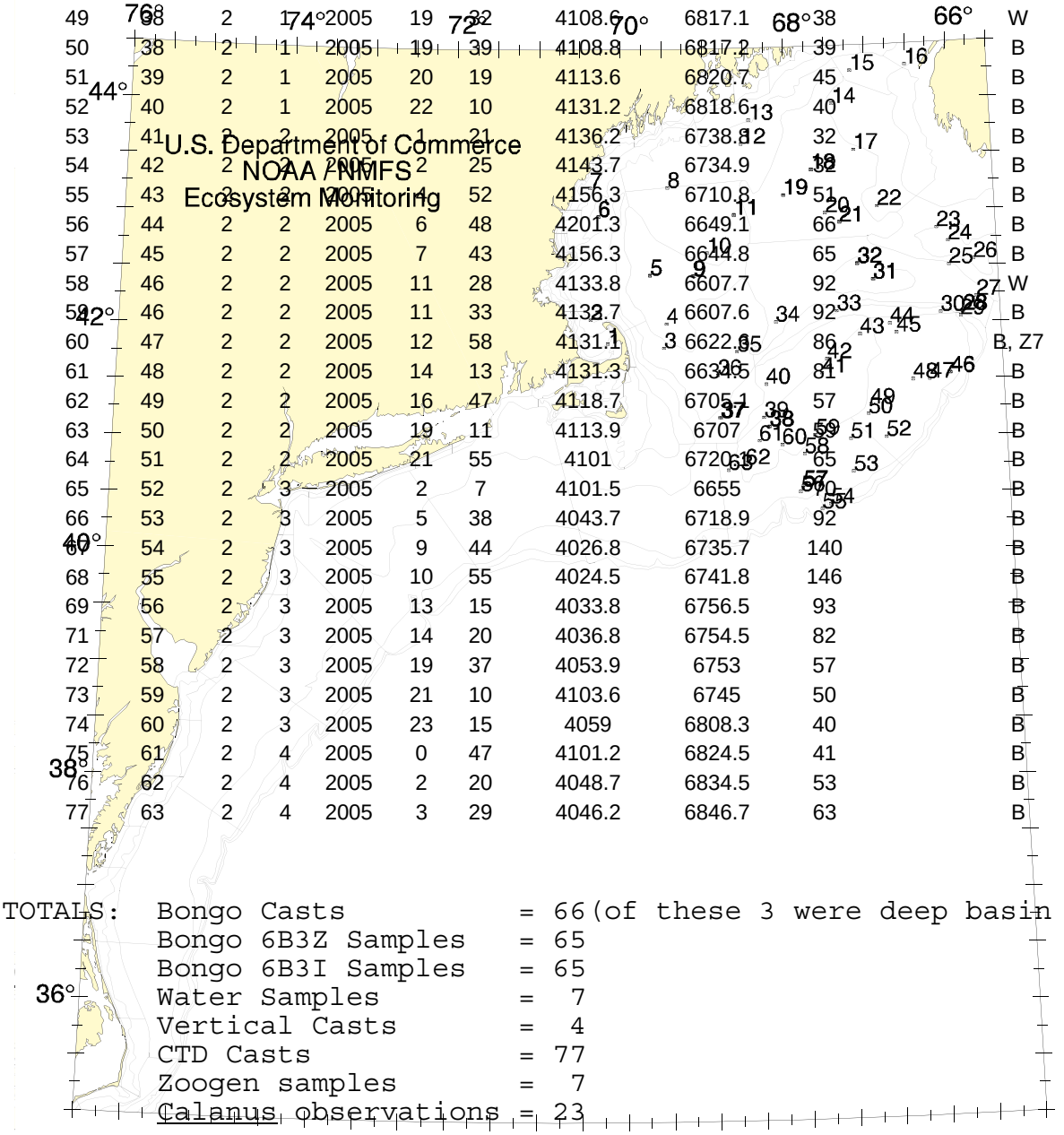
CAST	STA.	Date(GMT)	TIME(GMT)	LAT	LONG	DEPTH	OPER.

		mm	dd	yy	hr	min			m	B=bongo W=water Z=zoogen N=nitrogen V=vertical cast (CTD only) D=deep tow CO=Calanus observed/vol
1	1	1	26	2005	4	51	4153.8	7010.8	24	B
2	2	1	26	2005	6	40	4206.4	7022.9	59	B
3	3	1	26	2005	10	45	4151.2	6930.7	185	B, CO/227cc
4	4	1	26	2005	12	44	4203.9	6928.7	195	B, CO/209cc
5	5	1	26	2005	18	38	4229.8	6940.1	251	B, D, CO/562cc
6	5	1	26	2005	19	30	4229.8	6940	250	B, CO/302cc
7	6	1	28	2005	22	24	4301.1	7016.9	156	W
8	6	1	28	2005	22	33	4301	7017.1	151	B, Z1, CO/209cc
9	7	1	29	2005	0	30	4316.3	7022.9	35	B
10	8	1	29	2005	4	38	4316.2	6926.7	156	B, CO/97cc
11	9	1	29	2005	9	35	4228.9	6908.6	222	B, CO/190cc
12	9	1	29	2005	10	0	4229	6909.4	223	V
13	10	1	29	2005	11	46	4241.2	6858.9	151	B
14	11	1	29	2005	14	33	4301.2	6838.9	188	W
15	11	1	29	2005	14	52	4301.1	6838.9	187	B, Z2, CO/221cc
16	12	1	29	2005	19	5	4338.8	6832.6	155	B
17	13	1	29	2005	20	49	4351.4	6826.6	117	B
18	14	1	30	2005	1	23	4358.9	6725.3	188	B, CO/326cc
19	15	1	30	2005	3	42	4416.3	6711	184	B, CO/178cc
20	16	1	30	2005	7	15	4418.5	6630.5	202	B
21	17	1	30	2005	12	21	4334.1	6710.5	209	B, Z3, CO/165cc
22	18	1	30	2005	15	9	4324.1	6741.9	244	B, D, CO/227cc
23	18	1	30	2005	15	51	4324.2	6742.1	245	B, CO/165cc
24	19	1	30	2005	18	15	4311.3	6802.7	192	W
25	19	1	30	2005	18	28	4311.1	6802.6	192	B, CO/178cc
26	20	1	30	2005	21	6	4301.1	6732.8	191	B, CO/178cc
27	21	1	30	2005	22	35	4256	6722.8	243	W
28	21	1	30	2005	22	45	4255.7	6722.8	243	B, CO/227cc
29	22	1	31	2005	1	24	4303.7	6655	181	B, Z4
30	23	1	31	2005	5	52	4251.2	6612.8	133	B
31	24	1	31	2005	7	30	4243.7	6604.8	67	B
32	25	1	31	2005	8	57	4231.3	6605.1	191	B
33	26	1	31	2005	11	22	4233.7	6547.3	83	B
34	27	1	31	2005	13	33	4213.7	6546.6	217	W
35	28	1	31	2005	14	48	4206.1	6556.6	227	V
36	28	1	31	2005	15	14	4206.2	6556.9	227	B, Z5
37	29	1	31	2005	17	24	4203.7	6558.6	169	B
38	30	1	31	2005	18	49	4206.2	6612.7	97	B
39	31	1	31	2005	23	8	4225	6659.9	357	B, Z6, D, CO/413cc
40	31	2	1	2005	0	4	4225.1	6660	357	B, CO/172cc

Table 1. (continued) STATION OPERATION REPORT FOR CRUISE DE0501

CAST	STA.	Date(GMT)			TIME(GMT)		LAT	LONG	DEPTH	OPER.
		mm	dd	yy	hr	min			m	B=bongo W=water Z=zoogen N=nitrogen V=vertical cast (CTD only) D=deep tow CO=Calanus observed/vol
41	32	2	1	2005	1	36	4233.8	6710.7	297	V
42	32	2	1	2005	2	0	4233.5	6711	294	B, CO/221cc
43	33	2	1	2005	5	4	4208.8	6726.8	195	B, CO/159cc

44	34	2	1	2005	8	45	4203.9	6810.6	219	B, CO/172cc
45	35	2	1	2005	11	37	4148.8	6838.8	165	B, CO/135cc
46	36	2	1	2005	13	33	4136.3	6852.8	119	B, CO/165cc
47	37	2	1	2005	16	5	4113.9	6850.8	93	B
48	37	2	1	2005	16	37	4113.9	6851.7	93	V
49	38	2	1	2005	19	32	4108.6	6817.1	38	W
50	38	2	1	2005	19	39	4108.8	6817.2	39	B
51	39	2	1	2005	20	19	4113.6	6820.7	45	B
52	40	2	1	2005	22	10	4131.2	6818.6	40	B
53	41	2	2	2005	1	21	4136.2	6738.8	32	B
54	42	2	2	2005	2	25	4143.7	6734.9	32	B
55	43	2	2	2005	4	52	4156.3	6710.8	51	B
56	44	2	2	2005	6	48	4201.3	6649.1	66	B
57	45	2	2	2005	7	43	4156.3	6644.8	65	B
58	46	2	2	2005	11	28	4133.8	6607.7	92	W
59	46	2	2	2005	11	33	4132.7	6607.6	92	B
60	47	2	2	2005	12	58	4131.1	6622.6	86	B, Z7
61	48	2	2	2005	14	13	4131.3	6634.5	81	B
62	49	2	2	2005	16	47	4118.7	6705.1	57	B
63	50	2	2	2005	19	11	4113.9	6707	59	B
64	51	2	2	2005	21	55	4101	6720.6	65	B
65	52	2	3	2005	2	7	4101.5	6655	70	B
66	53	2	3	2005	5	38	4043.7	6718.9	92	B
67	54	2	3	2005	9	44	4026.8	6735.7	140	B
68	55	2	3	2005	10	55	4024.5	6741.8	146	B
69	56	2	3	2005	13	15	4033.8	6756.5	93	B
71	57	2	3	2005	14	20	4036.8	6754.5	82	B
72	58	2	3	2005	19	37	4053.9	6753	57	B
73	59	2	3	2005	21	10	4103.6	6745	50	B
74	60	2	3	2005	23	15	4059	6808.3	40	B
75	61	2	4	2005	0	47	4101.2	6824.5	41	B
76	62	2	4	2005	2	20	4048.7	6834.5	53	B
77	63	2	4	2005	3	29	4046.2	6846.7	63	B



TOTALS:

Bongo Casts	=	66 (of these 3 were deep basin tows)
Bongo 6B3Z Samples	=	65
Bongo 6B3I Samples	=	65
Water Samples	=	7
Vertical Casts	=	4
CTD Casts	=	77
Zoogen samples	=	7
Calanus observations	=	23

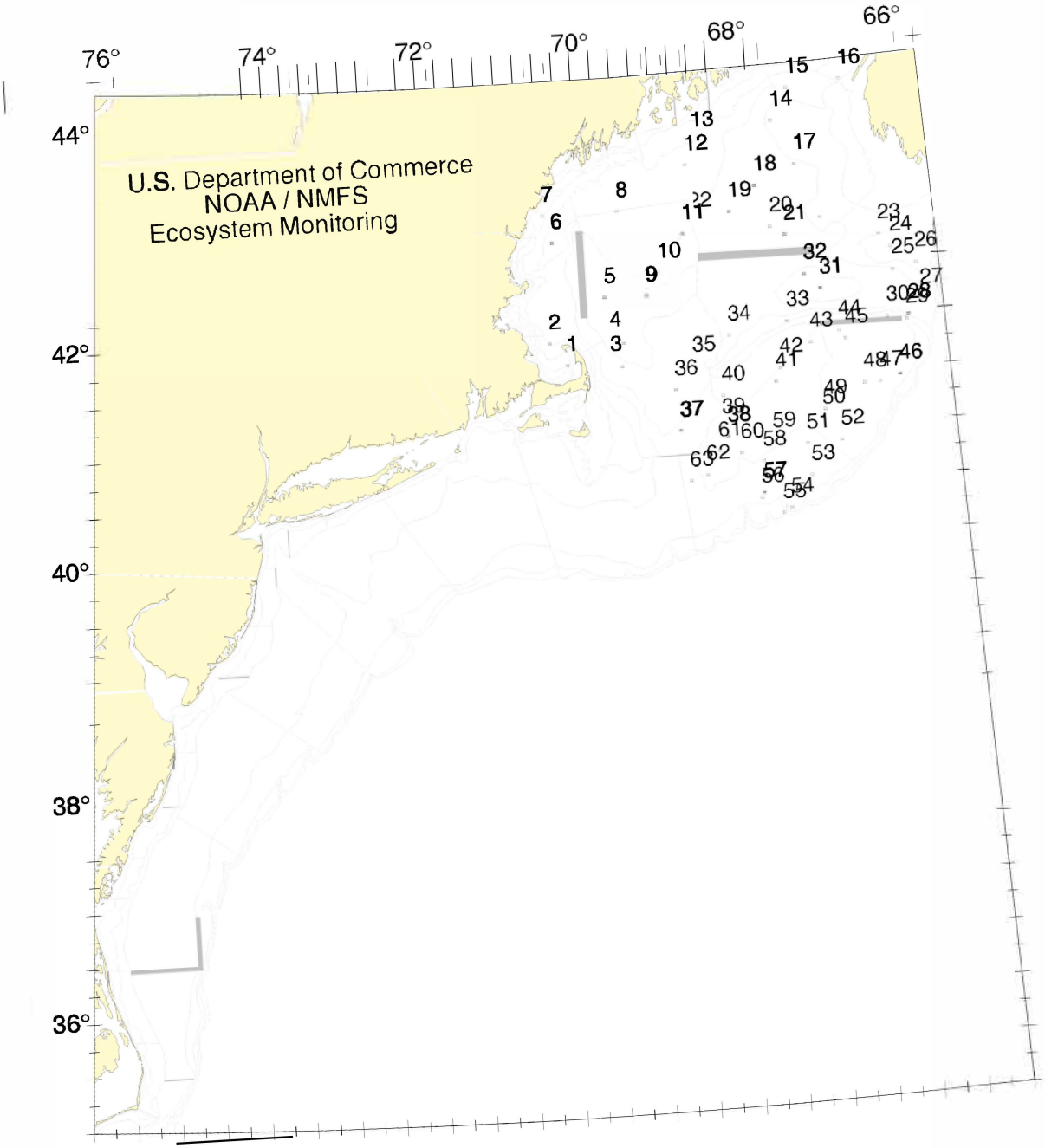


Figure 1. Station locations numbered consecutively for Winter Ecosystems Monitoring Cruise DE 05-01 Jan 25 - Feb 4 2005.