CRUISE RESULTS
NOAA Fisheries Research Vessel DELAWARE II
Cruise No. DE 07-09
Northeast Shelf Ecosystem Monitoring Late Summer Survey

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CRUISE PERIOD AND AREA

The cruise period was 14 to 29 August 2007. The NOAA fisheries research vessel DELAWARE II sampled at a total of 111 stations. Of these, 23 were located in the Gulf of Maine (GOM), 30 were located on Georges Bank (GB), 30 were in the Southern New England (SNE) area and 28 in the Mid-Atlantic Bight (MAB). The Gulf of Maine (GOM) stations included 4 fixed stations: the Wilkinson, and Georges basins, the site of a proposed liquefied natural gas (LNG) terminal east of Boston Harbor and the Northeast Channel (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 northeast continental shelf ecosystem. Key parameters measured for the Ecosystem Monitoring Program included ichthyoplankton and zooplankton composition, abundance and distribution, plus water column temperature and salinity. Near-surface along-track chlorophyll-a fluorescence, water temperature and salinity were measured while underway with the vessel's flow-through sampling system. Secondary objectives of this cruise included the following:

- Vertical CTD casts to within 5 meters of the bottom in Gulf of Maine deep basin areas 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 zooplankton for the Census of Marine Zooplankton Project (formerly called the Zooplankton Genome Project) based at University of Connecticut, Avery Point.
- Collection of near-surface water samples for detection of *Pseudonitzchia* diatoms as part of the Harmful Algal Bloom Project (HAB) of the Woods Hole Oceanographic Institution (WHOI).
- Note turbidity of water column through the use of a secchi disk at selected stations.
- Collection of seawater and plankton samples for Falmouth Academy High School student project.
- Calibration of flowmeters used for the plankton tows on this cruise and on a previous trip conducted by the Marine Mammal Investigation.
- Note presence and volume of *Calanus finmarchicus* in samples upon return of cruise to shore.

METHODS

The survey consisted of 111 stations at which the vessel stopped to lower instruments over the side (Figure 1). All stations sampled were at randomly stratified locations except for five stations in the GOM, and three in the MAB. Four of the non-random GOM stations were at fixed positions visited on all Ecosystem Monitoring cruises: Wilkinson Basin, Georges Basin, a proposed Liquefied Natural Gas terminal site east of Boston and the Northeast Channel. The other four non-random stations on this cruise were located at positions between randomly selected stations, and were done to improve areal coverage on transits greater than four hours.

Plankton and hydrographic sampling was conducted at all stations by making double oblique tows using the 61-cm bongo sampler and a Seabird CTD. The tows were made to approximately 5 m above the bottom, or to a maximum depth of 200 m. All plankton tows were conducted at a ship speed of 1.5 – 2.0 knots. Plankton sampling gear consisted of a 61-cm 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 (Figure 2.). A 45-kg lead weight in the shape of a flat-bottomed pear was attached by an 80-cm length of 3/8-inch diameter chain below the aluminum bongo frame to depress the sampler. The flat bottomed configuration of the depressor weight made for safer deployment and retrieval of the sampling gear when the boat was rolling in rough seas. 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 off the starboard stern quarter of the vessel using an A-frame and a Sea-Mac winch which was placed on the aft deck specifically for this operation. After retrieval, the bongo frames were carried into a covered work area on the port side of the aft deck and placed on tables for wash down of the nets to obtain the plankton samples. This work space allowed for much easier removal of the samples, particularly during inclement weather. The 61-cm bongo plankton samples were preserved in a 5% solution of formalin in seawater. The zooplankton genetics samples from the 20-cm diameter bongos were preserved in 95% ethanol, which was changed once at 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 m of the bottom was made in the Wilkinson and Georges basins to provide hydrographic data from below the 200 m limit set for bongo tows.

Continuous monitoring of the seawater salinity, temperature and chlorophyll-*a* level, from a depth of 3.7 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 twice a day using a 1.7 liter Niskin bottle taking a water sample from 25 or more meters depth in an isohaline portion of the water column. Calibration of the CTD salinities and chlorophyll-a from the surface flow-through system was undertaken twice daily while the ship was underway. Sample analysis for these calibrations followed the protocol outlined in the Ecosystem Monitoring Program Operations Manual.

Zooplankton genetics (zoogen) samples were collected using the 20-cm diameter bongos described above at 5 randomly designated stations in each of the four regions sampled: Mid-Atlantic Bight, Southern New England, Georges Bank and Gulf of Maine. Collecting of these samples was facilitated by the excellent

weather which made deployment of the 20-cm bongos much easier than it had been on the Winter Ecosystems Monitoring Survey.

Seawater sample collections were made at random stations on Georges Bank and the Gulf of Maine to test for the presence of *Pseudonitzchia*, a pennate diatom that can cause paralytic shellfish poisoning. These samples were collected by filling a small 50 ml container containing some growth medium with seawater, and placing them in a small refrigerator set to approximate the ambient seawater temperature.

Water column turbidity was measured through the use of a secchi disk at 10 stations across the entire survey area of the cruise. The white plastic disk, 31 cm in diameter, was shackled to the end of the bongo tow cable, with the 45 kg depressor weight attached below it. Secchi depth was measured using the wire out meter.

Eight plankton and 24 seawater samples were collected as part of a Falmouth Academy High School student project to correlate near-shore plankton abundance with nutrient levels in the water. These samples were collected from the Mid-Atlantic Bight and Southern New England regions. The plankton was collected with the 20-cm diameter bongos described earlier. The samples from both nets were combined and frozen after the tow was completed. Seawater from the discharge of the flow-through analysis system was collected into three 4-dram vials at each of the eight stations sampled and frozen along with the corresponding plankton sample.

Flowmeters were calibrated at sea in Vineyard Sound. The bongo sampler was towed at normal bongo tow speeds of 1.5 – 2.0 knots, with the cod ends open, for a distance of 0.333 nautical miles. After having been towed for that distance, the bongos were removed from the water, flowmeters were read, nets were hosed down to clear the meshes, and the sampler returned to the water, but now towed for the same distance and speed in the opposite direction, to offset the possible effects of any currents on the flowmeters. Two runs were made in each direction first with one bongo frame to calibrate the flowmeters used on this cruise, and then again with a second frame to calibrate flowmeters that had not been calibrated in 2007.

Presence and volume of *Calanus finmarchicus* was noted in the samples after completion of the cruise by measuring the settled height of the samples in mm, and then converting it to cc's using the method listed in Prezioso and Kane (in prep).

RESULTS

A summary of routine survey activities is presented in Table 1. Areal coverage for the cruise is shown in Figure 1. Excellent weather for almost the entire cruise period offered the potential for sampling at all planned stations. However, the vessel was forced to sail at a reduced speed of 8 knots due to a damaged reduction gear between the propeller shaft and the main drive engine. Operating at reduced speed forced the vessel to miss the five southernmost and twelve northernmost stations in the cruise plan. A comparison of Figure 1 with the area boundaries displayed in Figure 2 indicates the extent of the loss of coverage due to this problem.

The DELAWARE II sailed at 1730 hours EDT on Tuesday, 14 August 2007, under calm conditions and proceeded southeast to sample the offshore stations. On Saturday, 18 August the vessel headed inshore to start sampling the inshore stations on the return route to Woods Hole, despite the fact that the five southernmost stations had not been reached. This decision was made to enable the DELAWARE II to reach Woods Hole in time for the scheduled personnel exchange and leave sufficient time for the northern

area sampling at its reduced 8 knot cruising speed. Sampling was carried out at two non-random stations, 28 and 29 (Figure 1), to provide the southernmost coverage for this cruise, at 36 20 N latitude, instead of 35 10 N latitude. The DELAWARE II returned to Woods Hole at 1800 hours EDT on Tuesday, 21 August. A planned small boat transfer of personnel was not carried out in the interest of safety as winds and seas had picked up. The captain arranged for an early sailing the following day, and accordingly, the vessel sailed at 0615 on Wednesday, 22 August. This quick turn-around by the officers and crew reduced the time in port to a mere 12 hours and provided an opportunity to offset the reduced speed of the vessel and provide improved coverage of the northern sampling area. The DELAWARE II reached the first stations of the second part of the cruise in the afternoon of the day of sailing, completing coverage of the eastern Southern New England area and continuing on to Georges Bank by 23 August. The vessel worked eastward and crossed the Hague Line on Georges Bank by Saturday, 25 August. Shortly before crossing the Hague Line, at 1042 EDT on station 84, the two teachers activated and launched the drifter buoy which they had decorated earlier with their school logos (Figure 3). At station 91, Georges Basin, styrofoam coffee cups were placed in a mesh bag below the CTD unit and compressed at depth to return to students for demonstrating the effects of water pressure at 350 meters. By the end of the next day the vessel was working in the eastern Gulf of Maine (GOM), heading west to complete as many stations as possible in the time remaining. Good weather augmented our efforts at covering the area, although it quickly became apparent that no coverage of the northern GOM, including Jordan Basin, would be possible at our reduced speed of 8 knots. By Tuesday, 28 August, sampling was terminated to permit the vessel adequate time to transit the Cape Cod Canal that evening. Flowmeter calibrations were carried out in Vineyard Sound on the morning of Wednesday, 29 August (Table 2). These calibrations proved to be higher than ones obtained in the past from either at sea or tow tank runs, possibly because the vessel may have not have been oriented parallel to the strong current that was in the area. Upon completion of the calibrations, the DELAWARE II returned to Woods Hole, docking at the WHOI pier at 12 noon, to permit transducer calibrations on the following day for a subsequent cruise.

DISPOSITION OF SAMPLES AND DATA

All samples and data, except for the zooplankton genetics samples, the HAB samples, the Falmouth Academy High School 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. Nancy Copley and Dave Kulis of the Woods Hole Oceanographic Institute took the zooplankton genetics and HAB samples from the vessel. The Ecosystems Monitoring Group in Narragansett retained copies of the CTD logs. Calanus volume information was forwarded to Tim Cole after the cruise report was completed.

SCIENTIFIC PERSONNEL

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Table 1. STATION OPERATION REPORT FOR CRUISE DE0709

CAST	STA.	Date(GMT) mm	did	yy	TIME(GMT) hr	min	LAT	LONG	DEPTH m	OPERATION B=bongo W=water Z=zoogen V=vertical cast (CTD only) CO=Calanus observed / vol S=secchi / meters HS=HighSchool sample HAB=WHOI HAB sample
1	1	8	15	2007	2	16	4113.9	7102	38	B
2	2	8	15	2007	6	20	4056.2	7028.5	45	B
3	3	8	15	2007	7	56	4054	7011.1	31	B
4	4	8	15	2007	11	35	4039	6943.3	54	B
6	5	8	15	2007	12	47	4036.5	6950.8	60	B, Z1
5	5	8	15	2007	12	33	4036.4	6950.7	60	W1, S1= 5m
7	6	8	15	2007	15	11	4018.9	6954.8	83	B
8	7	8	15	2007	18	14	4008.7	6928.7	86	B
10	8	8	15	2007	21	1	4006.4	6952.2	110	B
11	9	8	16	2007	0	99	4015.9	7020.4	97	B
12	10	8	16	2007	5	24	4016.3	7100.8	112	B
13	11	8	16	2007	9	2	4026	7134.5	78	B
14	12	8	16	2007	16	27	3943.6	7219	98	W3
15	12	8	16	2007	16	37	3943.6	7219	99	B, CO/ 308cc
16	13	8	16	2007	19	45	3924	7214.6	279	W4
17	13	8	16	2007	20	16	3924.7	7213.9	428	B, Z2
18	14	8	17	2007	0	12	3943.6	7234.7	76	B, CO/ 277cc
19	15	8	17	2007	3	0	3938.7	7256.2	64	B, CO/ 630cc
20	16	8	17	2007	4	34	3928.7	7254.9	65	B, CO/ 376cc
21	17	8	17	2007	7	46	3926.1	7324.2	33	B, Z3
22	18	8	17	2007	11	41	3903.9	7301	80	B, CO/314cc
23	19	8	17	2007	13	4	3856.4	7254.6	110	W5
24	19	8	17	2007	13	15	3856.6	7254.6	110	B
25	20	8	17	2007	14	26	3851.2	7256.9	128	B, Z4
26	21	8	17	2007	19	37	3836.2	7340.5	63	W6
27	21	8	17	2007	19	47	3836.2	7340.5	63	B, CO/ 221cc
28	22	8	17	2007	21	8	3829.1	7333.1	91	B
28	22	8	17	2007	21	8	3829.1	7333.1	91	B
29	23	8	18	2007	2	37	3801	7404.6	106	B, CO/ 172cc
30	24	8	18	2007	7	36	3733.8	7434.3	65	B, CO/ 258cc
31	25	8	18	2007	8	28	3733.7	7440.5	56	B, Z5
32	26	8	18	2007	11	44	3708.6	7455	46	B
33	27	8	18	2007	12	35	3703.9	7456.9	46	W7, S2=19m
35	28	8	18	2007	17	51	3625.9	7456.8	39	B
34	27	8	18	2007	12	45	3703.8	7457.2	44	B
36	29	8	18	2007	21	55	3625.5	7536.6	26	W8
37	29	8	18	2007	22	4	3625.6	7536.6	26	B
37	29	8	18	2007	22	4	3625.6	7536.6	26	B
38	30	8	18	2007	0	36	3641.3	7544.7	15	B, HS1
39	31	8	19	2007	4	30	3706.1	7520.6	26	B

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CAST	STA.	Date(GMT) mm	did	yy	TIME(GMT) hr	min	LAT	LONG	DEPTH m	OPERATION B=bongo W=water Z=zoogen V=vertical cast (CTD only) CO=Calanus observed/vol S=secchi / meters HS=HighSchool sample HAB=WHOI HAB sample
40	32	8	19	2007	7	8	3718.5	7538	16	B, HS2
41	33	8	19	2007	12	8	3741.2	7454.8	28	W9
42	33	8	19	2007	12	17	3741.2	7454.7	27	B, Z6
43	34	8	19	2007	14	57	3801.2	7452.6	29	B
44	35	8	19	2007	18	24	3823.7	7430.5	37	B, Z7
45	36	8	19	2007	20	46	3826.1	7450.4	22	W10
46	36	8	19	2007	20	51	3826.2	7450.3	22	B
47	37	8	19	2007	21	57	3833.6	7448.7	26	B, HS3
48	38	8	20	2007	0	24	3846.3	7431	26	B
49	39	8	20	2007	3	12	3841.3	7404.6	52	B
50	40	8	20	2007	4	54	3853.8	7406.7	41	B
51	41	8	20	2007	6	47	3905.9	7400.8	38	B
52	42	8	20	2007	8	45	3916.1	7349	36	B
53	43	8	20	2007	11	24	3933.5	7402.7	23	B, HS4
54	44	8	20	2007	15	58	4003.4	7352.9	24	B, HS5
55	45	8	20	2007	20	36	4020.8	7321.5	32	W11
56	45	8	20	2007	20	44	4020.8	7321.5	32	B
57	46	8	20	2007	23	0	4026.3	7305.2	37	B
58	47	8	21	2007	0	49	4036.2	7256.8	26	B, HS6
59	48	8	21	2007	3	7	4036.4	7238.8	37	B
60	49	8	21	2007	4	18	4043.6	7236.8	29	B
60	50	8	21	2007	5	52	4046.2	7224.6	34	B
62	51	8	21	2007	9	4	4034	7201.1	56	B
63	52	8	21	2007	10	50	4041	7149	54	B, Z8
64	53	8	21	2007	13	9	4051.2	7132.8	59	W12, S3= 8m
65	53	8	21	2007	13	22	4051.2	7133	59	B, Z9
66	54	8	21	2007	17	23	4113.8	7110.8	42	B
67	55	8	21	2007	18	31	4120.8	7106	30	B, HS7
68	56	8	22	2007	16	57	4127	6938.3	27	B, HS8
69	57	8	22	2007	17	54	4131.3	6934.7	39	B
70	58	8	23	2007	1	7	4058.8	6848.7	73	B
71	58	8	23	2007	1	22	4059.1	6848.5	73	W13
72	59	8	23	2007	3	50	4051.4	6913.2	61	B, Z10
73	60	8	23	2007	7	3	4026.2	6916.9	75	B
74	61	8	23	2007	10	10	4031.2	6849.1	70	B
75	62	8	23	2007	13	48	4028.7	6814.9	107	W14, HAB 1, S4= 9m
76	62	8	23	2007	13	59	4028.7	6815	107	B
77	63	8	23	2007	15	37	4028.8	6802.8	128	B
78	64	8	23	2007	17	37	4018.8	6756.8	169	B
79	65	8	23	2007	21	18	4041.2	6736.7	84	B, Z11

Table 1. (cont.) STATION OPERATION REPORT FOR CRUISE DE0709

CAST	STA.	Date(GMT) mm	did	yy	TIME(GMT) hr	min	LAT	LONG	DEPTH m	OPERATION B=bongo W=water Z=zoogen V=vertical cast (CTD only) CO=Calanus observed / vol S=secchi / meters HS=HighSchool sample HAB=WHOI HAB sample
80	66	8	23	2007	23	26	4053.5	6723	82	B
81	66	8	23	2007	23	37	4053.7	6722.6	82	W15, HAB 2
82	67	8	24	2007	2	27	4048.8	6656.7	98	B
83	68	8	24	2007	6	20	4101.6	6625.1	305	V, HAB 3
84	68	8	24	2007	6	39	4101.7	6625.3	305	B
85	69	8	24	2007	9	25	4058	6650	76	B
85	69	8	24	2007	9	27	4058	6650	76	B, Z12
86	70	8	24	2007	10	26	4103.6	6654.5	70	B
87	71	8	24	2007	12	11	4113.8	6704.6	65	W16, S5= 7m
88	71	8	24	2007	12	23	4113.9	6704.5	65	B
89	72	8	24	2007	15	59	4113.6	6736.8	38	B, Z13, HAB 4
90	73	8	24	2007	18	22	4111.2	6800.8	45	B
91	74	8	24	2007	19	44	4111.4	6814.2	50	B
92	75	8	24	2007	20	34	4115.9	6812.7	48	B
93	75	8	24	2007	20	45	4116.1	6812.4	45	W17
94	76	8	25	2007	1	41	4158.7	6818.5	191	B, Z14, CO/ 357cc
95	77	8	25	2007	3	59	4146.6	6806.9	47	B
96	78	8	25	2007	5	16	4144	6755.1	28	B
97	79	8	25	2007	7	12	4148.7	6740.8	34	B
98	80	8	25	2007	9	42	4139.1	6725	58	B, HAB 5
99	81	8	25	2007	11	0	4141.1	6713.1	57	B, Z15
100	82	8	25	2007	13	39	4131.4	6652.6	67	W18, S6= 8m
101	82	8	25	2007	13	48	4131.4	6652.5	67	B
102	83	8	25	2007	16	5	4121.3	6632.8	90	B
103	84	8	25	2007	18	45	4138.5	6630.8	77	B, HAB 6, launch drifter buoy
104	85	8	25	2007	22	47	4143.6	6551	128	B
105	86	8	26	2007	0	11	4148.6	6558.5	97	B
106	86	8	26	2007	0	26	4148.4	6558.2	97	W19
107	87	8	26	2007	3	32	4151.1	6626.7	9999	B
108	88	8	26	2007	6	55	4205.8	6640.4	74	B, HAB 7
109	89	8	26	2007	9	52	4200.4	6708.2	55	B, Z16
110	90	8	26	2007	11	27	4213.5	6704.7	208	B, CO/ 215cc
111	91	8	26	2007	13	40	4226	6704.6	363	V, HAB 8, styrofoam cup compression demo
112	91	8	26	2007	14	6	4226	6704.5	362	B, Z17, CO/ 172cc
113	92	8	26	2007	18	9	4228.8	6622.6	250	W20, S7= 12m
114	92	8	26	2007	18	27	4228.8	6622.3	250	B, CO/ 91cc
115	93	8	26	2007	20	56	4216.5	6605	268	V
116	93	8	26	2007	21	13	4216.4	6604.9	268	B
117	94	8	26	2007	23	46	4213.5	6546.1	220	B
118	95	8	27	2007	1	34	4218.5	6536.9	106	B, CO/ 85cc
119	96	8	27	2007	5	6	4231.5	6602.8	172	B, CO/ 190cc

Table 1. (cont.) STATION OPERATION REPORT FOR CRUISE DE0709

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120	96	8	27	2007	5	31	4230.4	6602.7	190	W21
121	97	8	27	2007	8	32	4251	6555	86	B, Z18, HAB 9, CO/ 370cc
122	98	8	27	2007	13	4	4303.8	6644.9	122	B, HAB 10, CO/ 289cc
123	99	8	27	2007	15	11	4303.7	6706.5	199	W22, S8=11m
124	99	8	27	2007	15	23	4303.6	6706.7	202	B, Z19, CO/ 394cc
125	100	8	27	2007	17	37	4258.7	6726.7	230	B, CO/ 518cc
126	100	8	27	2007	18	14	4258.5	6727.5	229	V, HAB 11
127	101	8	27	2007	20	28	4241.6	6730.8	190	B, CO/ 227cc
128	102	8	28	2007	1	19	4246	6821.5	208	B, Z20, CO/ 333cc
129	103	8	28	2007	2	29	4246.2	6829.8	188	B, 481cc
130	103	8	28	2007	2	55	4246.3	6828.7	196	W23, HAB 12
131	104	8	28	2007	8	11	4211.5	6906.6	171	B, HAB 13, CO/ 394cc
132	105	8	28	2007	9	10	4216.2	6905	197	B, CO/425cc
133	106	8	28	2007	11	13	4223.6	6920.5	247	W24, S9= 13m
134	106	8	28	2007	11	33	4223.6	6920.6	246	B, CO/ 333cc
135	107	8	28	2007	13	42	4229.9	6940	252	V, HAB 14, S10= 17 m
136	107	8	28	2007	13	58	4230	6940	242	B, CO/ 747cc
137	108	8	28	2007	17	20	4231.1	7011	77	B
138	109	8	28	2007	20	34	4228.7	7040.5	61	B, HAB 15, CO/ 209cc
139	110	8	28	2007	21	13	4225.3	7036.7	84	B, CO/ 172cc
140	111	8	28	2007	23	49	4213.8	7015.2	28	B, CO/ 79cc
141	111	8	28	2007	23	59	4213.5	7014.9	28	W25, HAB 16

TOTALS:

Bongo Casts	= 111
Bongo 6B3Z Samples	= 111
Bongo 6B3I Samples	= 111
Water Samples	= 25
Vertical Casts	= 7
CTD Casts	= 139
Secchi Casts	= 10
Zoogen samples	= 20
HAB samples	= 16
Falmouth Academy HS Samples	= 8
Calanus observations	= 27

Table 2. Results of bidirectional flowmeter calibration runs,
Vineyard Sound 29 August 2007.

Flocal AUG 07

FM # / Direction	Initial Reading	End Reading	Revs	M/Rev	AVG M/Rev	CAL FACTOR	FM #
2684 UP	83079	84808	1729	0.3567	0.4083	0.4042	B02684
2684 DN	87015	88356	1341	0.4599			
2684 UP	84808	87015	2207	0.2794	0.4002		
2684 DN	88356	89540	1184	0.5209			
9629 UP	49835	51588	1753	0.3518	0.4109	0.4051	09629
9629 DN	53830	55142	1312	0.4701			
9629 UP	51588	53830	2242	0.2751	0.3993		
9629 DN	55142	56320	1178	0.5235			
15285 UP	20301	25617	5316	0.1160	0.3739	0.3812	15285
15285 DN	31242	32218	976	0.6319			
15285 UP	25617	31242	5625	0.1096	0.3885		
15285 DN	32218	33142	924	0.6674			
02697 UP	49979	55266	5287	0.1166	0.3799	0.3883	02697
02697 DN	60883	61842	959	0.6431			
02697 UP	55266	60883	5617	0.1098	0.3968		
02697 DN	61842	62744	902	0.6837			

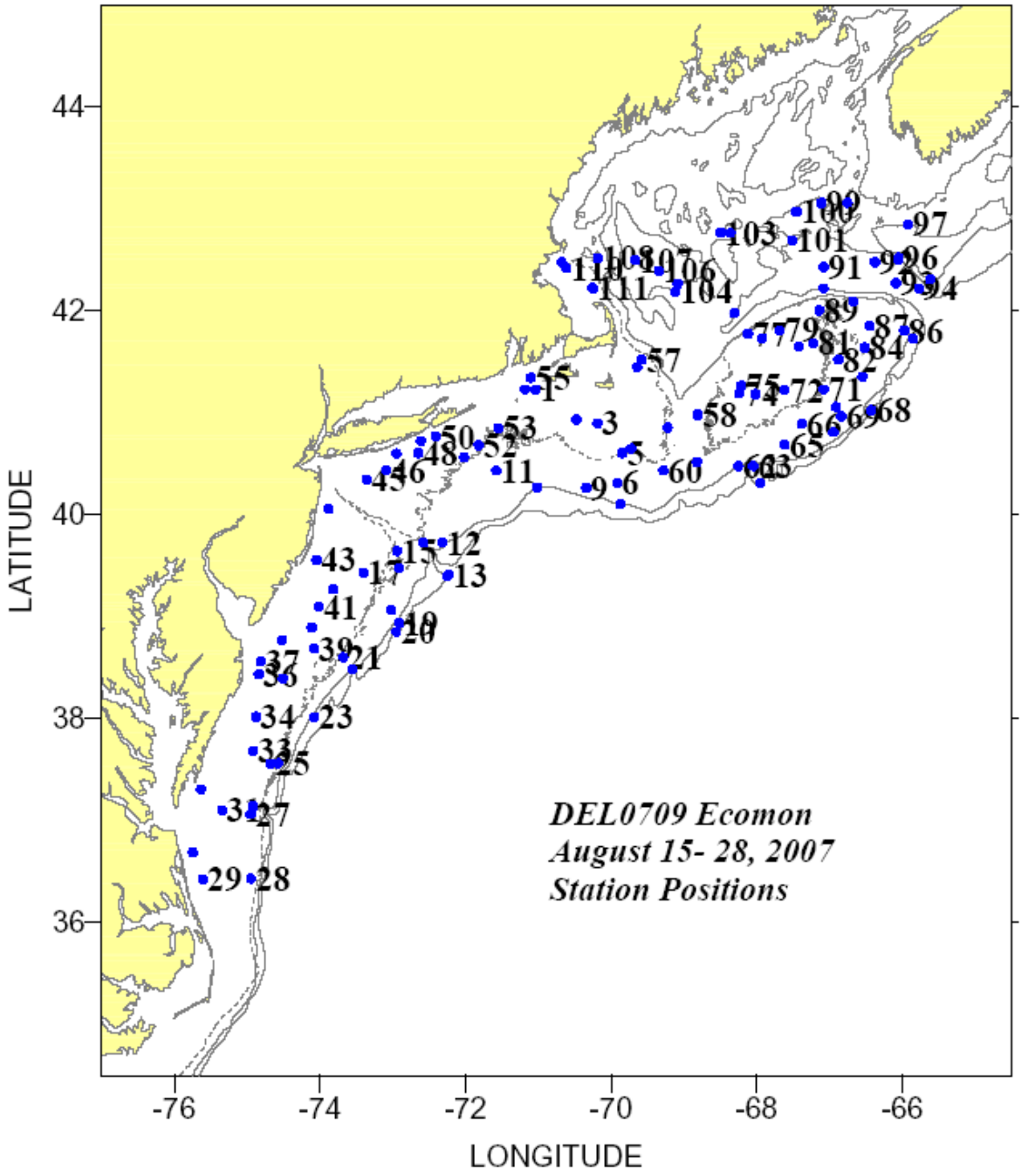


Figure 1. Station locations numbered consecutively for Late Summer Ecosystem Monitoring Cruise DE 07-09, 15 - 28 August 2007, showing actual coverage achieved, as opposed to the area of each region as seen in Figure 2.

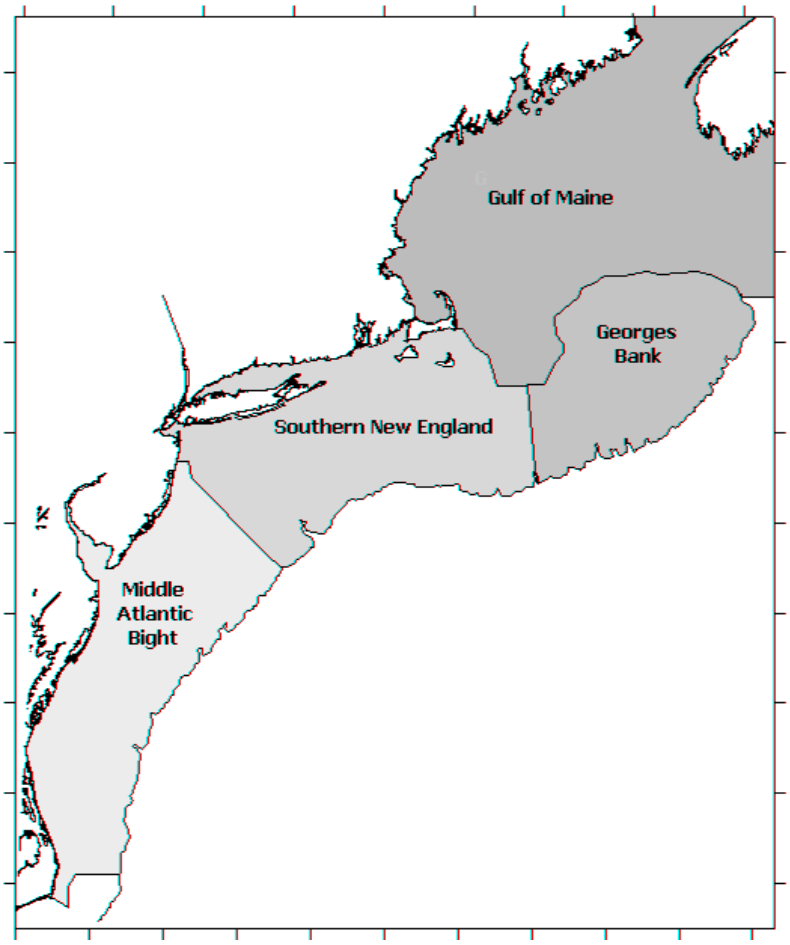


Figure 2. Boundary outlines of the 4 areas that were sampled during DE0709 Ecosystems Monitoring Cruise, for comparison with actual coverage achieved, as displayed in Figure 1.

Figure 3. NOAA and ARMADA Teachers-at-Sea Amy Pearson and Kimberly Pratt launching drifter buoy from DELAWARE II.

Appendix A.

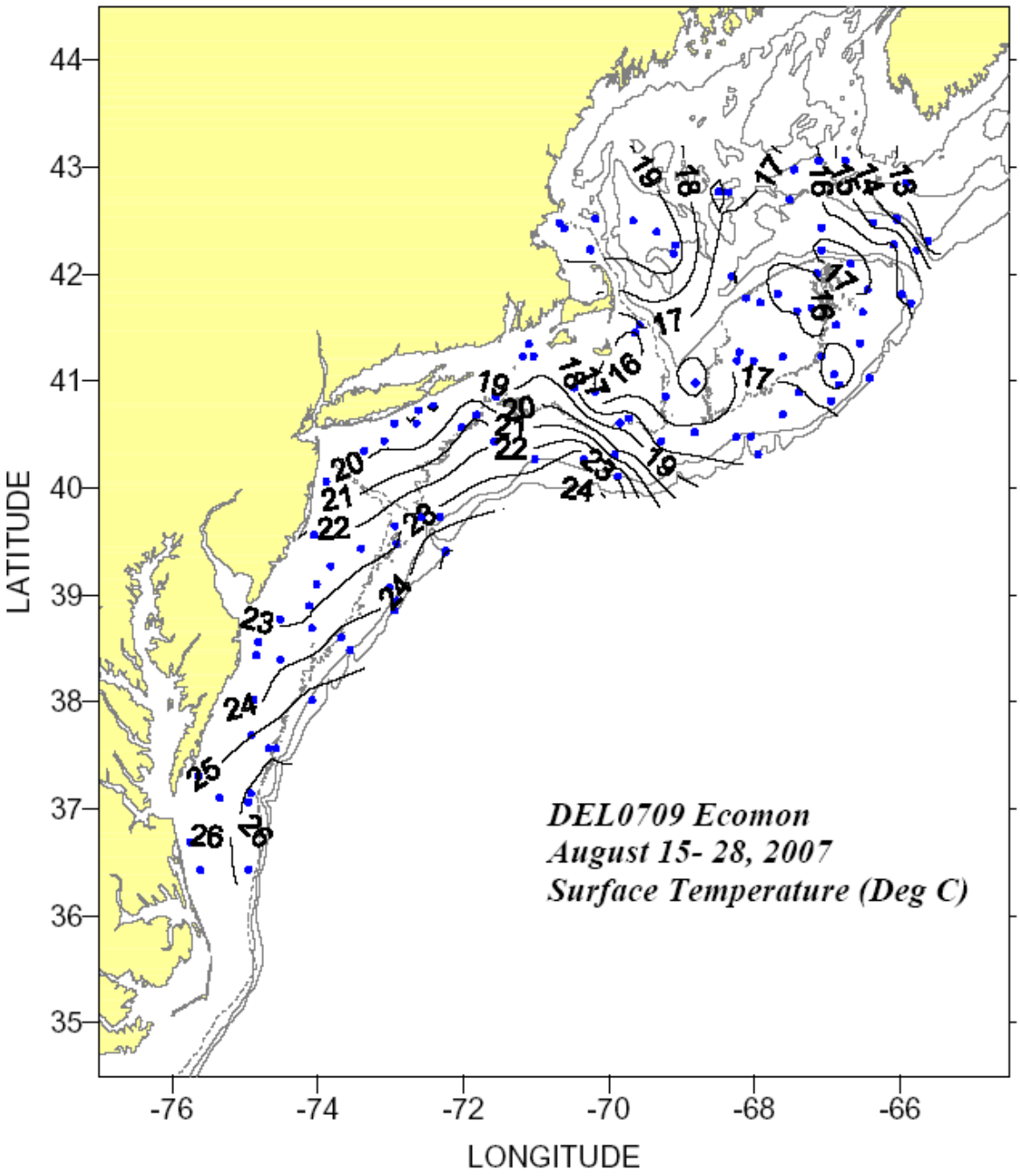
Areal average surface and bottom temperature/salinity and temperature/salinity anomalies for the 2007 Summer ECOMON Survey DEL0709

		SURFACE						BOTTOM						
CRUISE	CD	#obs	T/S	Anomaly	SDV1	SDV2	Flag	#obs	T/S	Anomaly	SDV1	SDV2	Flag	Purpose
Gulf of Maine West														
DEL0709	239	15	18.37	0.75	0.27	2.90	1	12	7.21	-0.25	0.27	4.13	1	22
DEL0709	239	15	32.03	0.00	0.18	0.86	1	12	33.31	0.05	0.16	0.71	1	22
Gulf of Maine East														
DEL0709	239	15	15.86	1.12	0.26	3.13	1	9	7.52	-0.68	0.33	4.74	1	22
DEL0709	239	15	32.18	-0.32	0.18	0.87	1	9	34.69	-0.13	0.15	0.82	1	22
Georges Bank														
DEL0709	236	35	16.68	0.37	0.19	1.31	0	23	11.07	-1.01	0.26	2.03	0	22
DEL0709	236	35	32.31	-0.41	0.11	0.42	0	23	32.78	-0.22	0.16	0.38	0	22
MAB North														
DEL0709	230	24	20.56	0.48	0.28	1.38	0	20	9.96	-0.75	0.33	1.53	0	22
DEL0709	230	24	32.47	0.12	0.18	0.48	0	20	33.01	-0.24	0.19	0.34	0	22
MAB South														
DEL0709	230	39	24.27	0.45	0.21	0.94	1	33	11.85	-0.20	0.24	1.52	1	22
DEL0709	230	39	32.06	0.06	0.16	0.57	1	33	32.89	-0.14	0.14	0.38	1	22

"CRUISE", the code name for a cruise: "CD", the calendar mid-date of all the stations within a region for a cruise:
"#obs", the number of observations include in each average: "T/S", the areal average temp/salt: "Anomaly", the areal average temp/salt anomaly:
"SDV1", the standard deviation associated with the average temp/salt anomaly: "SDV2", the standard deviation of the individual anomalies from which the average anomaly was derived

"Flag", a value of "1" indicates that a true areal average could not be calculated due to poor station coverage. The areal averages listed were derived from a simple average of the observations within the region.

"Purpose", 2 digit code assigned by DMS to identify a unique NEFSC program survey.


DEL0709 Ecomon
August 15- 28, 2007
Surface Temperature (Deg C)
LATITUDE
LONGITUDE
44
43
42
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39
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37
36
35
-76
-74
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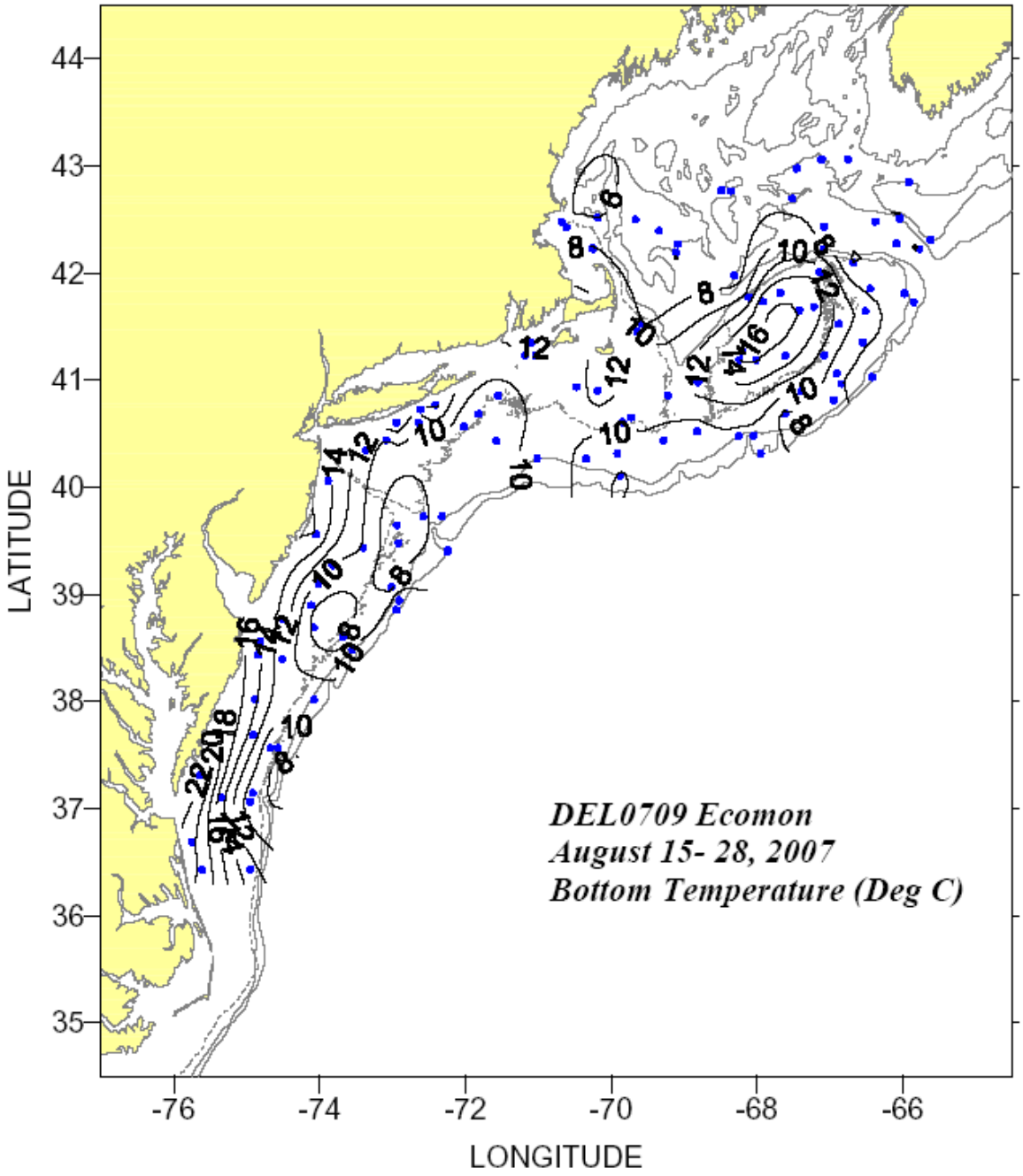
-70
-68
-66


DEL0709 Ecomon
August 15- 28, 2007
Bottom Temperature (Deg C)
LATITUDE
LONGITUDE
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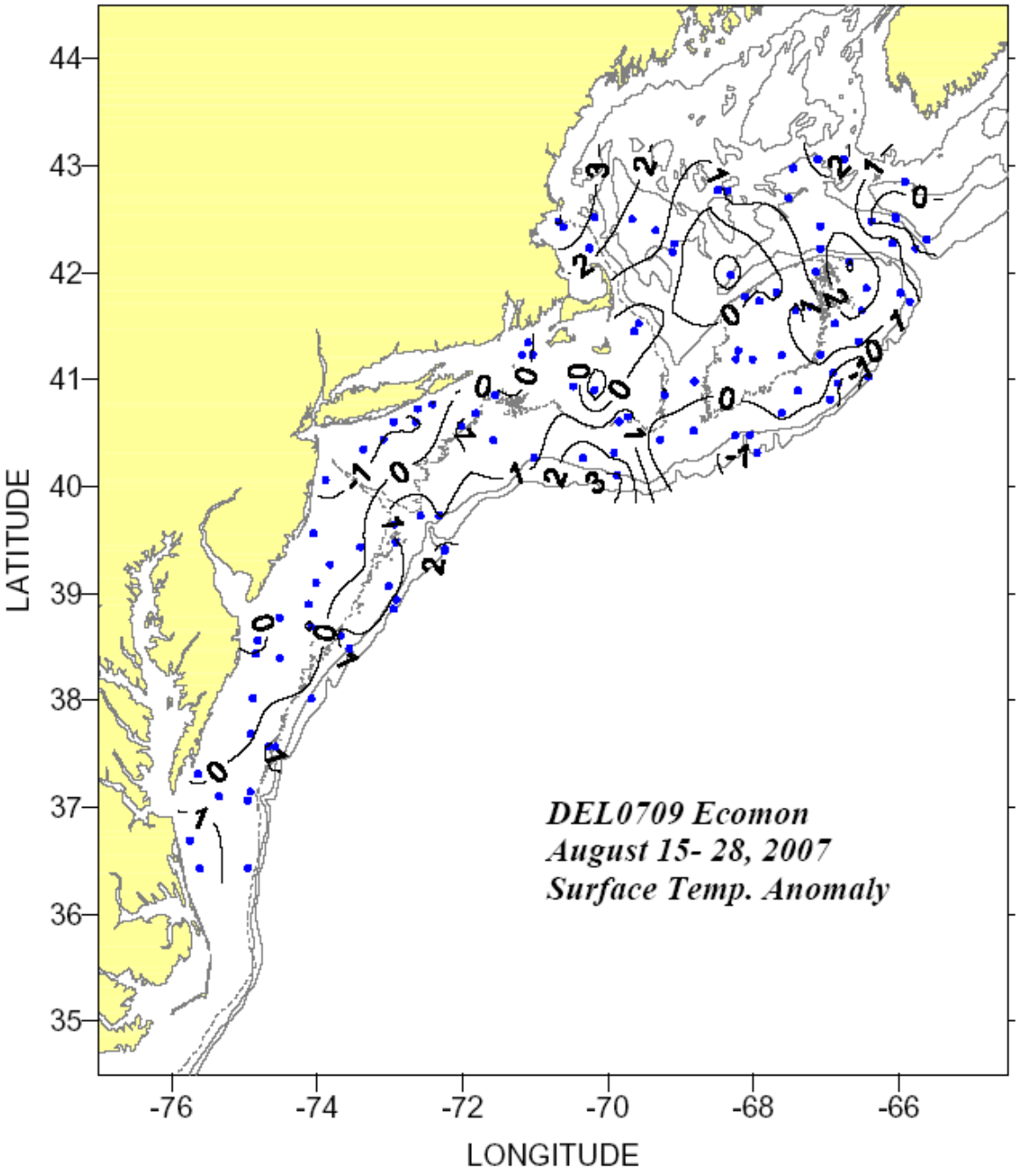
-76
-74
-72
-70
-68
-66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LATITUDE
-76
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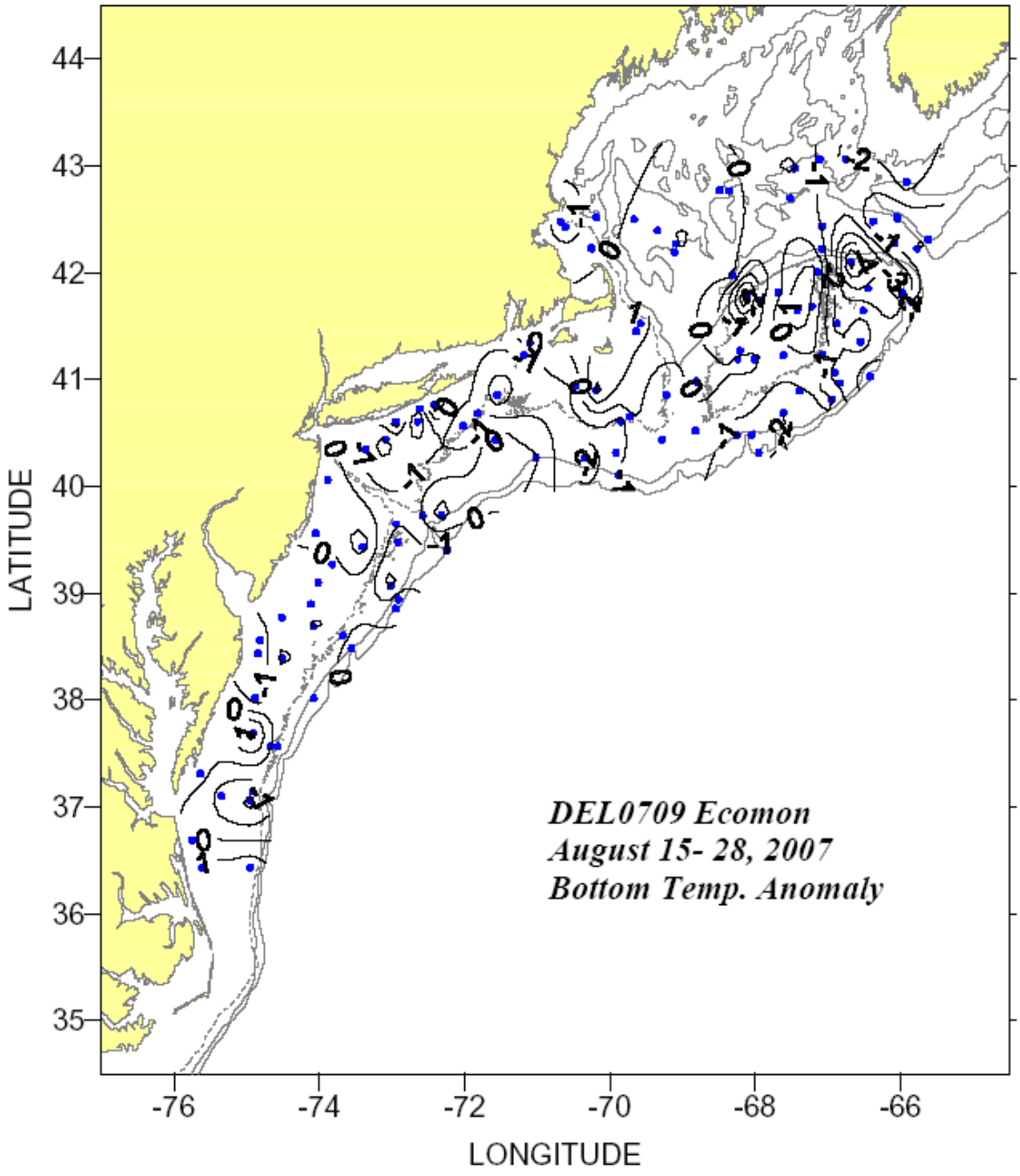
-66
LONGITUDE
DEL0709 Ecomon
August 15- 28, 2007
Surface Temp. Anomaly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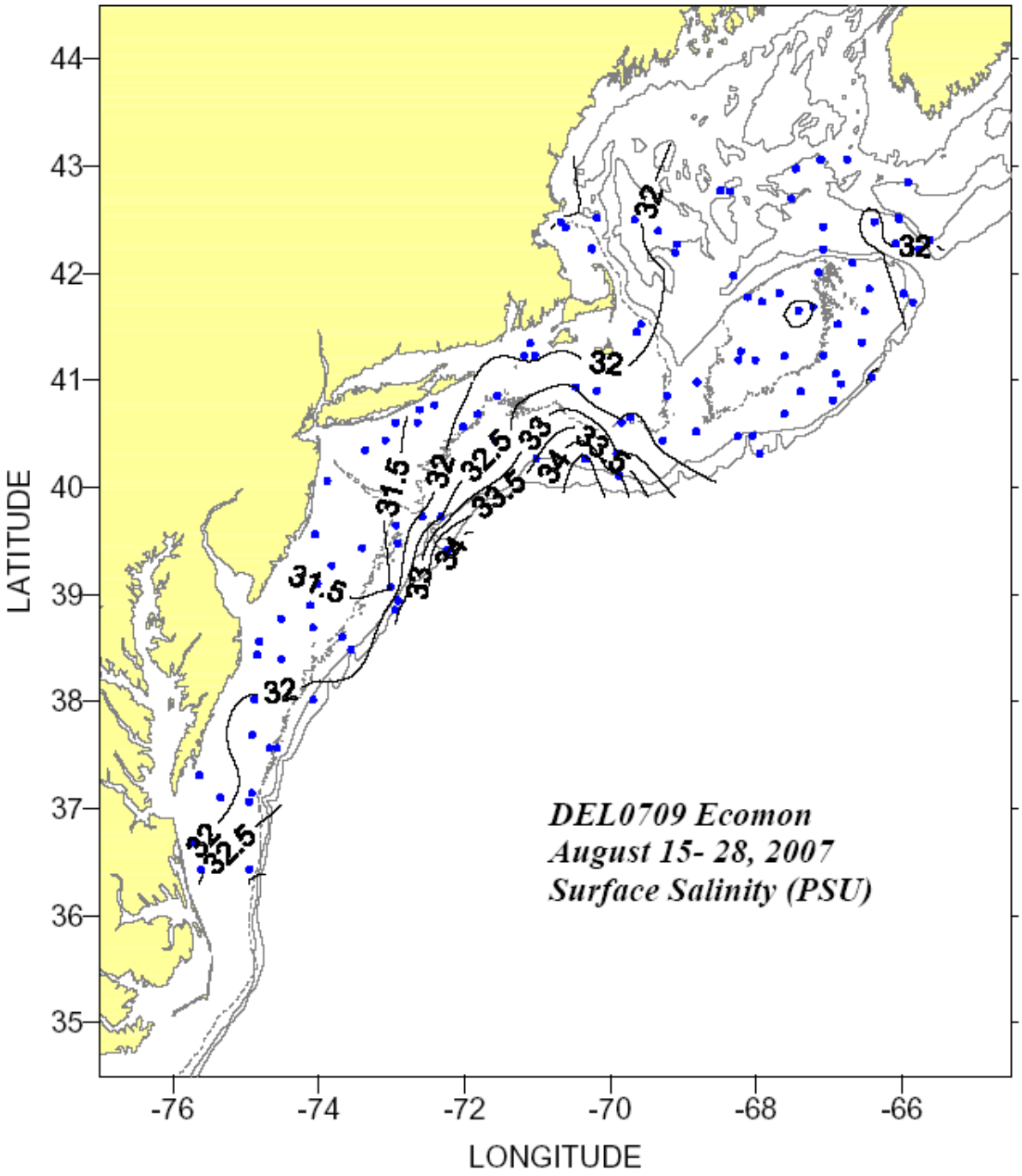
DEL0709 Ecomon
August 15- 28, 2007
Bottom Temp. Anomaly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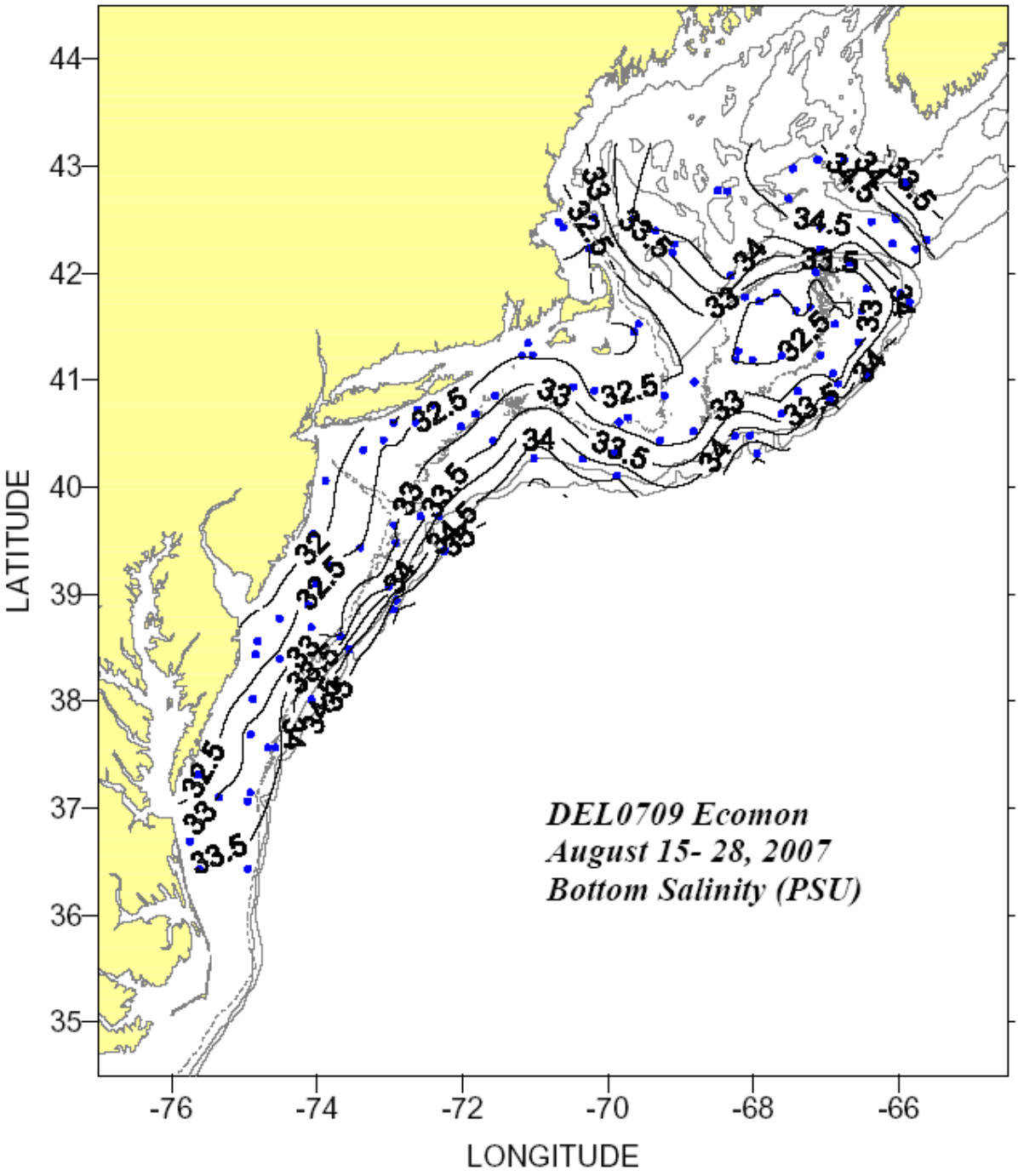
DEL0709 Ecomon
August 15- 28, 2007
Surface Salinity (PSU)


LATITUDE
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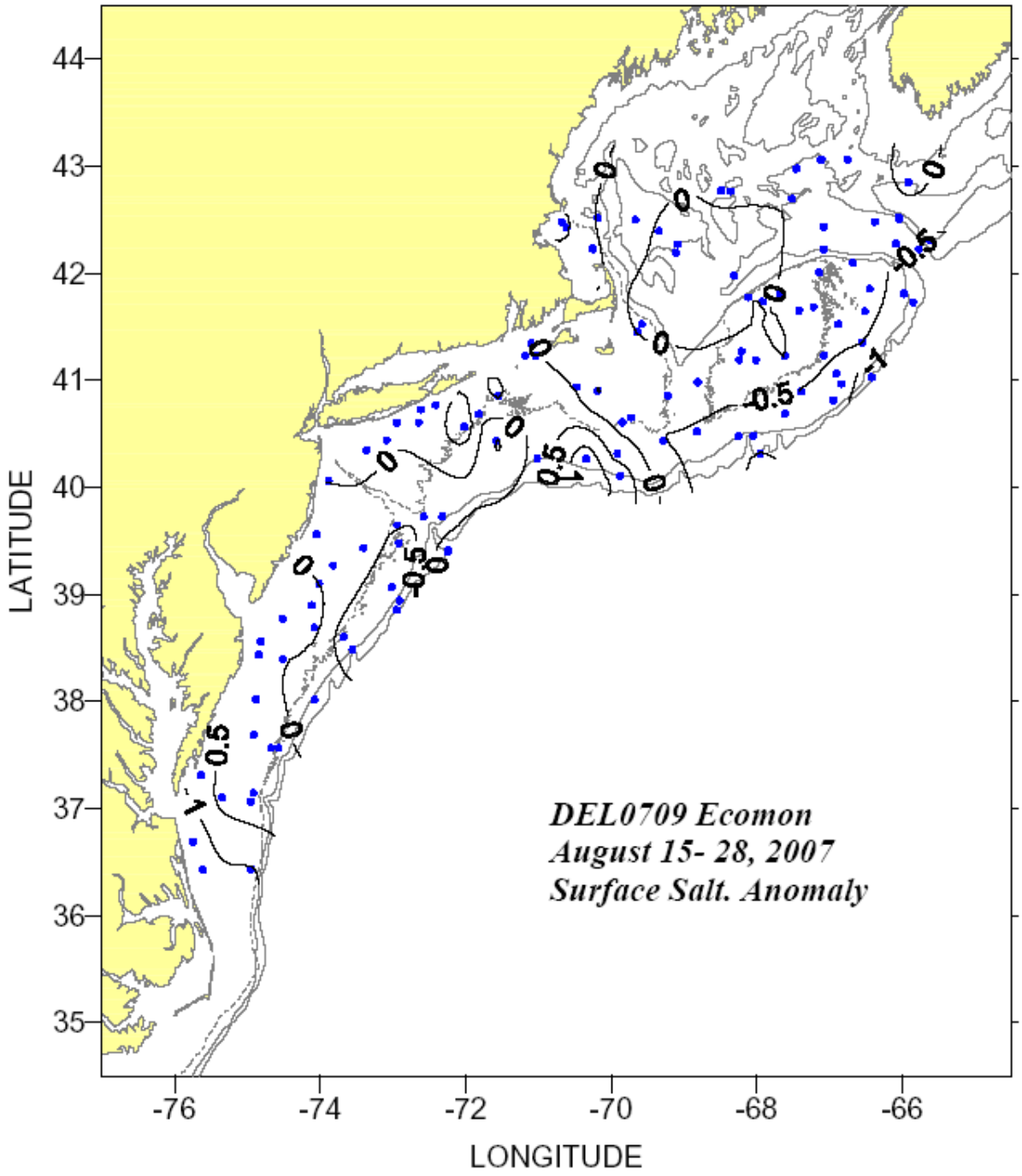
DEL0709 Ecomon
August 15- 28, 2007
Bottom Salinity (PSU)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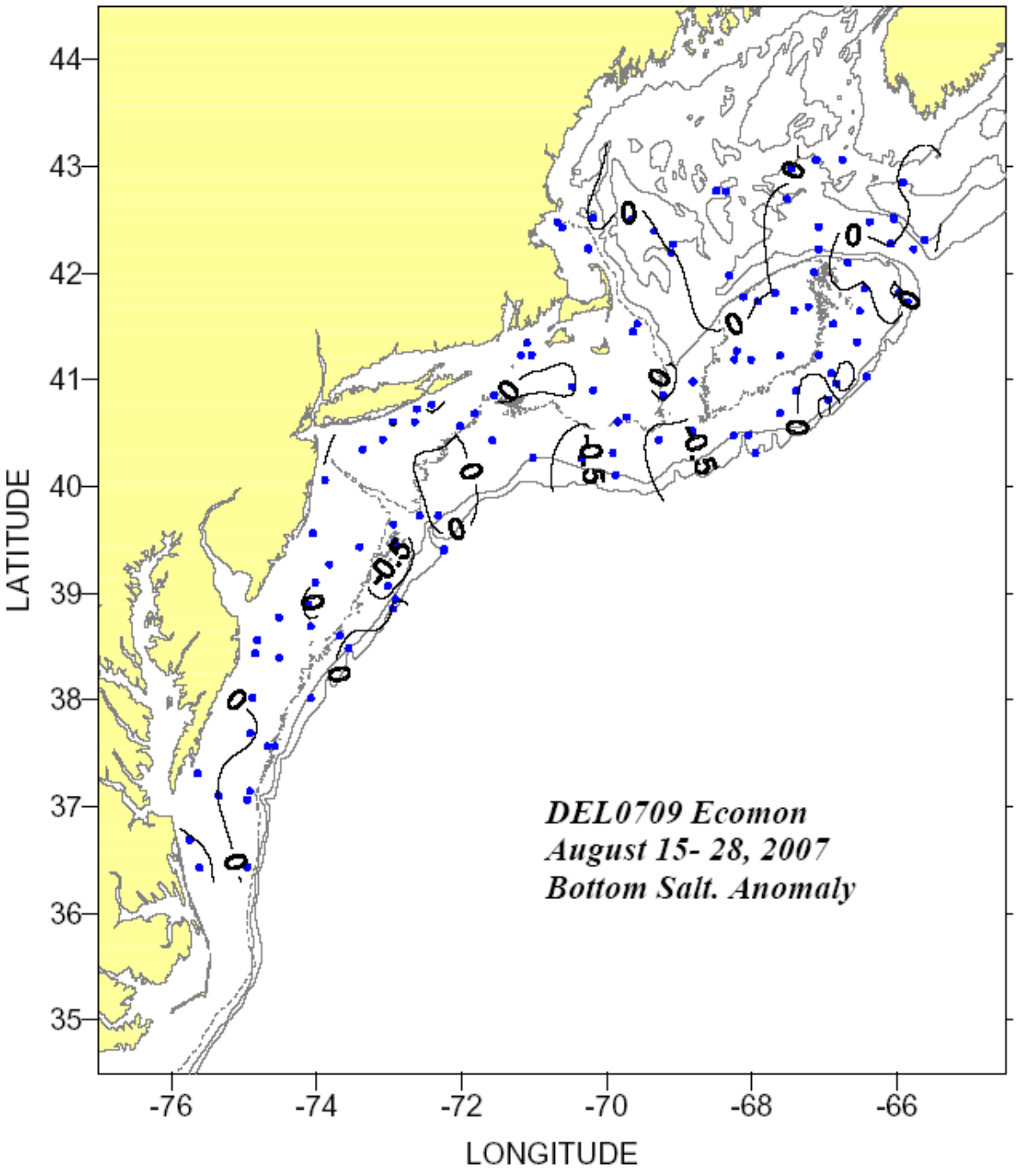
DEL0709 Ecomon
August 15- 28, 2007
Surface Salt. Anomaly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LATITUDE
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LONGITUDE
DEL0709 Ecomon
August 15- 28, 2007
Bottom Salt. Anomaly

Del0709 ECOMON
15 - 28, August 2007

Cast #	Sta #	Lat	Long	Day	Mo	Year	Time (GMT)	Btm Depth	Sfc Temp	Sfc Salt	Btm Temp	Btm Salt	Meters from Bottom
1	1	4113.9	7102.0	15	8	2007	2:07	38	18.81	31.91	12.20	32.44	4
2	2	4056.2	7028.5	15	8	2007	6:07	45	18.44	32.51	10.32	32.88	4
3	3	4054.0	7011.1	15	8	2007	7:55	31	15.71	32.00	13.71	32.25	5
4	4	4039.0	6943.3	15	8	2007	11:34	54	18.49	32.60	10.87	32.68	5
5	5	4036.4	6950.7	15	8	2007	12:33	60	18.74	32.50	9.29	32.93	2
6	5	4036.5	6950.8	15	8	2007	12:46	60	18.85	32.51	9.27	32.93	4
7	6	4018.9	6954.8	15	8	2007	15:10	83	20.08	32.91	8.29	33.43	7
10	8	4006.4	6952.2	15	8	2007	21:01	110	23.04	34.08	10.36	34.49	4
11	9	4015.9	7020.4	16	8	2007	0:37	97	23.95	34.75	9.50	34.04	5
12	10	4016.3	7100.8	16	8	2007	5:24	112	22.47	33.50	11.06	34.88	5
13	11	4026.0	7134.5	16	8	2007	9:01	78	21.82	32.03	8.68	33.35	3
14	12	3943.6	7219.0	16	8	2007	16:27	98	23.32	32.35	8.08	33.46	41
15	12	3943.6	7219.0	16	8	2007	16:37	99	23.37	32.39	9.74	34.07	6
16	13	3924.0	7214.6	16	8	2007	19:45	279	25.07	34.59	8.68	35.17	6
17	13	3924.7	7213.9	16	8	2007	20:16	428	25.12	34.83	12.11	35.45	229
18	14	3943.6	7234.7	17	8	2007	0:12	76	23.44	32.03	7.26	33.21	4
19	15	3938.7	7256.2	17	8	2007	3:00	64	22.77	31.69	6.27	33.00	4
20	16	3928.7	7254.9	17	8	2007	4:34	65	22.93	31.69	6.92	32.95	4
21	17	3926.1	7324.2	17	8	2007	7:46	33	22.66	31.32	10.06	32.50	5
22	18	3903.9	7301.0	17	8	2007	11:40	80	23.58	31.41	7.10	33.27	5
23	19	3856.4	7254.6	17	8	2007	13:04	110	23.90	32.26	11.87	34.66	56
24	19	3856.6	7254.6	17	8	2007	13:15	110	23.89	32.21	11.95	35.29	10
25	20	3851.2	7256.9	17	8	2007	14:25	128	24.27	32.39	11.34	35.35	7
26	21	3836.2	7340.5	17	8	2007	19:37	63	24.33	31.62	6.19	32.87	4
27	21	3836.2	7340.5	17	8	2007	19:46	63	24.39	31.66	6.18	32.87	7
28	22	3829.1	7333.1	17	8	2007	21:07	91	24.55	31.62	10.78	34.60	3
29	23	3801.0	7404.6	18	8	2007	2:37	106	25.34	32.13	11.25	34.86	5
30	24	3733.8	7434.3	18	8	2007	7:35	65	25.79	32.18	7.41	33.26	6
31	25	3733.7	7440.5	18	8	2007	8:28	56	25.97	32.23	8.32	33.05	6
32	26	3708.6	7455.0	18	8	2007	11:43	46	26.10	32.07	8.99	33.16	6
33	27	3703.9	7456.9	18	8	2007	12:34	46	26.11	32.23	8.45	33.24	1
34	27	3703.8	7457.2	18	8	2007	12:45	44	26.12	32.22	8.45	33.21	5

Del0709 ECOMON
15 - 28, August 2007

Cast #	Sta #	Lat	Long	Day	Mo	Year	Time (GMT)	Btm Depth	Sfc Temp	Sfc Salt	Btm Temp	Btm Salt	Meters from Bottom
35	28	3625.9	7456.8	18	8	2007	17:51	39	25.62	32.97	12.85	33.55	6
36	29	3625.5	7536.6	18	8	2007	21:55	26	26.77	32.46	19.61	33.75	3
37	29	3625.6	7536.6	18	8	2007	22:04	26	26.76	32.45	19.65	33.75	6
38	30	3641.3	7544.7	19	8	2007	0:18	15	26.21	31.69	20.52	33.13	4
39	31	3706.1	7520.6	19	8	2007	4:30	26	25.57	31.78	14.48	33.08	3
40	32	3718.5	7538.0	19	8	2007	7:07	16	24.76	31.96	23.80	32.10	6
41	33	3741.2	7454.8	19	8	2007	12:07	28	24.96	32.19	13.27	33.22	1
42	33	3741.2	7454.7	19	8	2007	12:16	27	25.04	32.20	13.65	32.94	5
43	34	3801.2	7452.6	19	8	2007	14:56	29	23.51	32.04	14.42	32.66	5
44	35	3823.7	7430.5	19	8	2007	18:23	37	23.81	31.67	10.67	32.57	4
45	36	3826.1	7450.4	19	8	2007	20:46	22	23.62	31.78	14.69	32.29	2
46	36	3826.2	7450.3	19	8	2007	20:51	22	23.61	31.79	17.88	32.19	5
47	37	3833.6	7448.7	19	8	2007	21:57	26	23.79	32.00	13.48	32.36	5
48	38	3846.3	7431.0	20	8	2007	0:24	26	22.78	31.75	13.81	32.14	5
49	39	3841.3	7404.6	20	8	2007	3:12	52	23.07	31.87	7.47	32.81	3
50	40	3853.8	7406.7	20	8	2007	4:54	41	22.95	31.78	8.36	32.72	3
51	41	3905.9	7400.8	20	8	2007	6:46	38	22.59	31.48	9.87	32.53	4
52	42	3916.1	7349.0	20	8	2007	8:45	36	22.46	31.50	9.76	32.57	5
53	43	3933.5	7402.7	20	8	2007	11:23	23	22.24	31.15	16.18	31.70	5
54	44	4003.4	7352.9	20	8	2007	15:58	24	20.09	31.28	14.33	31.89	5
55	45	4020.8	7321.5	20	8	2007	20:36	33	19.71	31.42	11.00	32.18	5
56	45	4020.8	7321.5	20	8	2007	20:43	32	19.77	31.42	11.01	32.18	4
57	46	4026.3	7305.2	20	8	2007	23:00	37	19.83	31.32	9.65	32.50	5
58	47	4036.2	7256.8	21	8	2007	0:49	26	19.19	31.43	14.01	31.89	4
59	48	4036.4	7238.8	21	8	2007	3:07	37	18.73	31.62	9.64	32.61	4
60	49	4043.6	7236.8	21	8	2007	4:18	29	19.47	31.46	14.19	31.97	4
61	50	4046.2	7224.6	21	8	2007	5:52	34	18.74	31.58	14.61	32.00	5
62	51	4034.0	7201.1	21	8	2007	9:04	56	20.81	32.15	8.37	32.81	6
63	52	4041.0	7149.0	21	8	2007	10:49	54	20.99	32.14	8.20	32.92	3
64	53	4051.2	7132.8	21	8	2007	13:08	59	18.89	32.46	9.30	32.88	16
65	53	4051.2	7133.0	21	8	2007	13:22	59	18.73	32.39	9.01	32.87	4
66	54	4113.8	7110.8	21	8	2007	17:22	42	18.04	31.92	11.51	32.51	6

Del0709 ECOMON
15 - 28, August 2007

Cast #	Sta #	Lat	Long	Day	Mo	Year	Time (GMT)	Btm Depth	Sfc Temp	Sfc Salt	Btm Temp	Btm Salt	Meters from Bottom
67	55	4120.8	7106.0	21	8	2007	18:31	30	18.53	31.85	14.42	32.07	4
68	56	4127.0	6938.3	22	8	2007	16:57	27	15.56	31.83	11.29	31.93	4
69	57	4131.3	6934.7	22	8	2007	17:53	39	17.23	31.85	7.49	32.12	4
70	58	4058.8	6848.7	23	8	2007	1:07	73	15.54	32.43	13.04	32.52	4
71	58	4059.1	6848.5	23	8	2007	1:22	67	15.44	32.44	13.11	32.52	24
72	59	4051.4	6913.2	23	8	2007	3:49	61	16.54	32.41	11.19	32.63	6
73	60	4026.2	6916.9	23	8	2007	7:03	75	17.49	32.31	9.25	32.84	4
74	61	4031.2	6849.1	23	8	2007	10:10	70	17.32	32.16	8.92	32.77	4
75	62	4028.7	6814.9	23	8	2007	13:48	107	17.44	32.20	9.50	32.71	56
76	62	4028.7	6815.0	23	8	2007	13:58	107	17.46	32.20	9.40	34.22	7
77	63	4028.8	6802.8	23	8	2007	15:37	128	17.66	32.24	9.34	34.25	3
78	64	4018.8	6756.8	23	8	2007	17:37	169	17.79	32.27	9.78	35.01	3
79	65	4041.2	6736.7	23	8	2007	21:17	84	17.47	32.28	7.22	33.12	1
80	66	4053.5	6723.0	23	8	2007	23:25	82	17.15	32.30	9.02	32.70	16
81	66	4053.7	6722.6	23	8	2007	23:37	82	17.12	32.30	8.95	32.71	19
82	67	4048.8	6656.7	24	8	2007	2:27	98	16.86	32.11	9.56	34.55	2
83	68	4101.6	6625.1	24	8	2007	6:19	305	16.40	31.94	6.76	34.95	7
84	68	4101.7	6625.3	24	8	2007	6:39	305	16.30	31.95	9.26	35.05	105
85	69	4058.0	6650.0	24	8	2007	9:26	76	15.82	32.21	7.97	32.84	4
86	70	4103.6	6654.5	24	8	2007	10:25	70	15.01	32.15	8.82	32.76	5
87	71	4113.8	6704.6	24	8	2007	12:10	65	16.13	32.34	12.41	32.54	25
88	71	4113.9	6704.5	24	8	2007	12:22	65	16.16	32.35	11.27	32.58	5
89	72	4113.6	6736.8	24	8	2007	15:58	38	16.61	32.42	15.27	32.47	6
90	73	4111.2	6800.8	24	8	2007	18:22	45	16.71	32.42	16.29	32.43	4
91	74	4111.4	6814.2	24	8	2007	19:43	50	17.25	32.39	16.16	32.45	5
92	75	4115.9	6812.7	24	8	2007	20:34	48	16.96	32.46	15.96	32.48	3
93	75	4116.1	6812.4	24	8	2007	20:45	45	16.43	32.52	16.07	32.48	24
94	76	4158.7	6818.5	25	8	2007	1:40	191	15.89	32.38	6.59	34.25	5
95	77	4146.6	6806.9	25	8	2007	3:58	47	16.28	32.49	10.50	32.57	5
96	78	4144.0	6755.1	25	8	2007	5:16	28	16.66	32.48	15.27	32.48	6
97	79	4148.7	6740.8	25	8	2007	7:11	34	15.58	32.46	15.42	32.46	5
98	80	4139.1	6725.0	25	8	2007	9:41	58	16.05	32.53	16.02	32.53	5

Del0709 ECOMON
15 - 28, August 2007

Cast #	Sta #	Lat	Long	Day	Mo	Year	Time (GMT)	Btm Depth	Sfc Temp	Sfc Salt	Btm Temp	Btm Salt	Meters from Bottom
99	81	4141.1	6713.1	25	8	2007	11:00	57	15.24	32.51	15.20	32.51	4
100	82	4131.4	6652.6	25	8	2007	13:38	67	16.38	32.30	12.32	32.53	30
101	82	4131.4	6652.5	25	8	2007	13:48	67	16.40	32.32	11.23	32.58	4
102	83	4121.3	6632.8	25	8	2007	16:04	90	16.31	32.28	8.31	32.73	4
103	84	4138.5	6630.8	25	8	2007	18:45	77	16.42	32.37	9.89	32.56	4
104	85	4143.6	6551.0	25	8	2007	22:46	128	16.05	31.93	7.29	34.02	5
105	86	4148.6	6558.5	26	8	2007	0:10	97	15.78	31.92	6.47	33.59	5
106	86	4148.4	6558.2	26	8	2007	0:25	97	15.75	31.90	6.41	33.56	22
107	87	4151.1	6626.7	26	8	2007	3:31	78	17.09	32.24	7.39	32.70	4
108	88	4205.8	6640.4	26	8	2007	6:55	74	17.69	32.17	5.61	33.10	3
109	89	4200.4	6708.2	26	8	2007	9:52	55	15.89	32.28	13.60	32.48	4
110	90	4213.5	6704.7	26	8	2007	11:26	208	17.81	32.16	7.52	34.62	4
111	91	4226.0	6704.6	26	8	2007	13:40	363	16.12	32.25	7.03	34.91	2
112	91	4226.0	6704.5	26	8	2007	14:06	362	16.24	32.25	7.13	34.88	162
113	92	4228.8	6622.6	26	8	2007	18:08	250	14.78	31.83	7.94	34.89	7
114	92	4228.8	6622.3	26	8	2007	18:27	250	14.66	31.89	8.02	34.85	50
115	93	4216.5	6605.0	26	8	2007	20:55	268	16.60	32.10	7.35	34.91	5
116	93	4216.4	6604.9	26	8	2007	21:13	265	16.07	31.96	7.77	34.92	64
117	94	4213.5	6546.1	26	8	2007	23:46	220	14.51	31.77	8.29	34.94	15
118	95	4218.5	6536.9	27	8	2007	1:34	106	12.34	32.02	6.23	33.71	4
119	96	4231.5	6602.8	27	8	2007	5:05	172	13.73	32.18	8.11	34.58	3
120	96	4230.4	6602.7	27	8	2007	5:31	190	13.65	32.17	6.33	32.78	126
121	97	4251.0	6555.0	27	8	2007	8:31	86	12.88	32.41	7.14	33.12	3
122	98	4303.8	6644.9	27	8	2007	13:04	122	14.47	32.35	7.42	34.16	4
123	99	4303.7	6706.5	27	8	2007	15:10	199	16.09	32.28	6.93	33.40	123
124	99	4303.6	6706.7	27	8	2007	15:22	202	16.56	32.30	7.64	34.71	5
125	100	4258.7	6726.7	27	8	2007	17:37	230	17.33	32.29	7.46	34.68	30
126	100	4258.5	6727.5	27	8	2007	18:13	229	17.11	32.29	7.46	34.70	4
127	101	4241.6	6730.8	27	8	2007	20:28	190	16.65	32.30	7.19	34.72	4
128	102	4246.0	6821.5	28	8	2007	1:19	208	17.39	32.25	6.85	34.40	6
129	103	4246.2	6829.8	28	8	2007	2:28	188	16.68	32.25	6.88	34.38	7
130	103	4246.3	6828.7	28	8	2007	2:55	196	16.65	32.25	6.54	33.36	104

Del0709 ECOMON
15 - 28, August 2007

Cast #	Sta #	Lat	Long	Day	Mo	Year	Time (GMT)	Btm Depth	Sfc Temp	Sfc Salt	Btm Temp	Btm Salt	Meters from Bottom
131	104	4211.5	6906.6	28	8	2007	8:10	171	19.77	31.99	5.76	33.51	6
132	105	4216.2	6905.0	28	8	2007	9:10	197	19.35	32.01	6.65	33.87	5
133	106	4223.6	6920.5	28	8	2007	11:13	247	19.56	32.19	6.64	34.01	3
134	106	4223.6	6920.6	28	8	2007	11:33	246	19.64	32.17	6.85	33.95	45
135	107	4229.9	6940.0	28	8	2007	13:41	252	19.42	31.91	6.75	34.02	4
136	107	4230.0	6940.0	28	8	2007	13:58	242	19.36	31.96	6.61	33.91	42
137	108	4231.1	7011.0	28	8	2007	17:19	77	19.84	31.51	5.80	32.60	5
138	109	4228.7	7040.5	28	8	2007	20:34	61	19.71	31.51	6.39	32.25	5
139	110	4225.3	7036.7	28	8	2007	21:13	84	19.44	31.51	6.13	32.32	4
140	111	4213.8	7015.2	28	8	2007	23:49	28	19.34	31.59	8.26	31.95	4
141	111	4213.5	7014.9	28	8	2007	23:58	28	19.18	31.54	8.36	31.92	5