

**Description of the
1994 Oceanographic Conditions
on the Northeast Continental Shelf**

by

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Abstract

A summary of hydrographic observations for 16 surveys on the northeast continental shelf during 1994 is presented. Distributions of station position, surface and bottom temperature, salinity, and temperature anomaly are portrayed. The average surface and bottom temperature and salinity have been calculated for each survey in five geographic regions over the northeast continental shelf: western Gulf of Maine (GOMW), eastern Gulf of Maine (GOME), Georges Bank (GB), northern Middle Atlantic Bight (MABN) and southern Middle Atlantic Bight (MABS).

Unlike temperature, salinity properties of the northeast shelf exhibit large interannual variability (Manning 1990). Areal average salinity calculations are included in this report because yearly changes may be an important hydrographic characteristic. The 1994 regional distributions show that the surface and bottom salinity of the northern MAB was fresher than the MARMAP reference for nearly all observations.

Introduction

The Northeast Fisheries Science Center (NEFSC) conducts several different surveys off the northeast continental shelf each year. Complete coverage of the shelf (Cape Hatteras to the Gulf of Maine) occurs during the spring and fall bottom-trawl surveys only. Station coverage on other cruises throughout the year varies. The oceanographic conditions during 1991, 1992 and 1993 have been described in Holzwarth-Davis and Taylor (1991, 1992 and 1993).

Temperature and salinity observations from 16 NEFSC surveys conducted during 1994 are summarized and presented in this report. Cruise operation summaries are presented for all cruises. Distribution plots of surface and bottom temperature, salinity, and temperature anomaly are contoured where sufficient data are available. Areal average temperature and salinity and the corresponding anomalies are also presented for the five different regions on the shelf. The data are presented chronologically in atlas form. No attempt has been made here to analyze the data or discuss in detail individual observations from the cruises.

Data and Methods:

Temperature and salinity measurements were obtained with a Seabird SBE 19 conductivity, temperature and pressure recording profiling instrument (Profiler). This instrument measures the pressure, temperature and conductivity of the water twice per second. Two different methods of deployment were used depending upon the type of work conducted at a station. Whenever a plankton haul was done, the Profiler was placed above the bongo nets, and a double oblique tow was made. If no plankton haul was done, the Profiler was deployed vertically down and up through the water column. Salinity samples are taken from the bottom of a vertical profile cast in order to calibrate the conductivity data. These samples are analyzed on shore with a Guildline Autosol salinometer.

The data from the *R/V Gloria Michelle* shrimp cruise were collected with expendable bathythermograph (XBT) probes. This data

set contains pressure and temperature only.

All raw Profiler data were processed using the Seabird manufactured software: DATCNV, ALIGNCTD, BINA VG, DERIVE, and ASCIIOUT to produce 1 decibar averaged ascii files. The data were edited, cleaned, and converted to a standard 80-column ASCII formatted cruise file and are archived in the NEFSC anonymous FTP account (whsun2:/ftp/pub/hydro).

Station distributions and horizontal contour plots of the surface and bottom temperature, salinity, and temperature anomaly were prepared for each survey. Areal average temperatures and salinities were calculated for the five regions of the northeast continental shelf shown in Figure 1: western and eastern Gulf of Maine, Georges Bank, and the northern and southern Middle Atlantic Bight. The areal averaging was done using the method described in Holzwarth and Mountain (1990). The areal averages and anomalies were plotted against the mid-date (calendar day) of all observations within a region for each cruise.

Results

The NEFSC cruises for which data are presented in this report are listed in Table 1. A summary of each cruise is listed in Appendix A and includes information on the type of cruise, its objectives, dates, the number of hydrographic stations, type(s) of instruments used, salinity calibration value, and notes pertaining to instrument performance.

Table 2 lists the surface and bottom areal average

temperatures and temperature anomalies that were calculated for each of the five regions. Table 3 lists the surface and bottom areal average salinity and salinity anomalies for the same five regions. For most cruises, the areal averages and anomalies could not be calculated for all regions due to limited station coverage. For several such cases a simple average (not an areal weighted mean) was determined for the observations in the region; these values are indicated by an asterisk. The standard deviations are also listed. SDV1 indicates how well the calculated anomaly represents the true regional average anomaly. SDV2 is an indicator of how closely the areal average matches the anomaly at any particular location within that region (see Holzwarth and Mountain, 1990 for explanation of SDV1 and SDV2).

Figures 2 through 5 present the time series of surface and bottom average temperature/salinity and temperature/salinity anomaly for each region. Station positions and distributions of surface and bottom temperature, salinity, and temperature anomaly for the different cruises are presented in Figures 6 through 81. Contour figures were not prepared for REL9401 and DEL9412 because there were not enough hydrographic stations occupied. Temperature anomaly distributions were not produced for *R/V Delaware* 9408 because the distance to standard MARMAP stations was too great for a reliable comparison to be made. No salinity samples were taken on the *R/V Gloria Michelle* 9412; consequently, no salinity plots were generated.

Discussion

The areal average temperature distributions for each defined region show a fairly typical yearly pattern. Warmer surface temperatures (relative to the MARMAP reference period) occurred during late June through mid-August of 1994 with the exception of the southern MAB.

In the past, areal average salinity values have not been included as part of the yearly atlas because salinity properties of the northeast shelf exhibit large interannual variability. Much of this variability can be attributed to yearly changes in river runoff and precipitation (Manning 1990). The regional average salinities and anomalies are included in this atlas because it was felt that this large interannual variability is an important characteristic of the hydrography of the northeast continental shelf. The surface salinity distribution of the northern MAB showed fresher conditions than the MARMAP reference period for all observations throughout the year.

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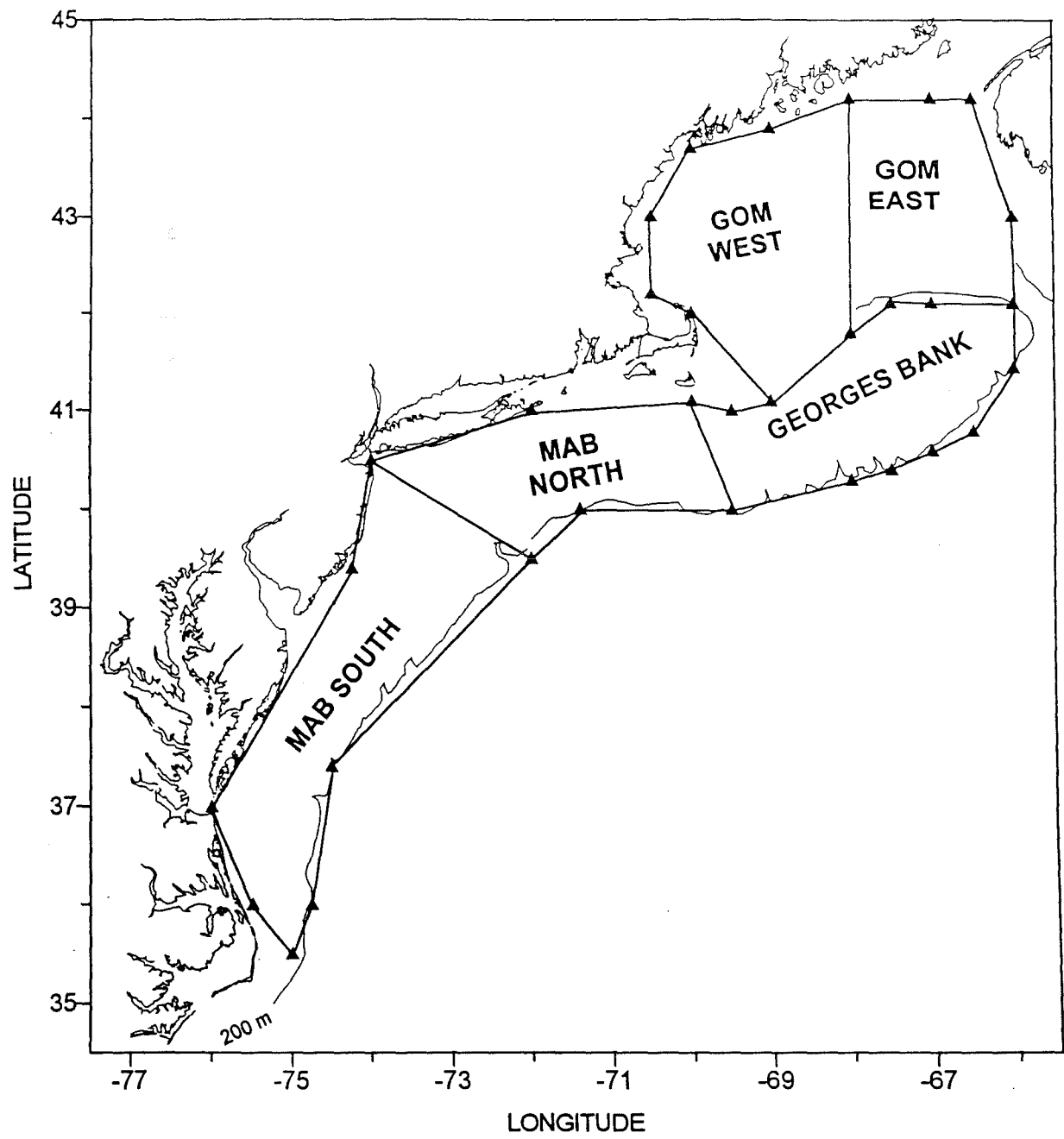


Figure 1. The regions of the northeast continental shelf covered by the Northeast Fisheries Science Center cruises during 1994

Table 1. Summary of 1994 Cruises

<u>Cruise</u>	<u>Program</u>	<u>Dates</u>	<u>Region¹</u>
DEL9401	Larval Herring Study	6-18 January	GB, GOMW
DEL9402	Winter Btm Trawl Survey I&II	31 January - 23 February	GB, MAB
DEL9403	Spring Btm Trawl Survey I-III	28 February - 27 April	MAB, GB, GOM
ALB9403	GLOBEC Stratification I&II	2-28 May	GB
DEL9404	Predator-Prey Study I&II	2-27 May	GB
DEL9406	Predator-Prey Study	20-30 June	GB
ALB9405	Scallop Survey I&II	22 June - 18 July	MAB
DEL9407	Clam Survey	18 July - 24 August	MAB, GB, GOM
GLM9412	GOM Shrimp Survey	2-11 August	GOMW
ALB9406	GOM Bottom Trawl	26 July - 5 August	GOM
REL9401	Marine Mammal Survey/WCR Study	22 August - 2 September	GB
ALB9407	Predator-Prey Study	22 August - 2 September	GB
DEL9408	Lobster Survey	6-12 September	CCB
DEL9409	Gear Comparison	19 - 29 September	MABN
ALB9409	Autumn Bottom Trawl Survey	6 September - 27 October	MAB, GB, GOM
ALB9410	GLOBEC Broad Scale Survey	8-18 November	GB
ALB9412	Cod Spawning study	29 November - 12 December	GB

¹ Regional abbreviations

GB = Georges Bank
 GOM = Gulf of Maine
 MAB = Middle Atlantic Bight
 MABN = Northern MAB
 NE Shelf = Northeastern Continental Shelf
 GOMW = Western GOM
 CCB = Cape Cod Bay

Table 2. Areal average surface and bottom temperatures and temperature anomalies for the NEFSC 1994 cruises in the five regions of the northeast continental shelf as shown in Figure 1¹.

CRUISE	CD	#Obs	SURFACE				BOTTOM						
			Temp	Anomaly	SDV1	SDV2	#Obs	Temp	Anomaly	SDV1	SDV2		
Gulf of Maine West													
de9401.dat	12	8	4.45	-1.55	0.50	0.30	*	8	5.15	-0.63	0.36	1.17	*
de9403.dat	108	26	5.53	0.47	0.22	0.59		26	5.69	0.73	0.19	0.89	
al9406.dat	210	25	16.32	1.43	0.25	2.00	*	25	7.67	1.40	0.22	0.84	*
gl9412.dat	217	40	19.93	3.12	0.20	2.60	*	40	6.33	0.84	0.12	0.89	*
de9408.dat	252	4	15.83	-0.28	0.83	0.38	*	4	10.95	2.93	0.58	1.42	*
al9409.dat	291	36	12.46	0.46	0.19	0.75		36	8.27	1.20	0.15	0.94	
al9410.dat	316	2	10.65	0.68	1.07	0.65	*	2	9.05	1.24	0.78	0.08	*
Gulf of Maine East													
de9403.dat	116	25	4.77	-0.09	0.23	0.95		21	7.58	1.35	0.23	1.19	
de9406.dat	177	4	12.90	1.27	0.44	1.01	*	4	10.95	-0.58	0.48	0.87	*
al9405.dat	198	5	16.90	5.01	0.37	0.91	*	5	7.24	-2.86	0.36	1.35	*
al9406.dat	215	6	17.72	2.50	0.40	1.67	*	6	8.90	1.61	0.36	0.38	*
al9407.dat	237	12	17.02	2.14	0.14	0.49	*	12	8.44	-2.32	0.14	1.13	*
al9409.dat	297	29	12.41	0.02	0.21	0.75		29	9.21	0.28	0.18	1.42	
al9410.dat	321	4	11.12	-0.49	0.43	0.51	*	4	10.78	-0.86	0.46	0.28	*
Georges Bank													
de9401.dat	14	41	6.00	-0.62	0.17	0.59	*	40	6.19	-0.65	0.17	0.91	*
de9402.dat	51	40	5.05	-0.03	0.23	1.92	*	31	5.36	-0.19	0.24	2.01	*
de9403.dat	100	57	5.54	0.50	0.18	1.25		48	5.82	0.55	0.23	0.93	
de9404.dat	133	196	8.26	0.80	0.08	0.95	*	190	7.74	1.03	0.09	1.39	*
al9403.dat	134	66	8.04	0.45	0.14	0.86	*	65	7.90	1.16	0.17	1.52	*
de9406.dat	176	93	12.17	0.63	0.10	0.96	*	93	11.28	1.08	0.11	1.81	*
al9405.dat	194	53	16.68	3.21	0.18	2.68		52	10.31	0.59	0.21	1.96	
de9407.dat	233	24	16.87	1.26	0.21	1.36	*	23	14.03	0.83	0.22	1.64	*
al9407.dat	239	94	16.77	1.83	0.10	1.29	*	92	10.94	-0.46	0.09	2.17	*
al9409.dat	280	54	14.60	-0.46	0.18	1.00		47	13.18	0.32	0.21	1.39	
al9410.dat	317	19	12.02	-0.35	0.39	0.79		17	11.89	0.34	0.27	0.89	
MAB North													
de9401.dat	8	28	5.94	-1.15	0.28	0.95	*	26	6.29	-0.86	0.31	1.12	*
de9402.dat	45	47	4.16	-0.96	0.25	0.83		41	5.52	-0.12	0.29	1.46	
de9403.dat	76	62	4.29	-0.08	0.26	0.94		55	5.52	0.40	0.34	1.36	
al9405.dat	184	31	20.87	2.70	0.27	1.69	*	31	6.78	-0.99	0.28	1.90	*
de9407.dat	225	23	21.20	1.29	0.30	1.98	*	22	10.11	0.22	0.33	3.16	*
de9409.dat	268	53	17.97	-0.31	0.24	0.95	*	41	13.63	1.36	0.24	1.16	*
al9409.dat	270	60	17.60	-0.15	0.27	0.89		56	13.77	1.34	0.33	1.47	
MAB South													
de9402.dat	34	62	6.20	-0.70	0.26	1.62		54	7.20	0.29	0.32	1.62	
de9403.dat	65	86	5.54	-0.19	0.23	1.02		76	5.53	-0.24	0.28	1.10	
al9405.dat	177	60	22.16	1.62	0.22	1.13	*	60	8.47	0.96	0.26	2.39	*
de9407.dat	213	78	22.91	-1.04	0.24	2.86		77	9.57	-1.43	0.29	3.46	
de9409.dat	262	3	19.50	0.17	1.32	0.69	*						
al9409.dat	256	86	20.81	-1.13	0.23	1.12		78	14.13	0.08	0.27	1.63	

¹ "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 included in each average: "Temp", the areal average temperature: "Anomaly", the areal average temperature anomaly: "SDV1", the standard deviation associated with the average temperature anomaly: "SDV2", the standard deviation of the individual anomalies from which the average anomaly was derived.

* A true areal average could not be calculated due to poor station coverage. The average values listed were derived from a simple average of the observations within the region.

Table 3. Areal average surface and bottom salinities and salinity anomalies for the NEFSC 1994 cruises in the five regions of the northeast continental shelf as shown in Figure 1.

CRUISE	CD	#Obs	SURFACE				BOTTOM						
			Salt	Anomaly	SDV1	SDV2	#Obs	Salt	Anomaly	SDV1	SDV2		
Gulf of Maine West													
de9401.dat	12	8	32.31	-0.54	0.23	0.14	*	8	32.72	-0.32	0.14	0.30	*
de9403.dat	108	26	32.36	-0.04	0.10	0.49		25	33.47	0.11	0.07	0.31	
al9406.dat	210	25	31.60	-0.21	0.10	1.74	*	25	33.18	0.19	0.06	0.30	*
de9408.dat	252	4	31.81	0.33	0.38	0.09	*	4	32.05	-0.42	0.25	0.15	*
al9409.dat	291	36	32.77	0.25	0.08	0.18		36	33.74	0.10	0.06	0.24	
al9410.dat	316	2	32.93	0.38	0.48	0.09	*	2	33.47	0.28	0.28	0.04	*
Gulf of Maine East													
de9403.dat	116	24	32.24	-0.26	0.13	0.45		25	34.12	0.21	0.09	0.48	
de9406.dat	177	4	32.49	-0.20	0.16	0.20	*	4	32.70	0.01	0.15	0.12	*
al9405.dat	198	5	32.25	-0.39	0.14	0.19	*	5	33.44	0.58	0.11	0.56	*
al9406.dat	215	6	32.43	0.07	0.17	0.22	*	6	34.68	0.31	0.09	0.13	*
al9407.dat	237	12	32.45	-0.10	0.05	0.10	*	12	33.65	0.77	0.05	0.48	*
al9409.dat	297	29	32.42	-0.12	0.12	0.56		29	34.08	0.15	0.09	0.50	
al9410.dat	321	4	32.93	0.25	0.16	0.04	*	4	33.04	0.38	0.14	0.08	*
Georges Bank													
de9401.dat	14	41	32.62	-0.27	0.06	0.22	*	40	32.73	-0.22	0.06	0.32	*
de9402.dat	51	40	32.94	0.02	0.08	0.55	*	31	33.13	-0.04	0.08	0.57	*
de9403.dat	100	55	32.83	-0.09	0.07	0.48		48	33.16	-0.01	0.08	0.35	
de9404.dat	133	196	32.90	0.08	0.03	0.31	*	190	33.14	0.09	0.03	0.42	*
al9403.dat	134	65	32.94	0.13	0.05	0.31	*	64	33.24	0.13	0.06	0.43	*
de9406.dat	176	93	32.66	0.04	0.03	0.35	*	93	32.80	0.04	0.03	0.28	*
al9405.dat	194	52	32.76	0.05	0.07	0.47		51	33.19	0.17	0.08	0.58	
de9407.dat	233	24	32.55	-0.05	0.07	0.24	*	23	32.94	0.26	0.07	0.60	*
al9407.dat	239	95	32.54	-0.05	0.04	0.48	*	93	33.22	0.40	0.03	0.53	*
al9409.dat	280	54	32.88	0.12	0.07	0.44		47	33.35	0.43	0.08	0.49	
al9410.dat	317	19	32.91	0.09	0.15	0.23		17	32.95	0.15	0.08	0.18	
MAB North													
de9401.dat	8	28	32.38	-0.46	0.11	0.25	*	25	32.52	-0.55	0.11	0.31	*
de9402.dat	45	48	32.62	-0.42	0.12	0.45		41	33.04	-0.37	0.10	0.45	
de9403.dat	76	62	32.41	-0.50	0.12	0.89		55	33.11	-0.24	0.11	0.57	
al9405.dat	184	31	31.04	-0.80	0.13	0.76	*	31	32.91	0.00	0.10	0.49	*
de9407.dat	225	23	31.79	-0.17	0.14	0.60	*	22	32.78	-0.06	0.12	0.57	*
de9409.dat	268	53	32.71	-0.20	0.11	0.45	*	41	33.34	-0.04	0.08	0.35	*
al9409.dat	270	60	32.64	-0.09	0.12	0.48		56	33.61	0.07	0.11	0.58	
MAB South													
de9402.dat	34	62	33.10	-0.58	0.15	0.58		54	33.60	-0.12	0.12	0.47	
de9403.dat	65	86	32.37	-0.82	0.13	1.49		76	32.75	-0.73	0.10	0.86	
al9405.dat	177	59	30.80	-1.14	0.11	0.52	*	59	33.79	0.44	0.09	0.75	*
de9407.dat	213	78	32.27	0.63	0.14	1.39		77	33.46	0.50	0.10	0.88	
de9409.dat	262	3	33.16	-0.60	0.58	0.15	*						
al9409.dat	256	86	32.59	0.39	0.13	1.35		78	33.13	-0.03	0.09	0.82	

* "Cruise", the code for a cruise: "CD", the calendar mid-date of all the stations within a region for a cruise: "#obs", the number of observations included in each average: "Salt", the areal average salinity: "Anomaly", the areal average salinity anomaly, "SDV1", the standard deviation associated with the average salinity anomaly: "SDV2", the standard deviation of the individual anomalies from which the average anomaly was derived.

* A true areal average could not be calculated due to poor station coverage. The average values listed were derived from a simple average of the observations within the region.

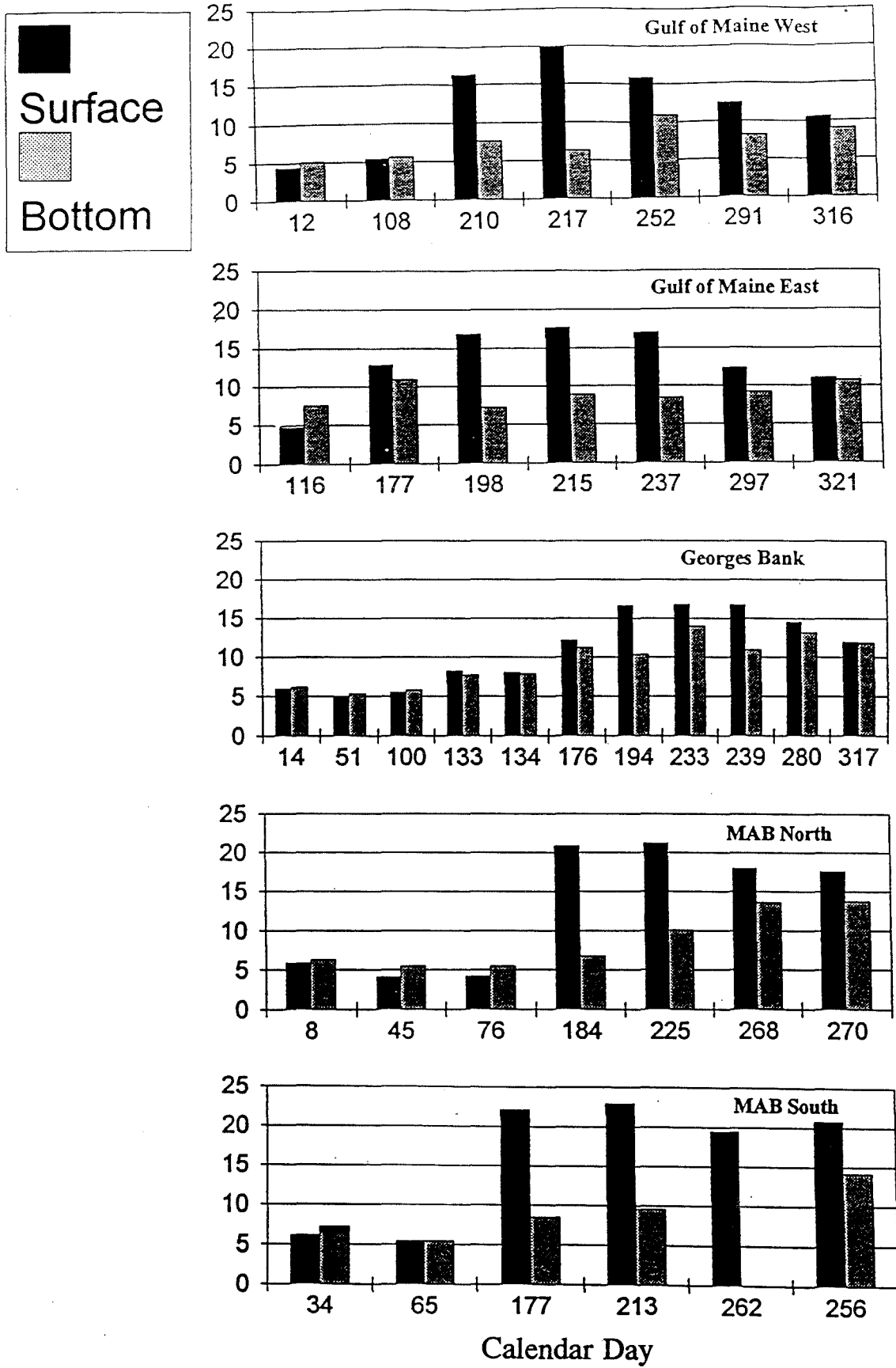


Figure 2. The 1994 areal average surface and bottom temperature values from Table 2

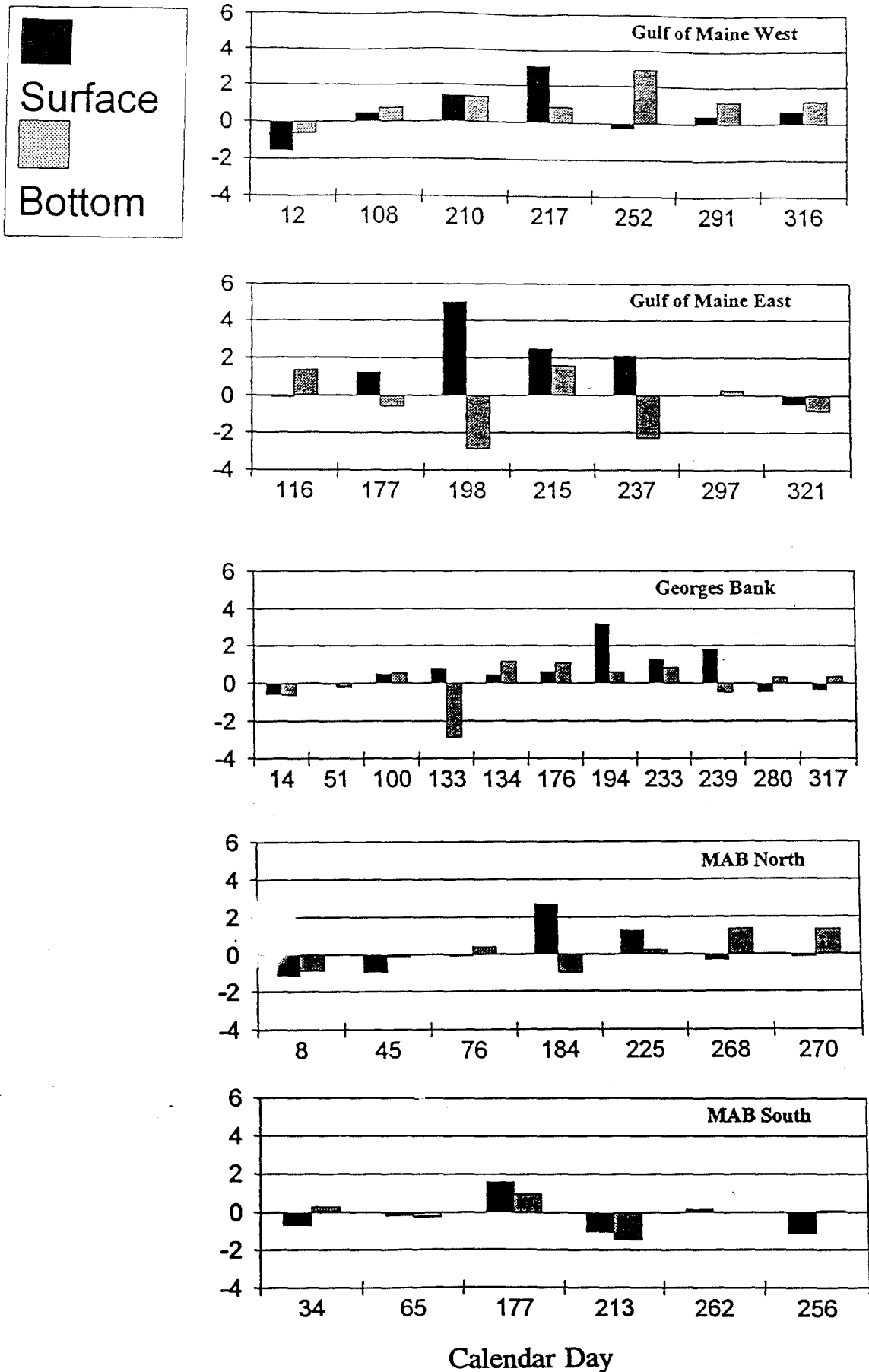


Figure 3. The 1994 areal average surface and bottom temperature anomalies from Table 2

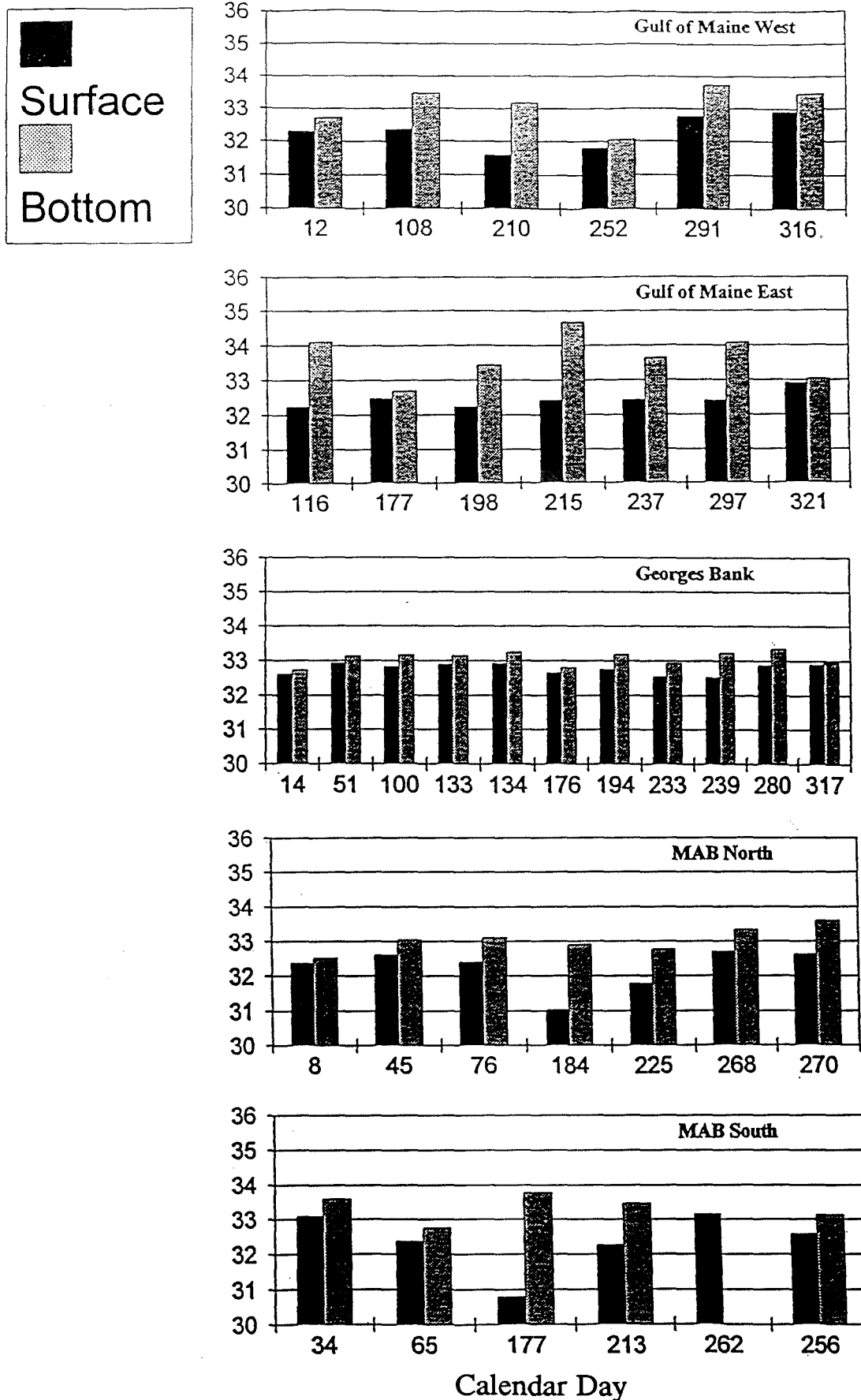


Figure 4. The 1994 areal average surface and bottom salinity values from Table 3.

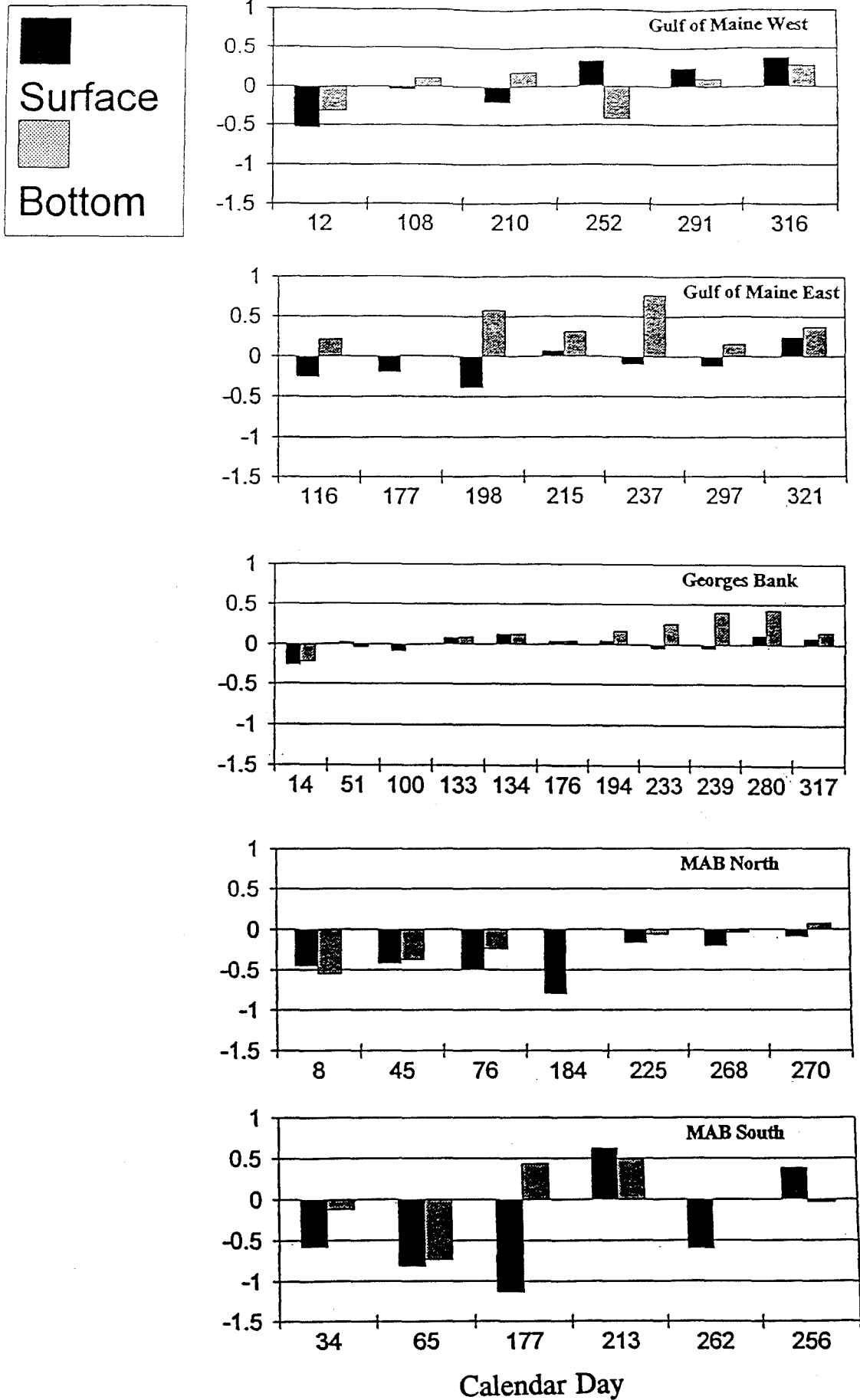


Figure 5. The 1994 areal average surface and bottom salinity anomalies from Table 3.

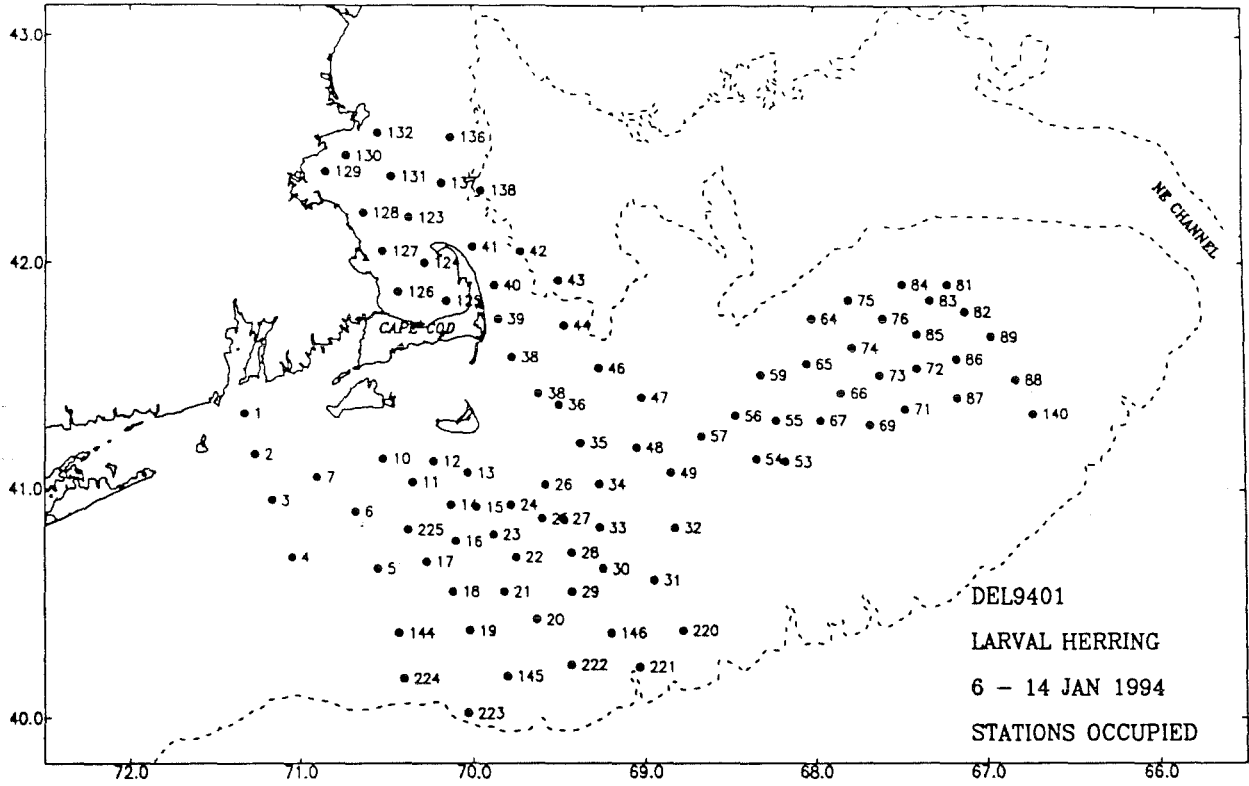


Figure 6. Hydrographic stations occupied during the larval herring/sand lance study DEL9401.

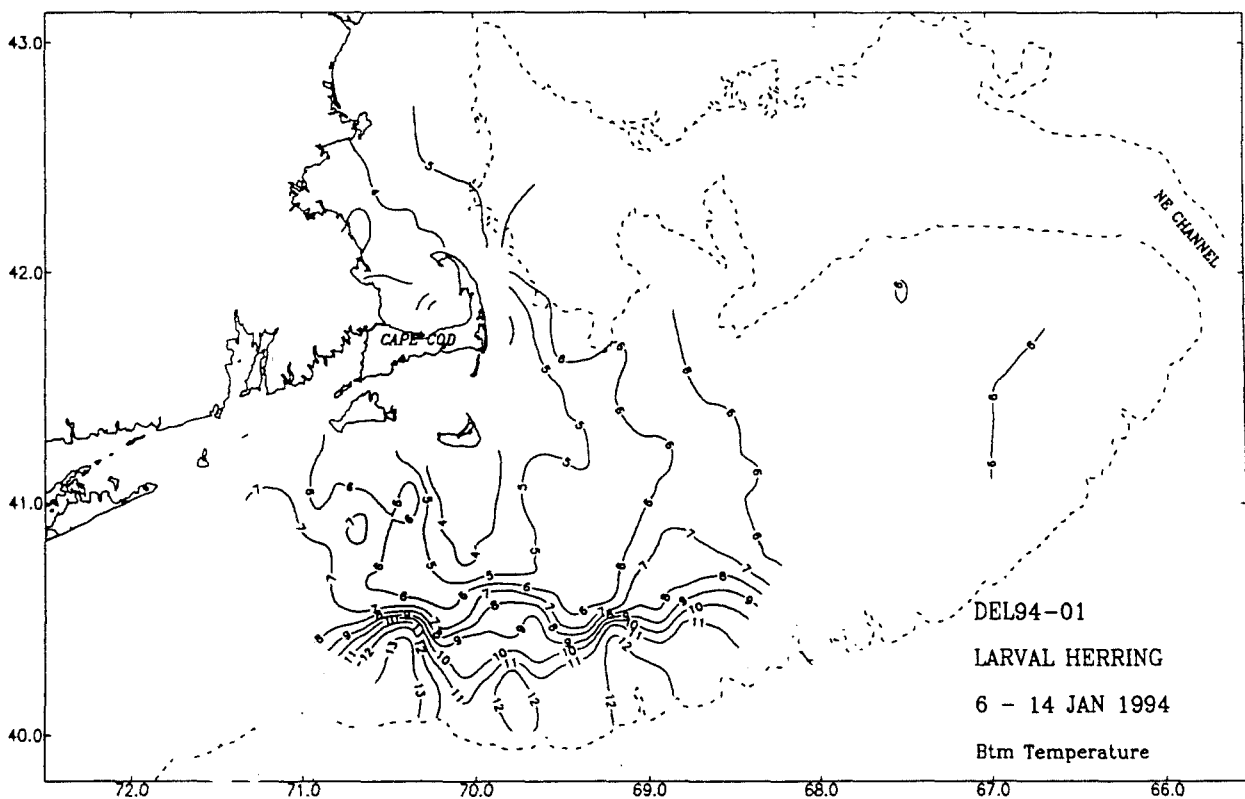
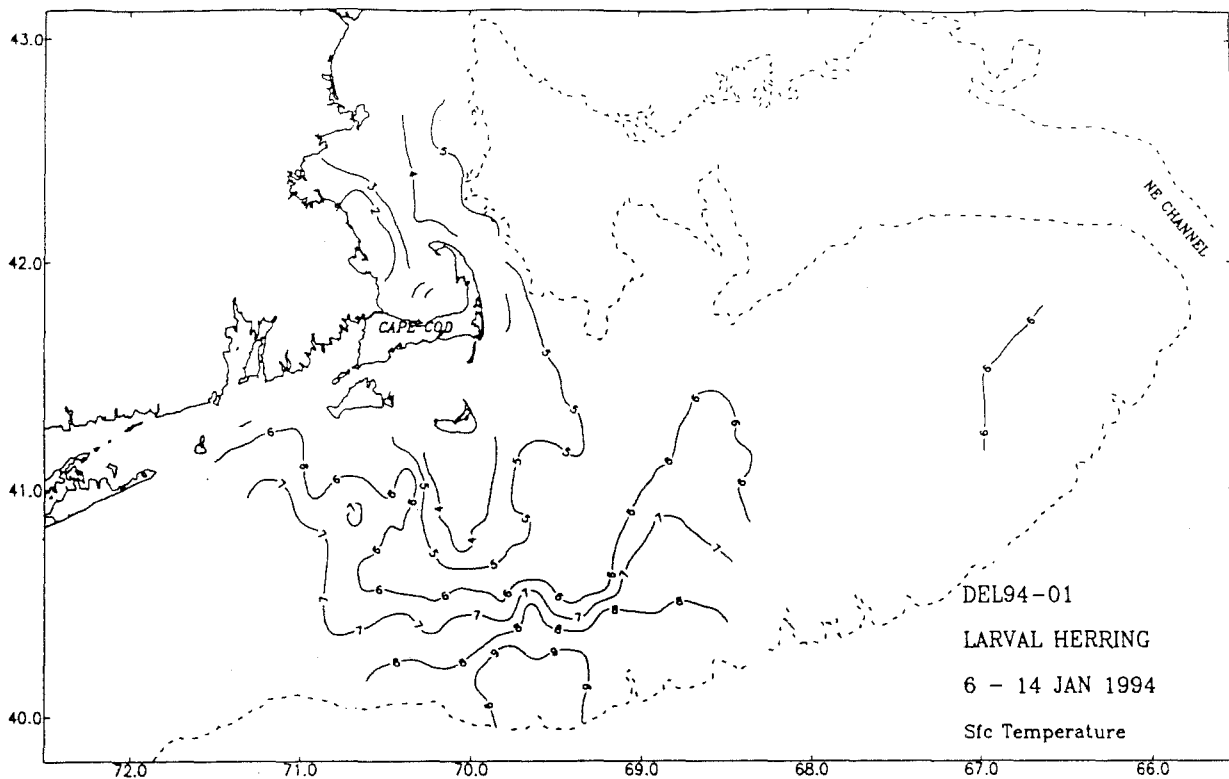


Figure 7. The surface and bottom temperature distribution for the larval herring/sand lance study DEL9401.

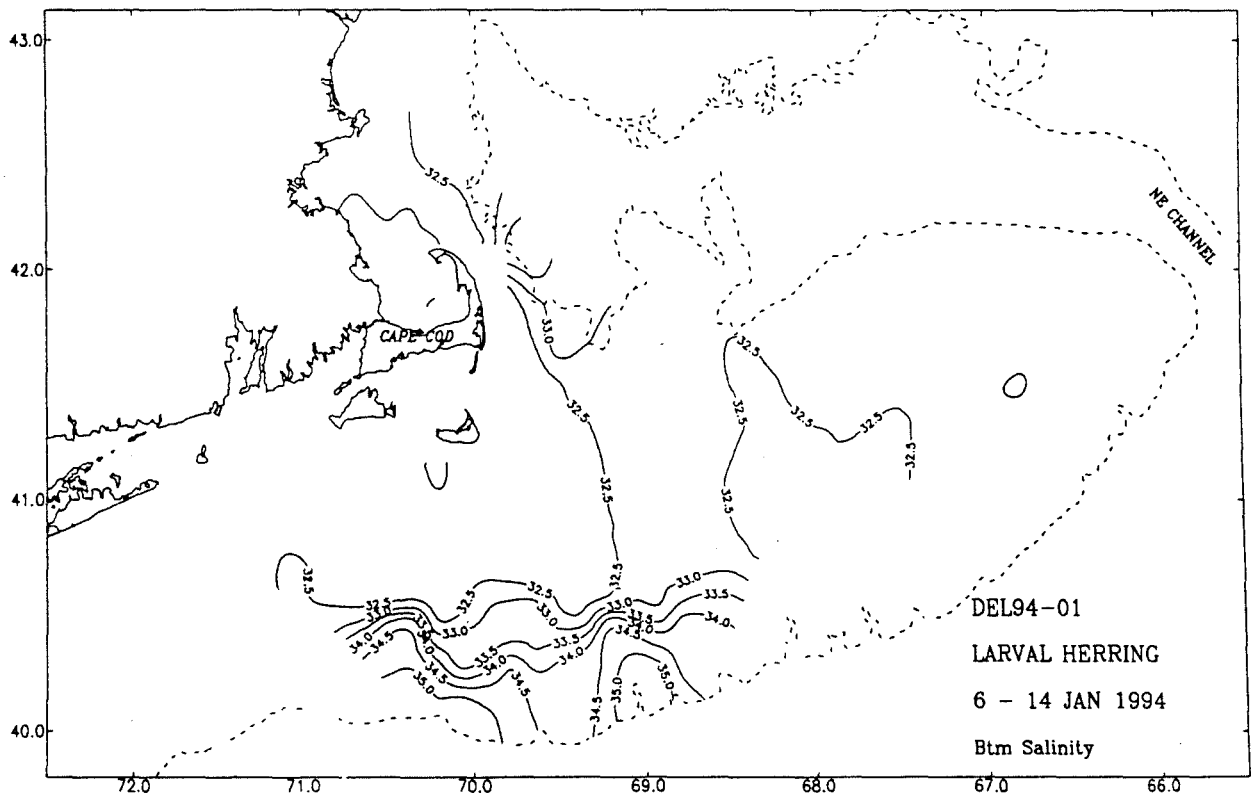
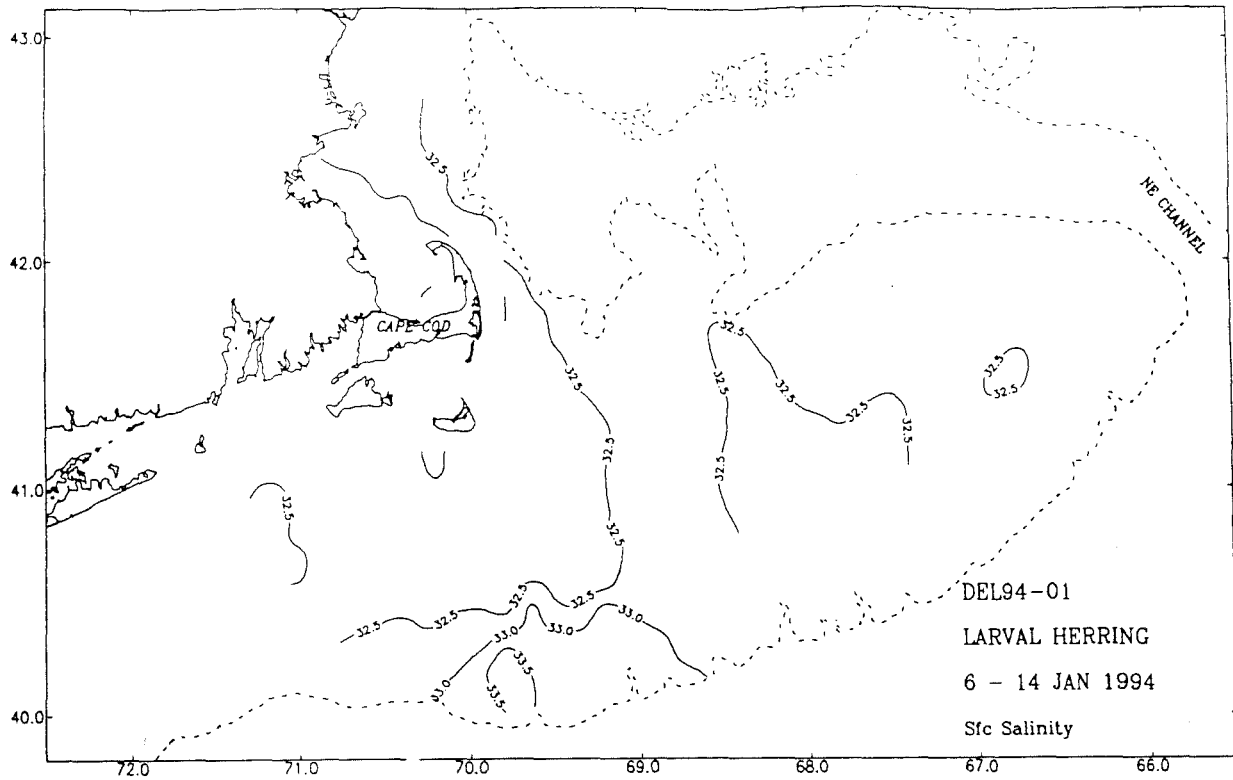


Figure 8. The surface and bottom salinity distribution for the larval herring/sand lance study DEL9401.

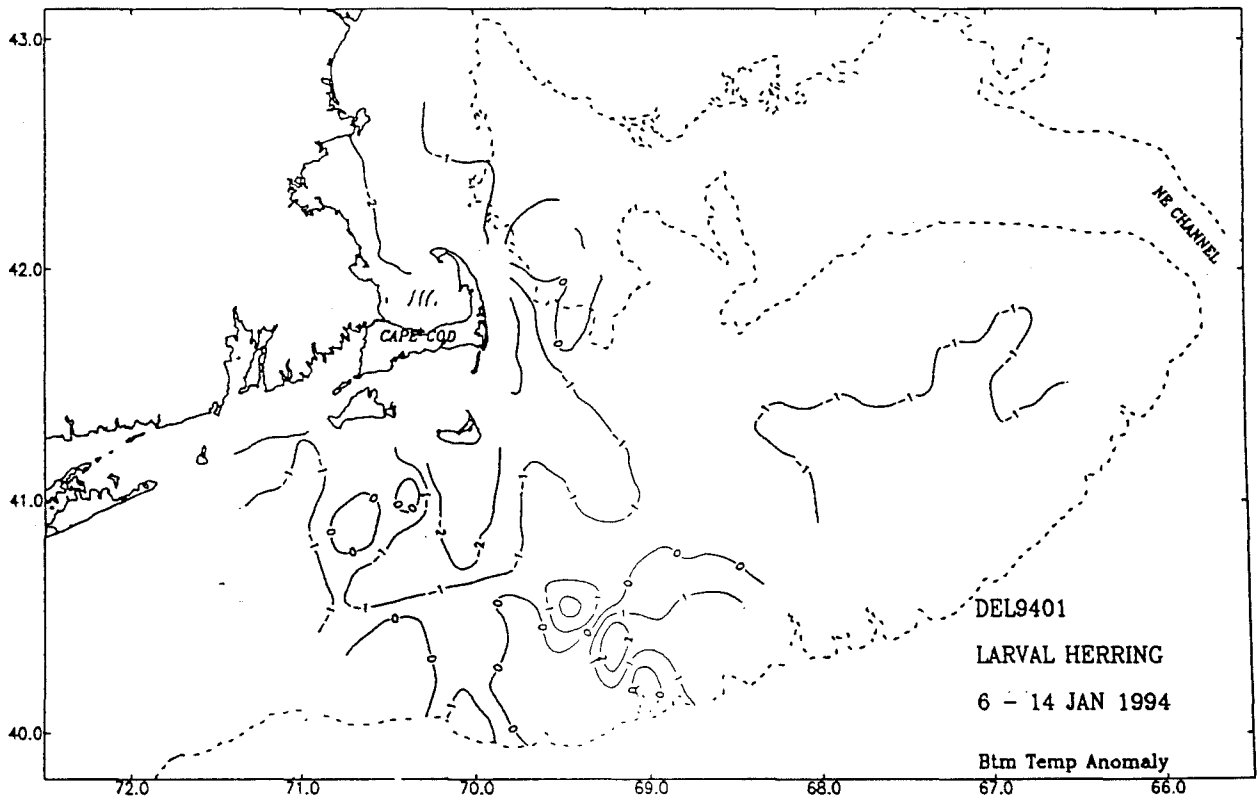
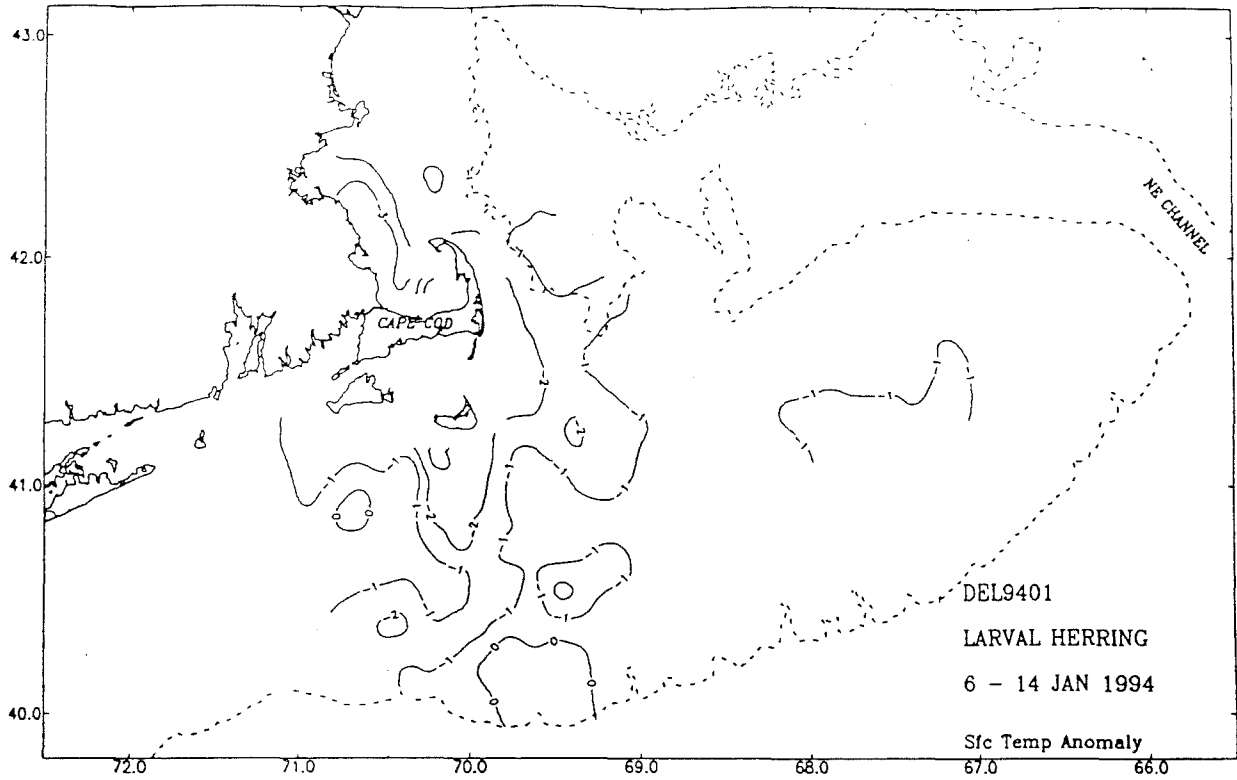


Figure 9. The surface and bottom temperature anomaly distribution for the larval herring/sand lance study DEL9401.

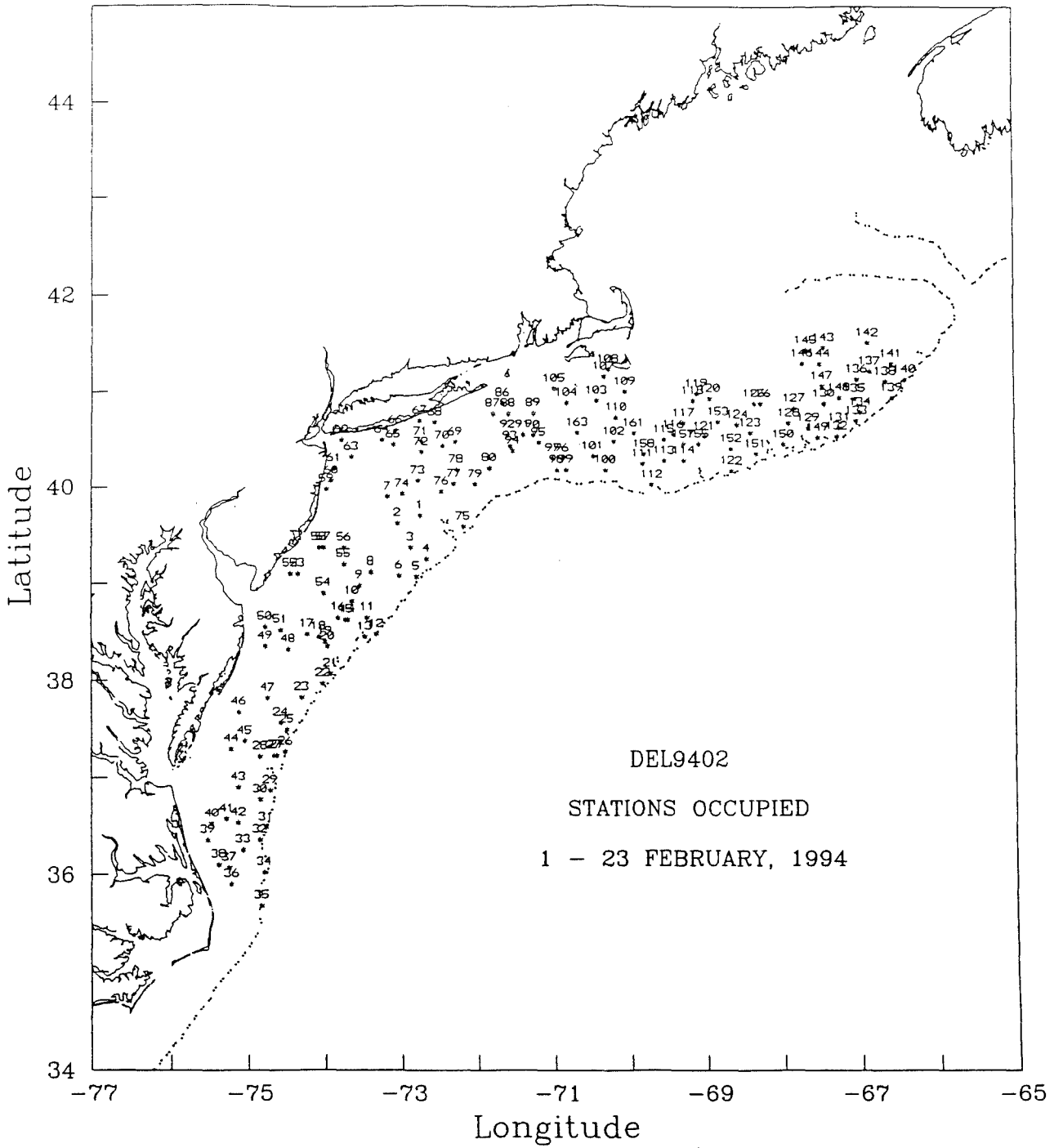


Figure 10. Hydrographic stations occupied during the winter bottom trawl survey DEL9402.

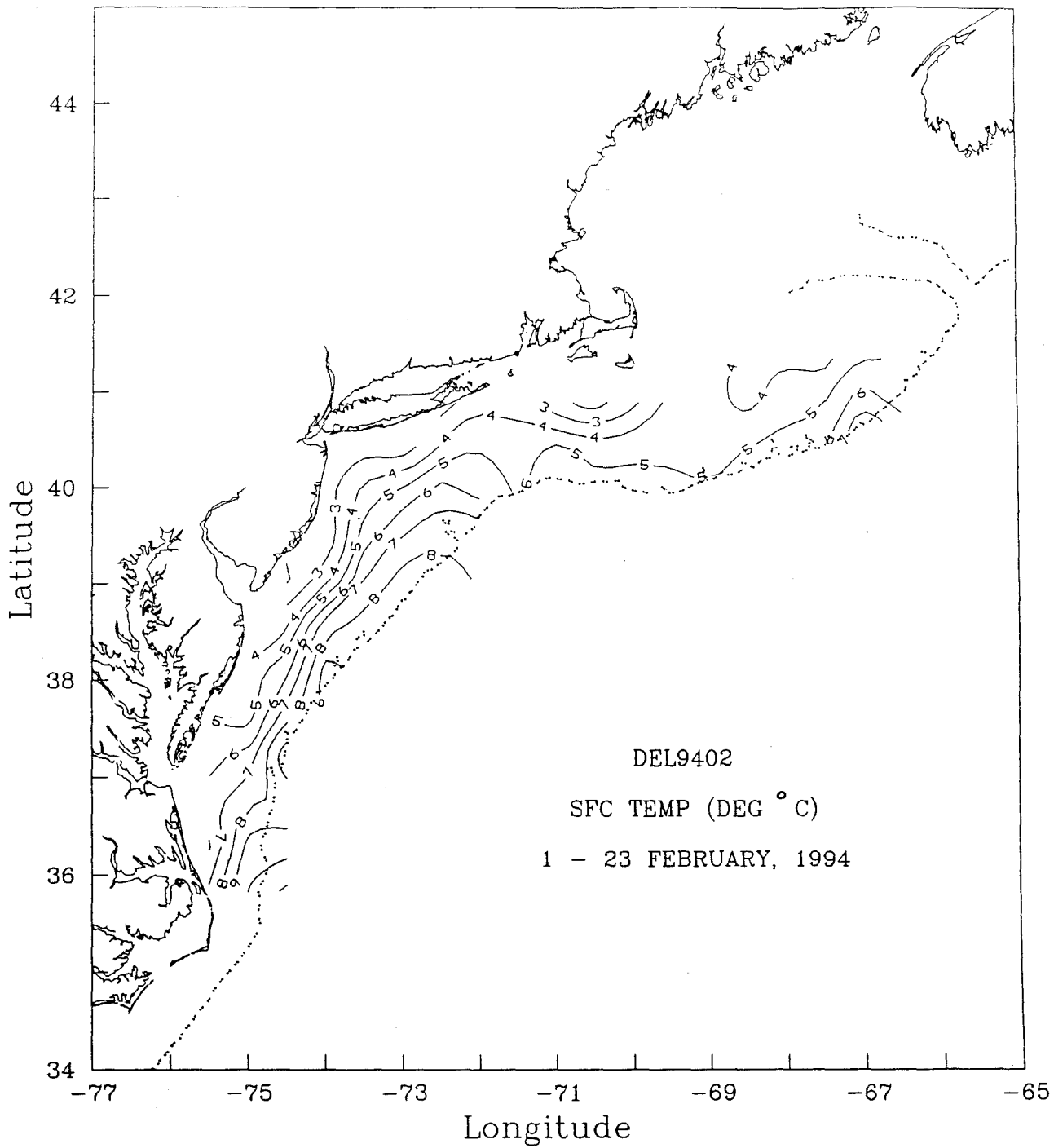


Figure 11. The surface temperature distribution for the winter bottom trawl survey DEL9402.

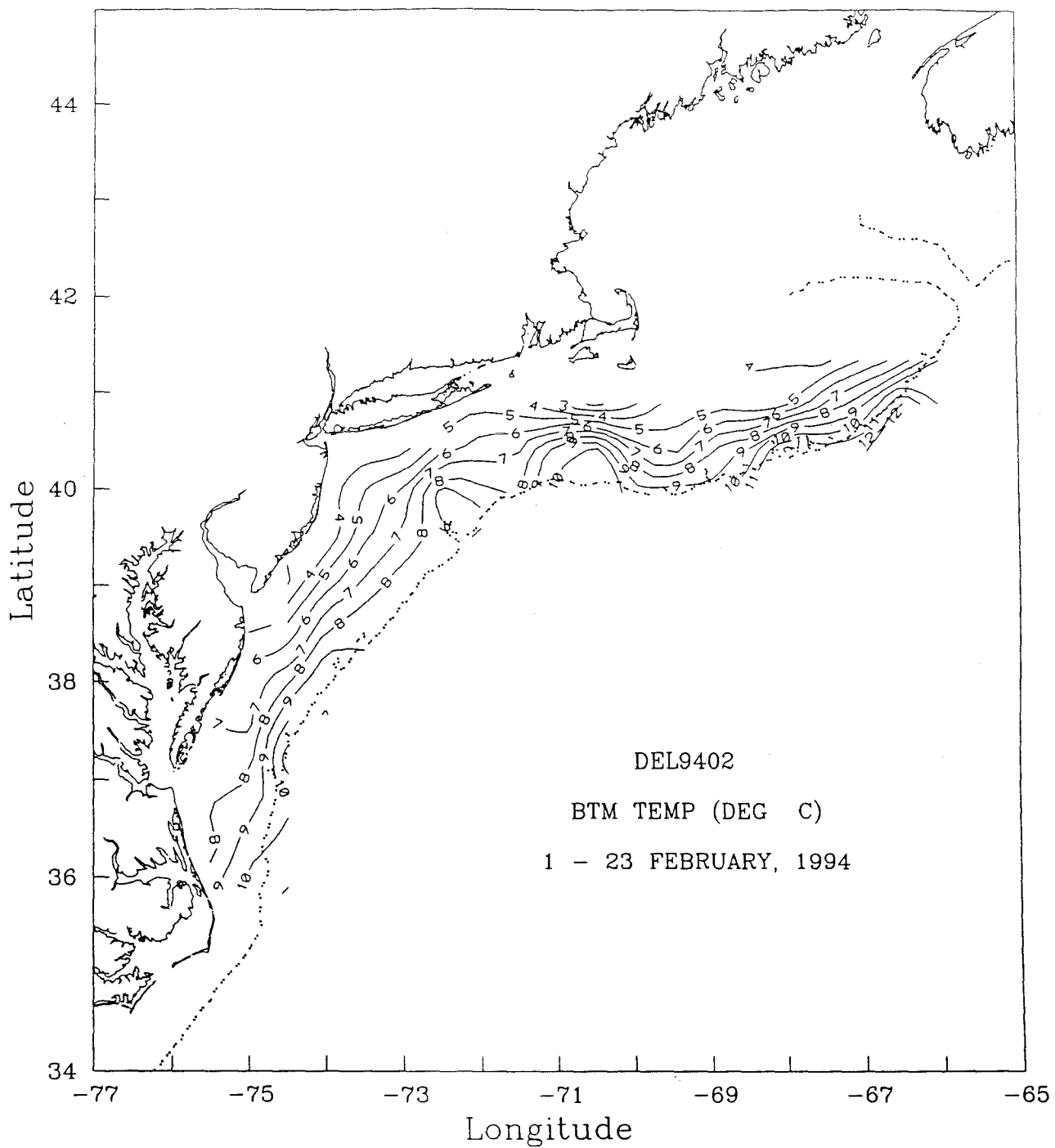


Figure 12. The bottom temperature distribution for the winter bottom trawl survey DEL9402.

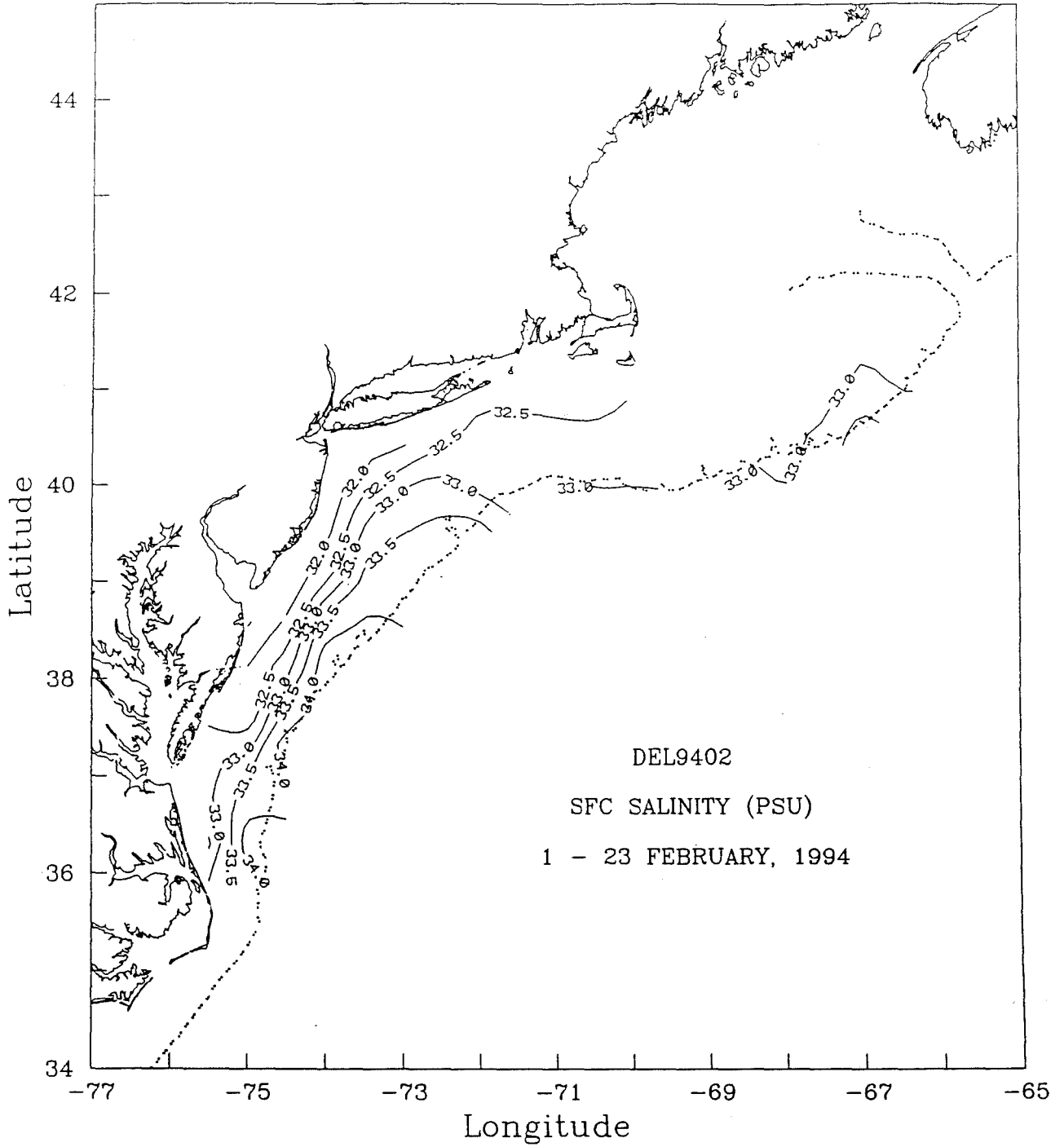


Figure 13. The surface salinity distribution for the winter bottom trawl survey DEL9402.

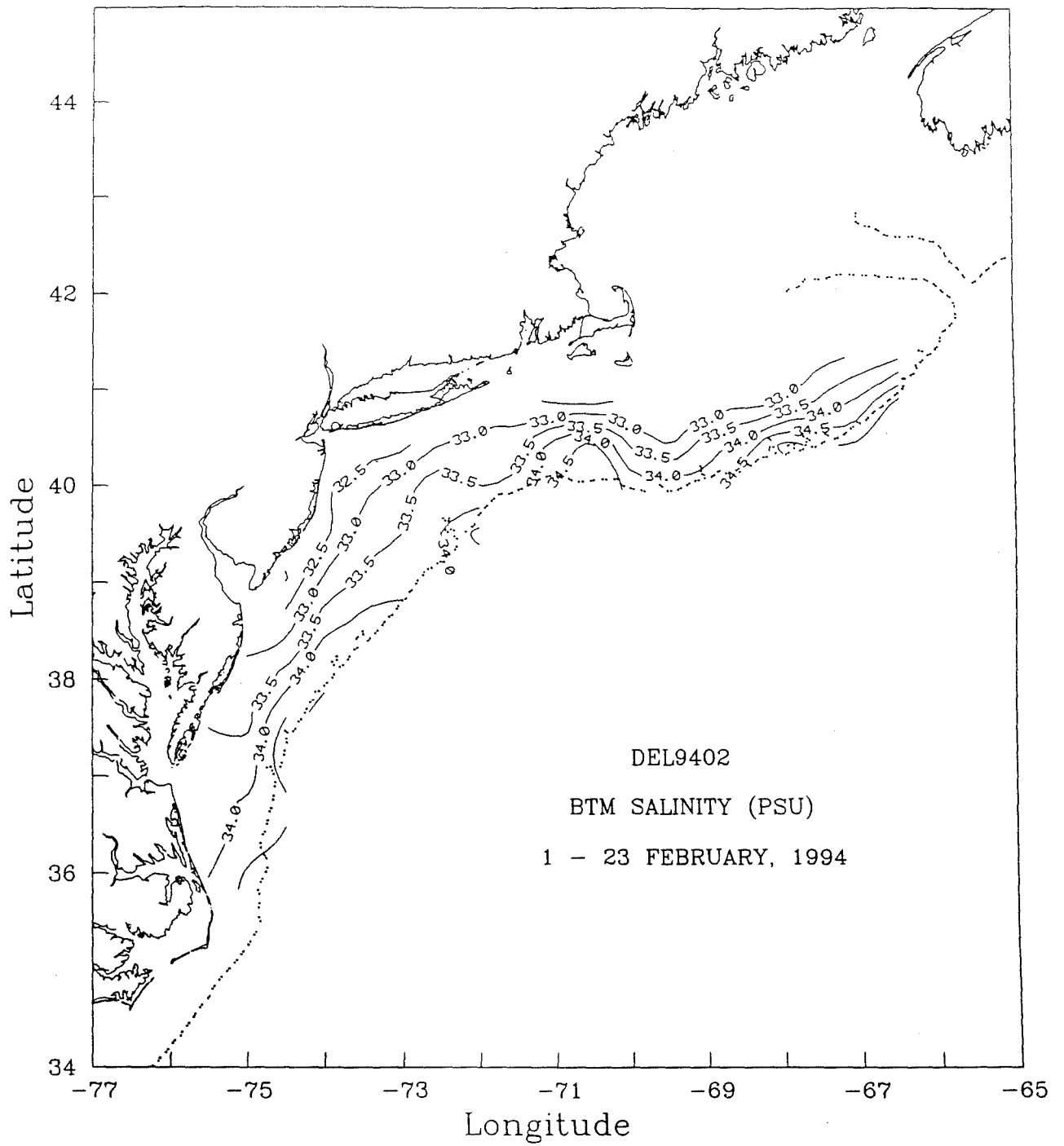


Figure 14. The bottom salinity distribution for the winter bottom trawl survey DEL9402.

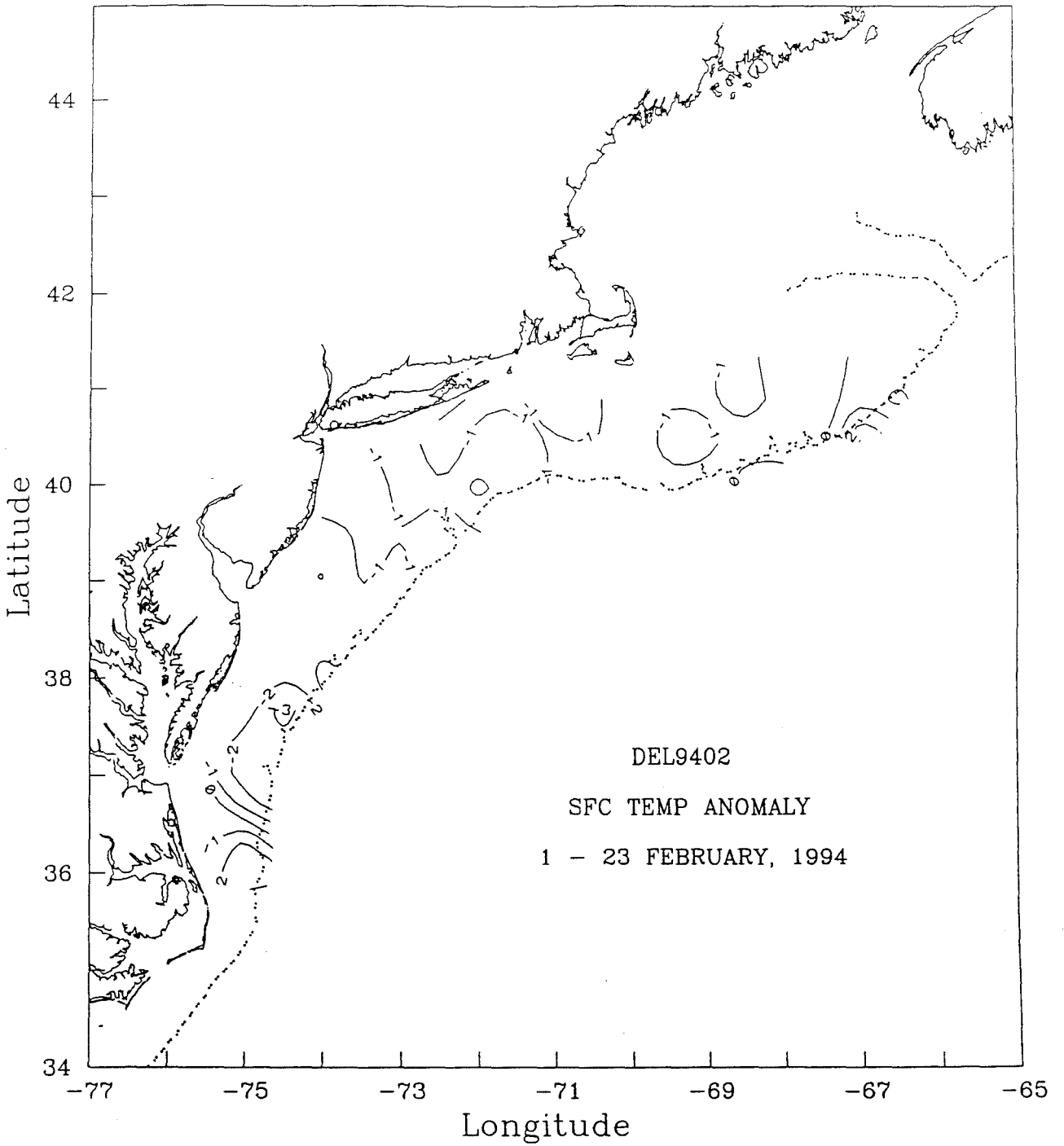


Figure 15. The surface temperature anomaly distribution for the winter bottom trawl survey DEL9402.

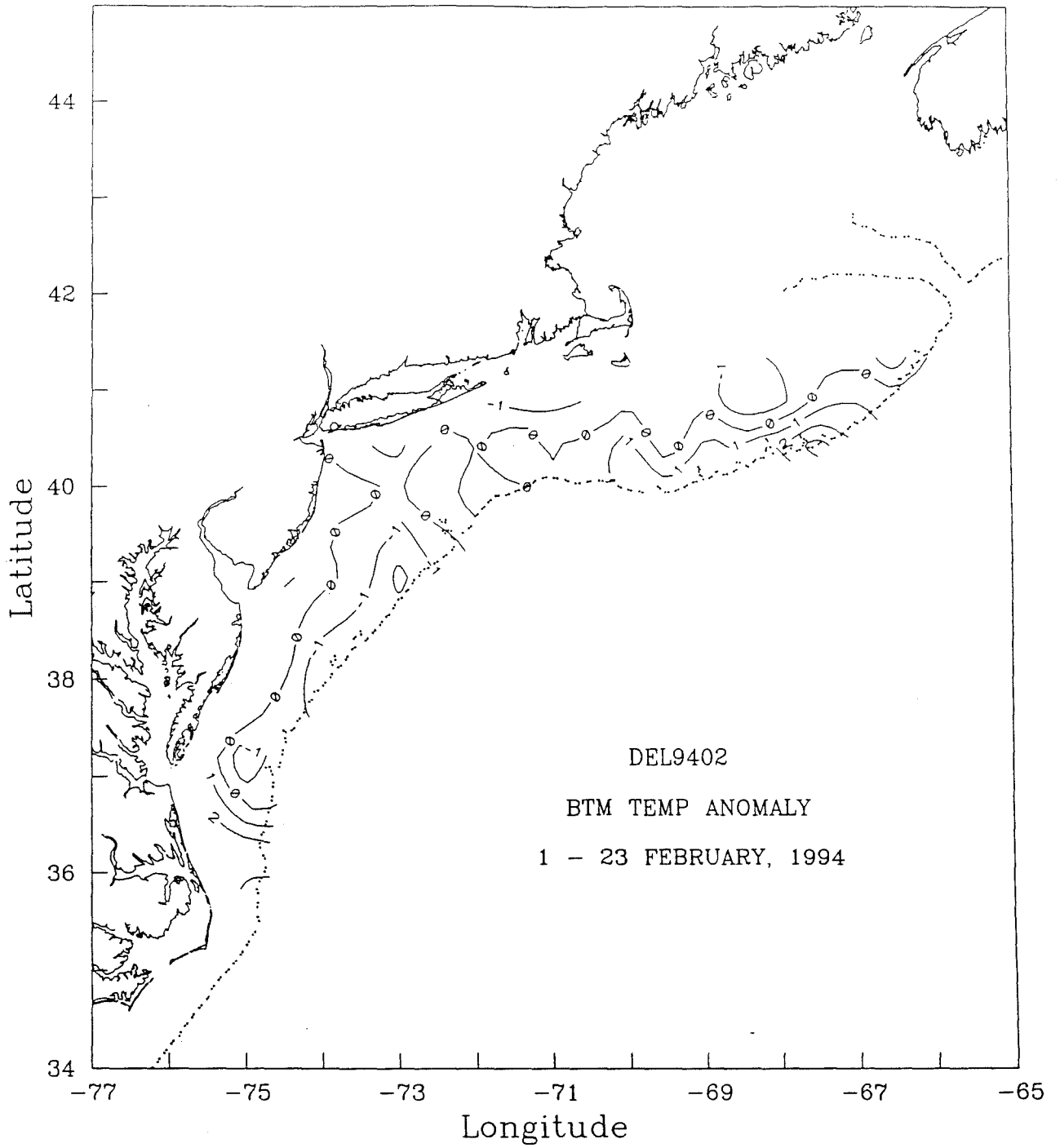


Figure 16. The bottom temperature anomaly distribution for the winter bottom trawl survey DEL9402.

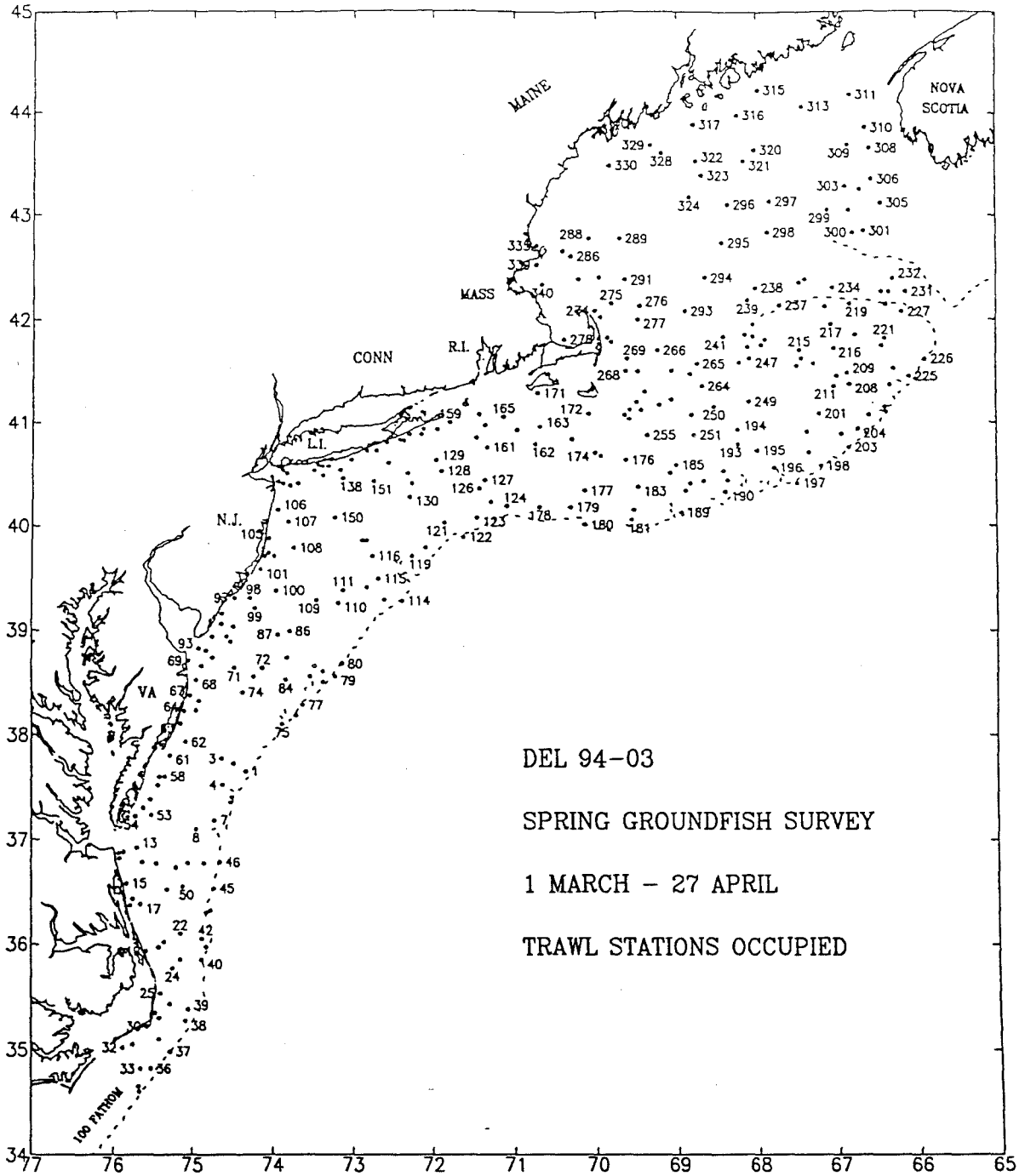


Figure 17. Hydrographic stations occupied during the spring bottom trawl survey DEL9403.

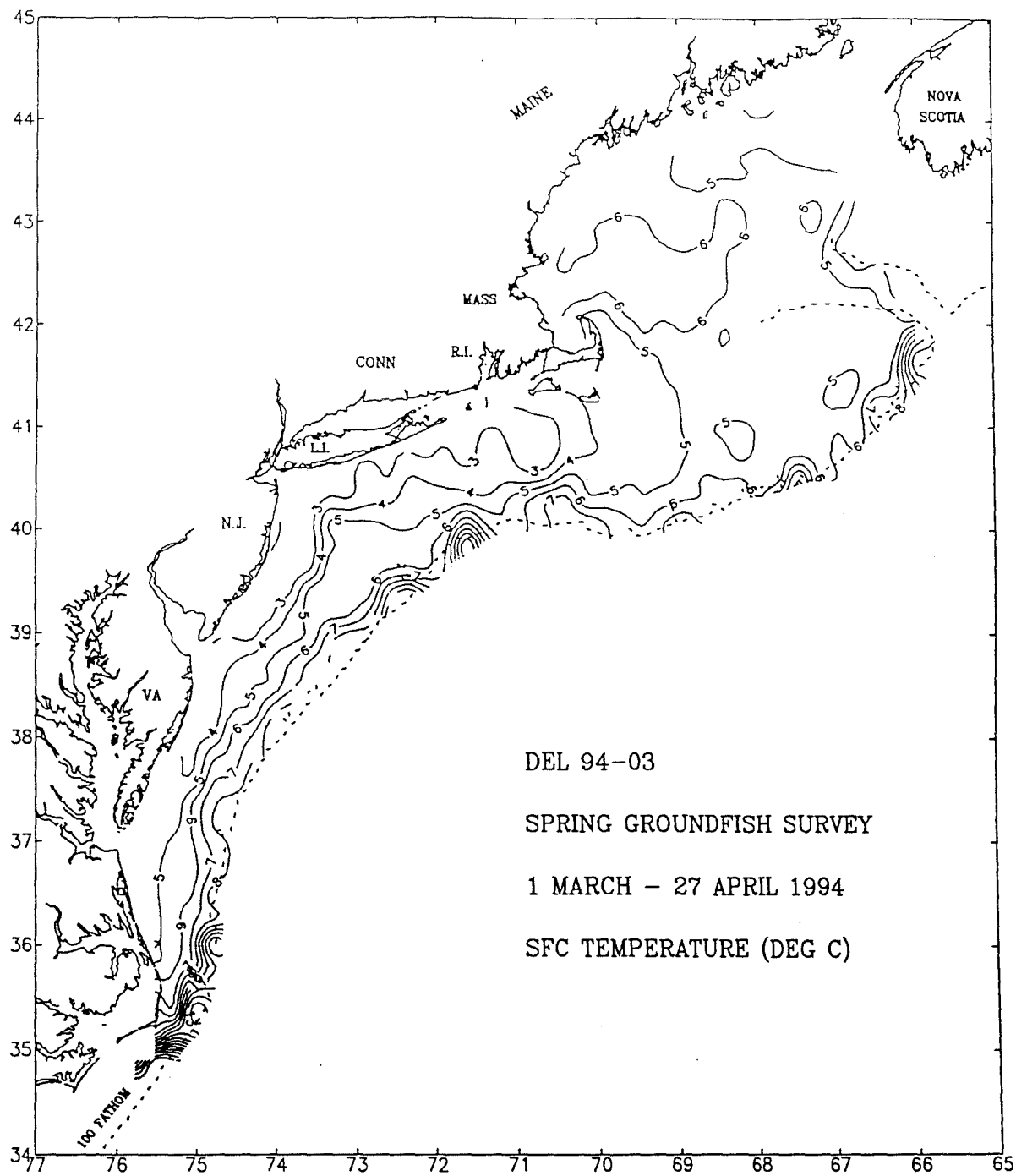


Figure 18. The surface temperature distribution for the spring bottom trawl survey DEL9403.

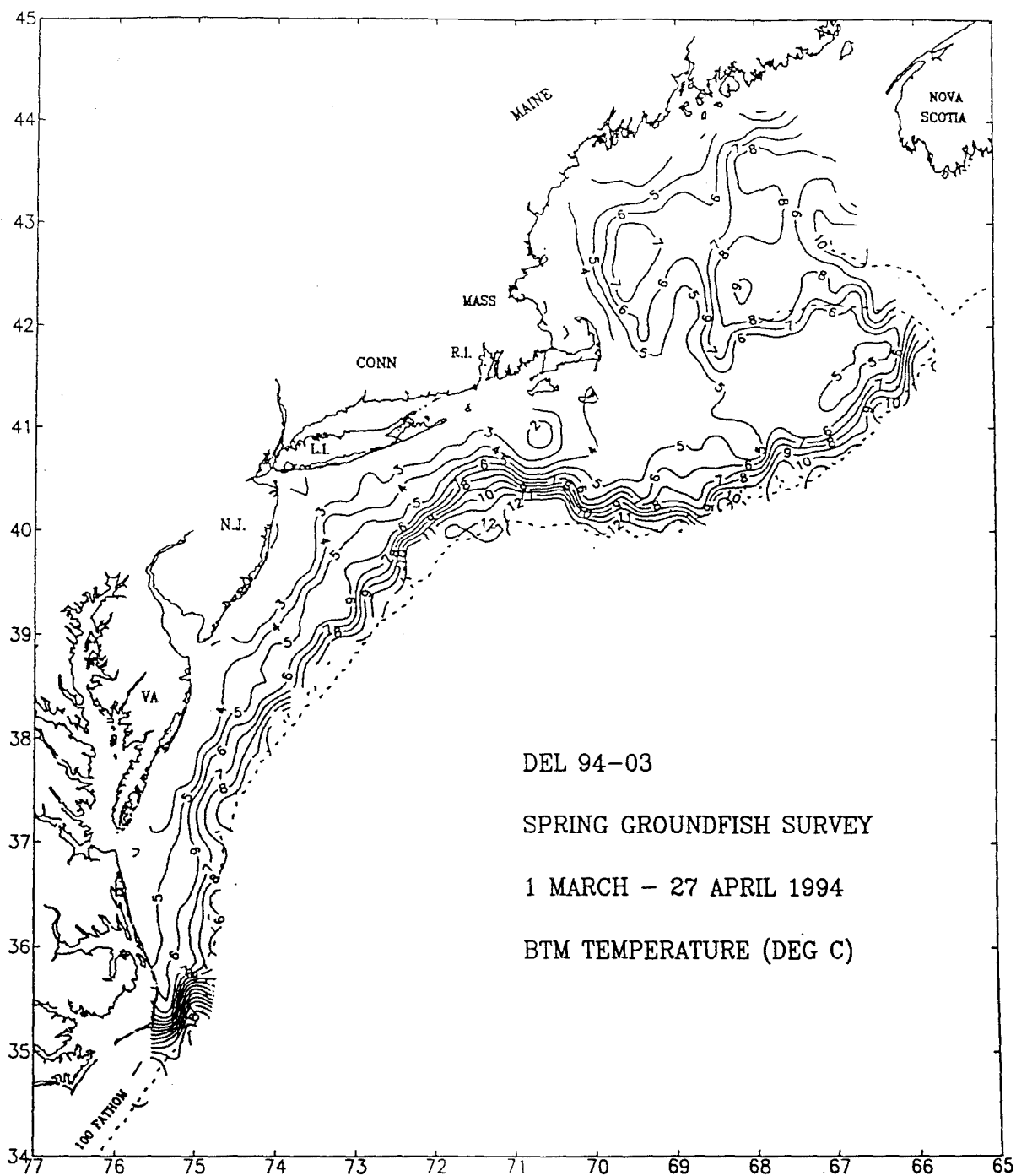


Figure 19. The bottom temperature distribution for the spring bottom trawl survey DEL9403.

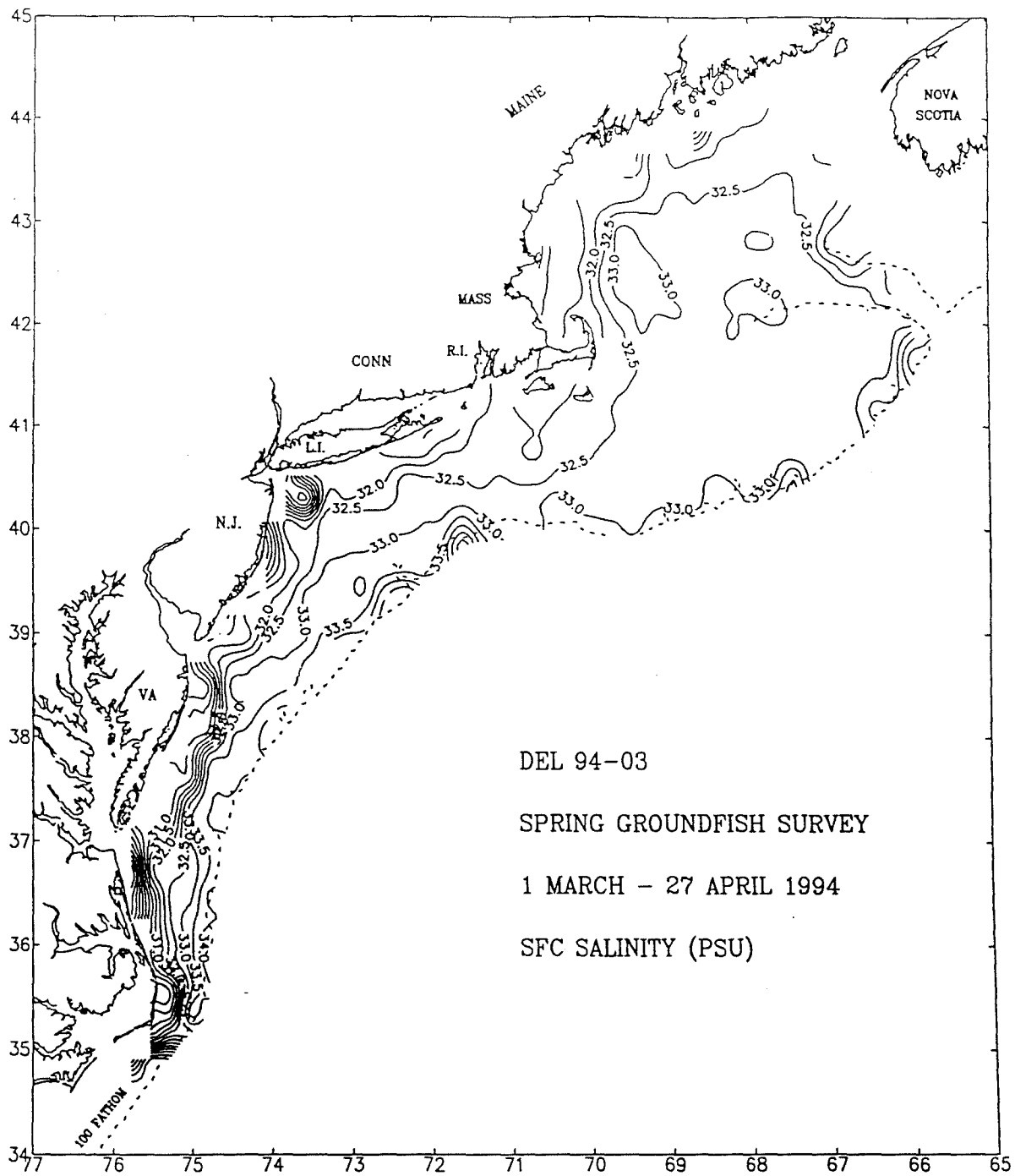


Figure 20. The surface salinity distribution for the spring bottom trawl survey DEL9403.

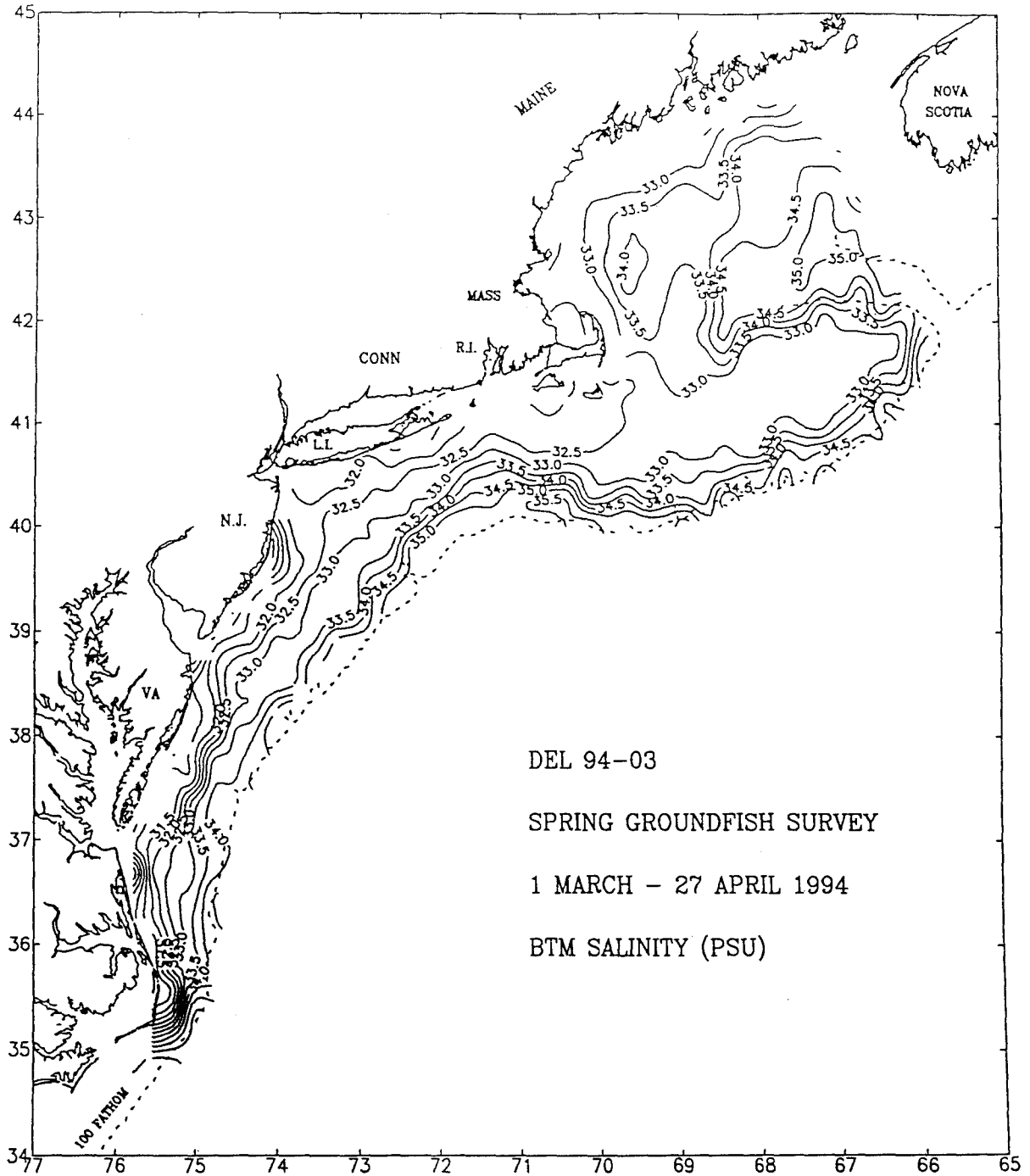


Figure 21. The bottom salinity distribution for the spring bottom trawl survey DEL9403.

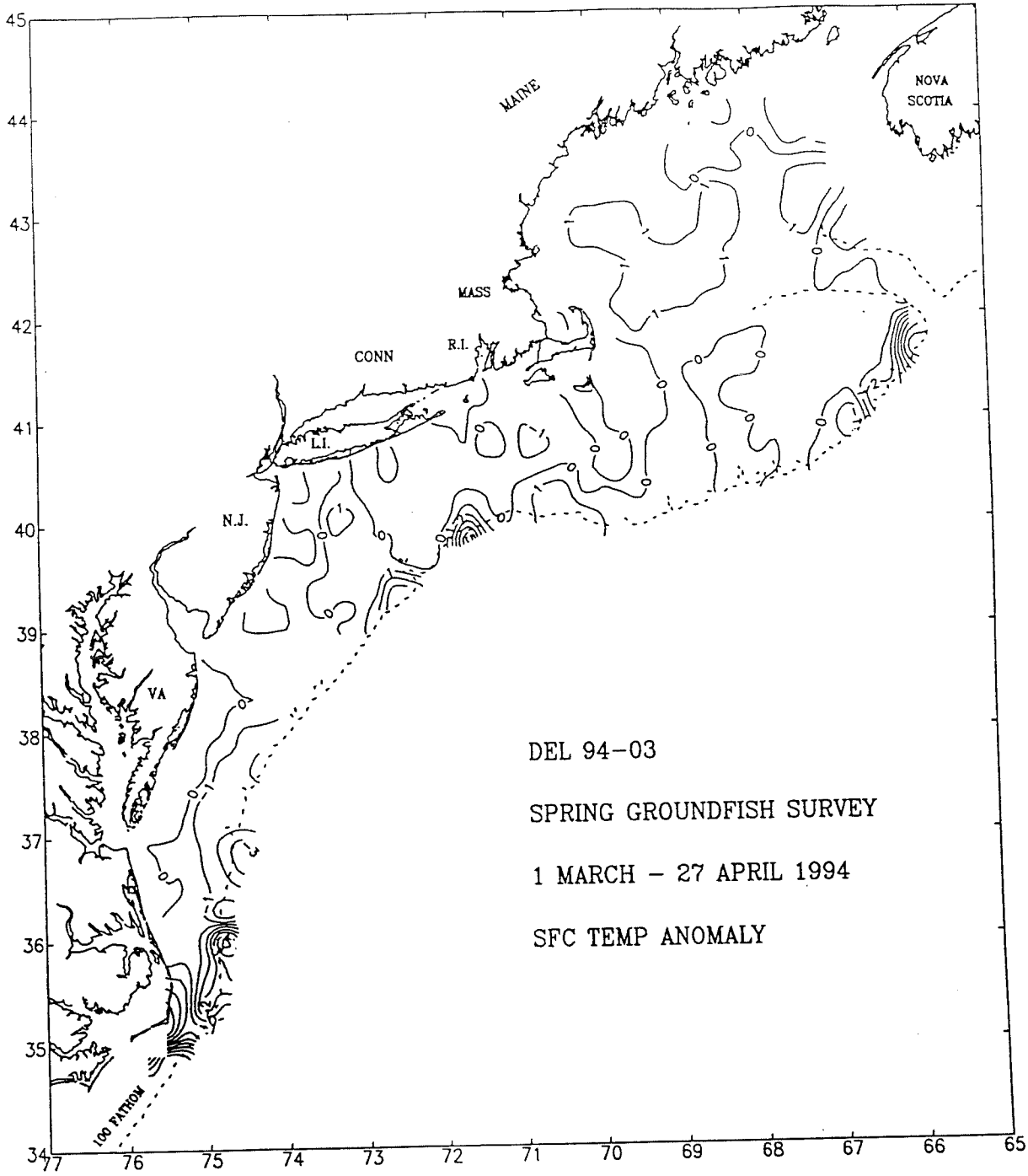


Figure 22. The surface temperature anomaly distribution for the spring bottom trawl survey DEL9403.

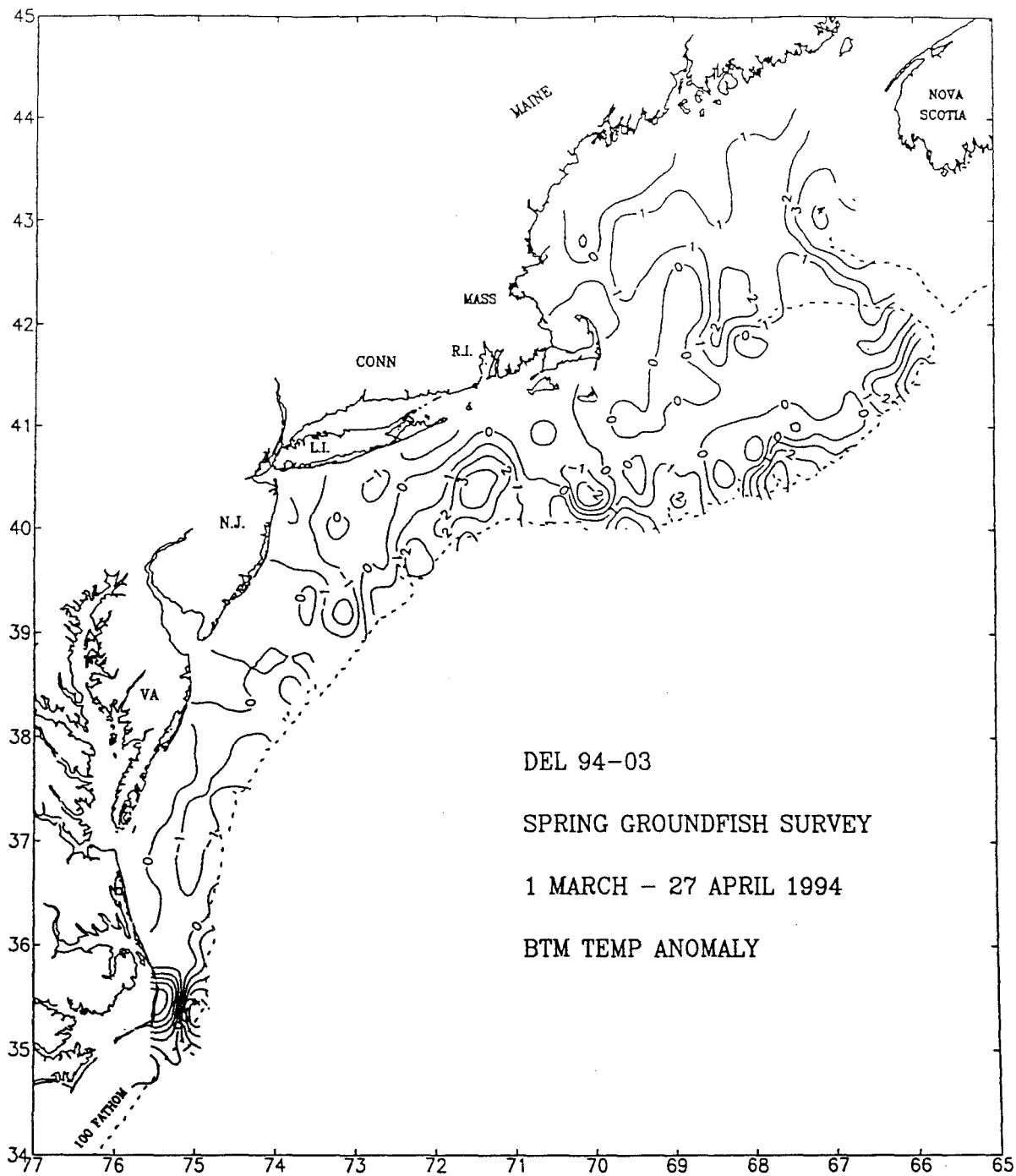


Figure 23. The bottom temperature anomaly distribution for the spring bottom trawl survey DEL9403.

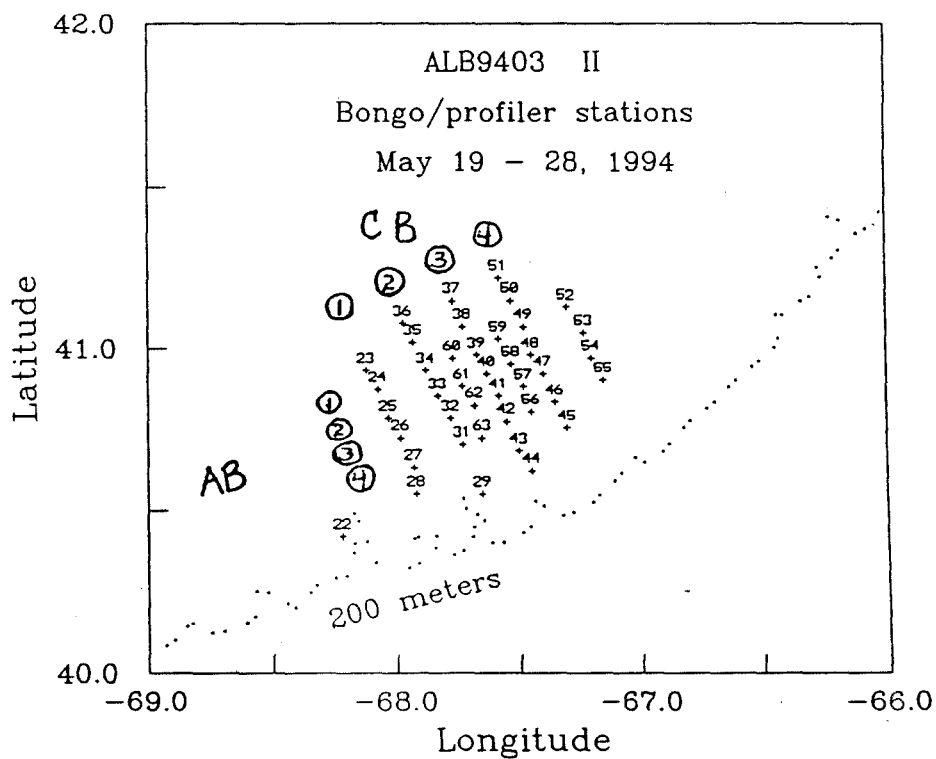
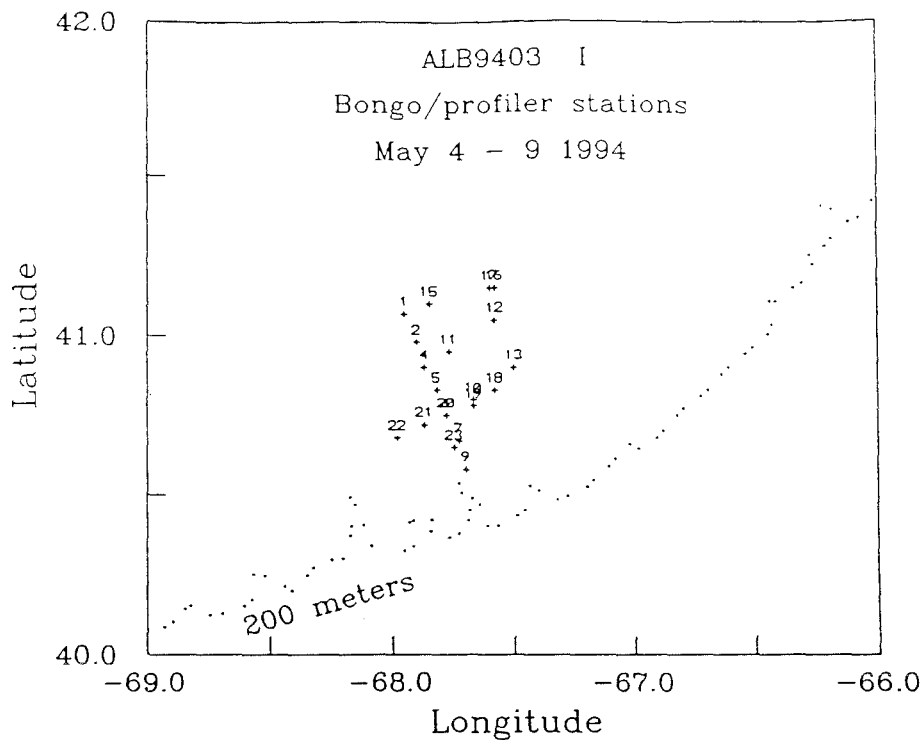


Figure 24. Hydrographic stations occupied during the GLOBEC cruise ALB9403 (legs I & II).

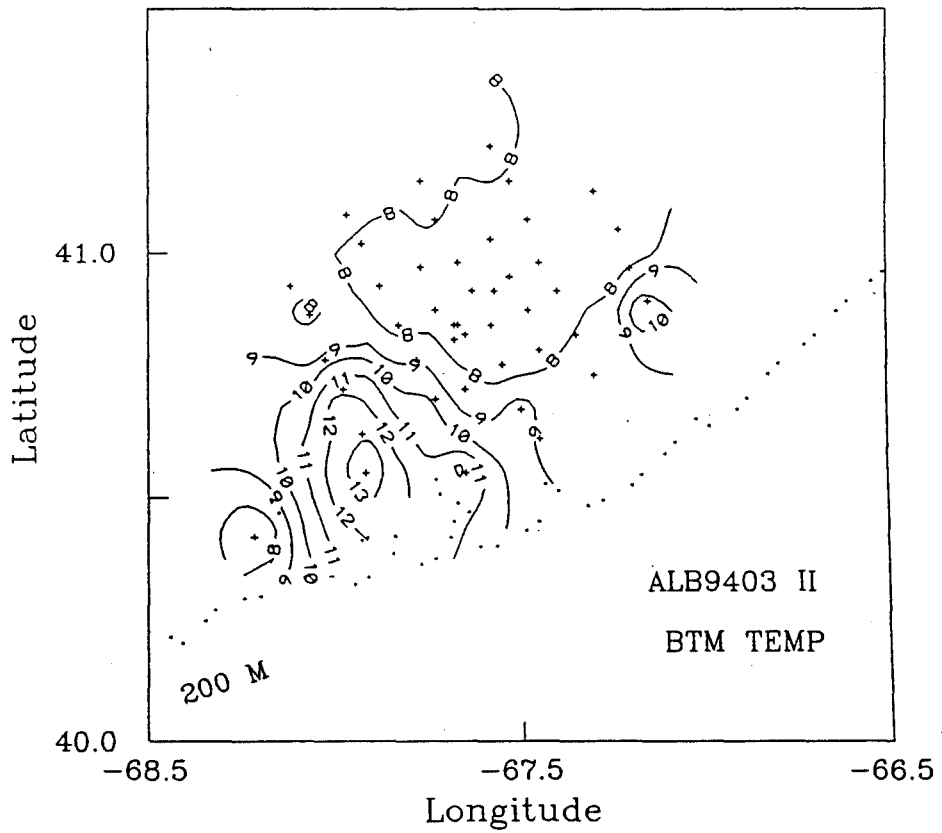
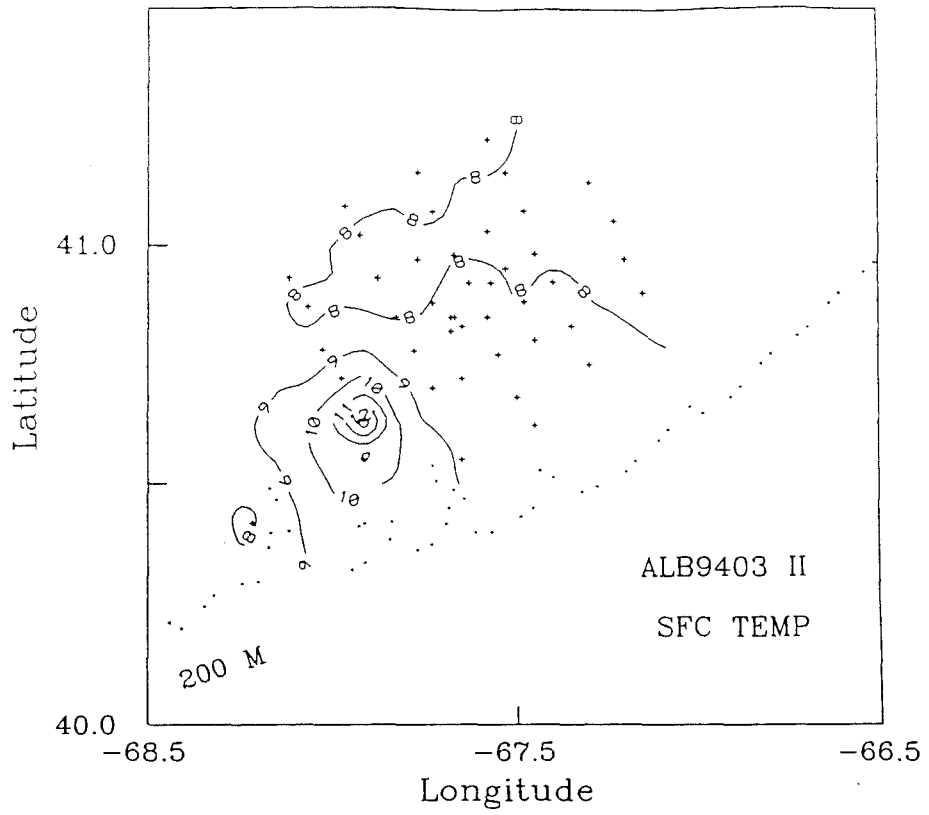


Figure 25. The surface and bottom temperature distributions during the GLOBEC cruise ALB9403 (II).

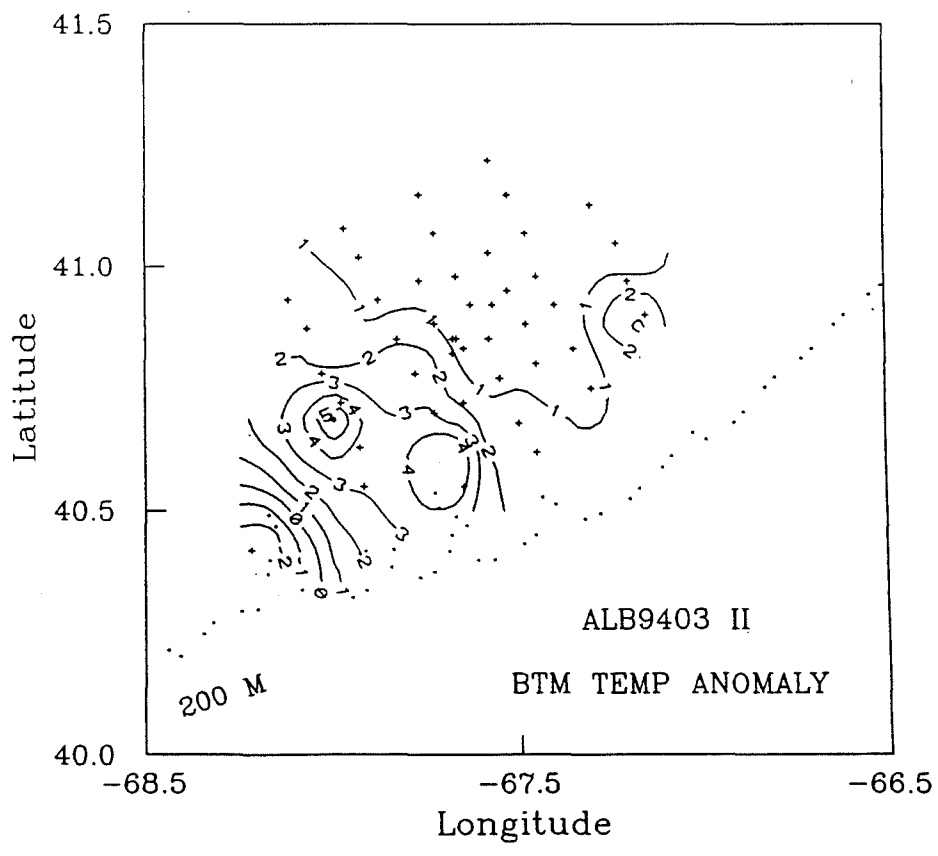
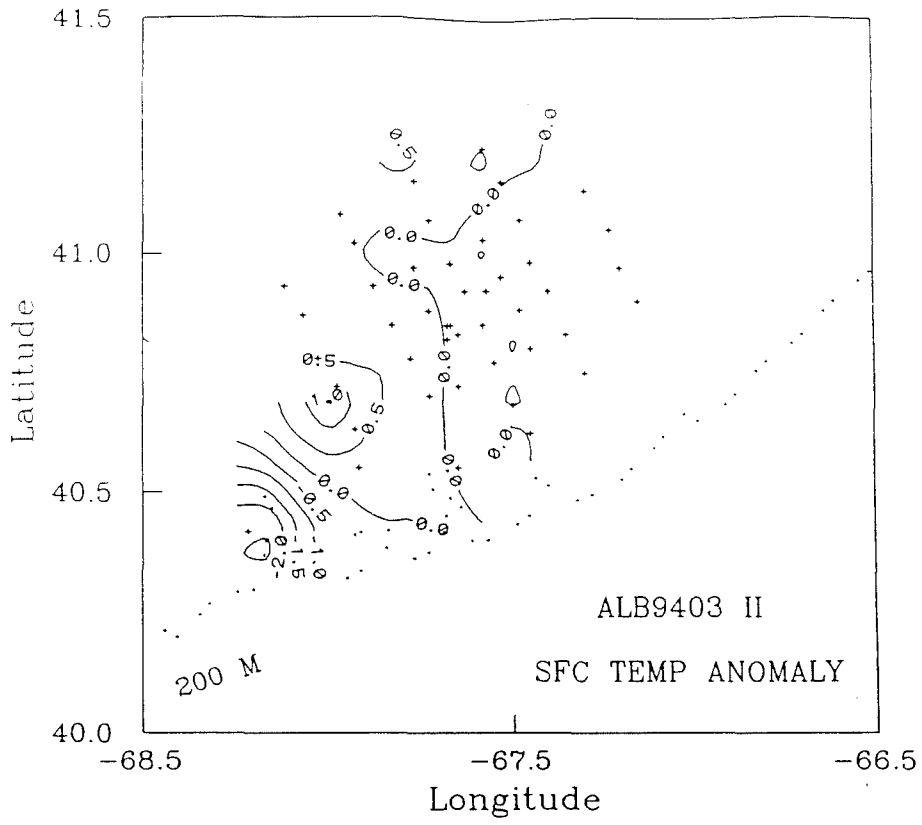


Figure 26. The surface and bottom temperature anomaly distributions during the GLOBEC cruise ALB9403 (II).

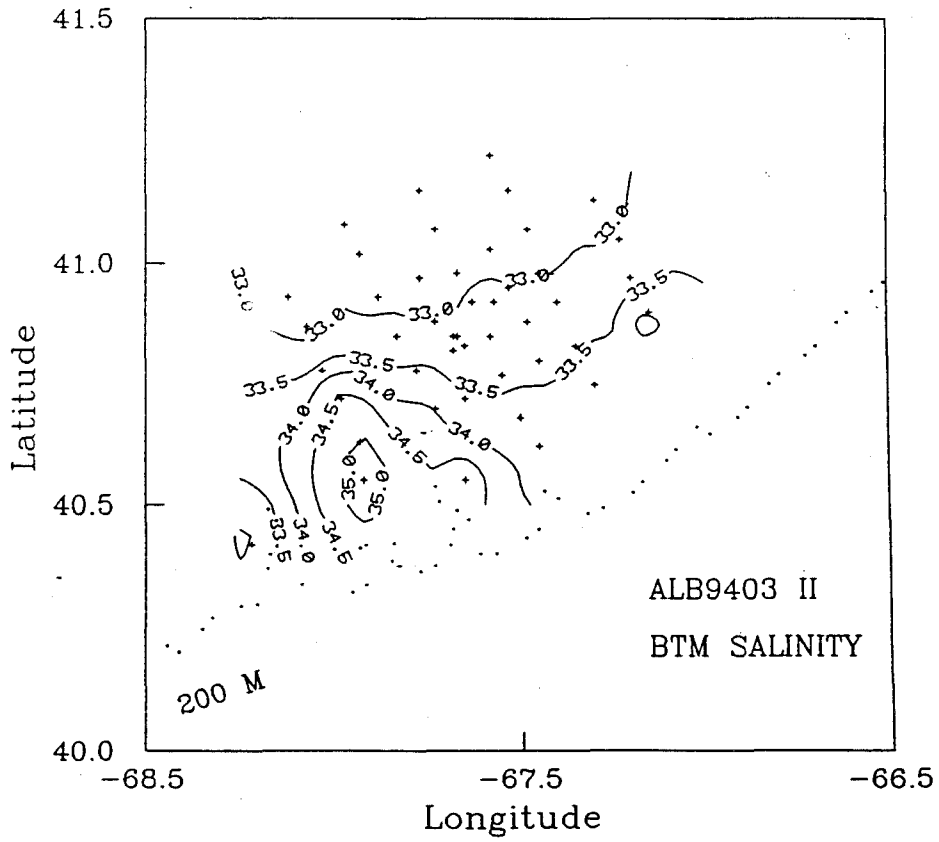
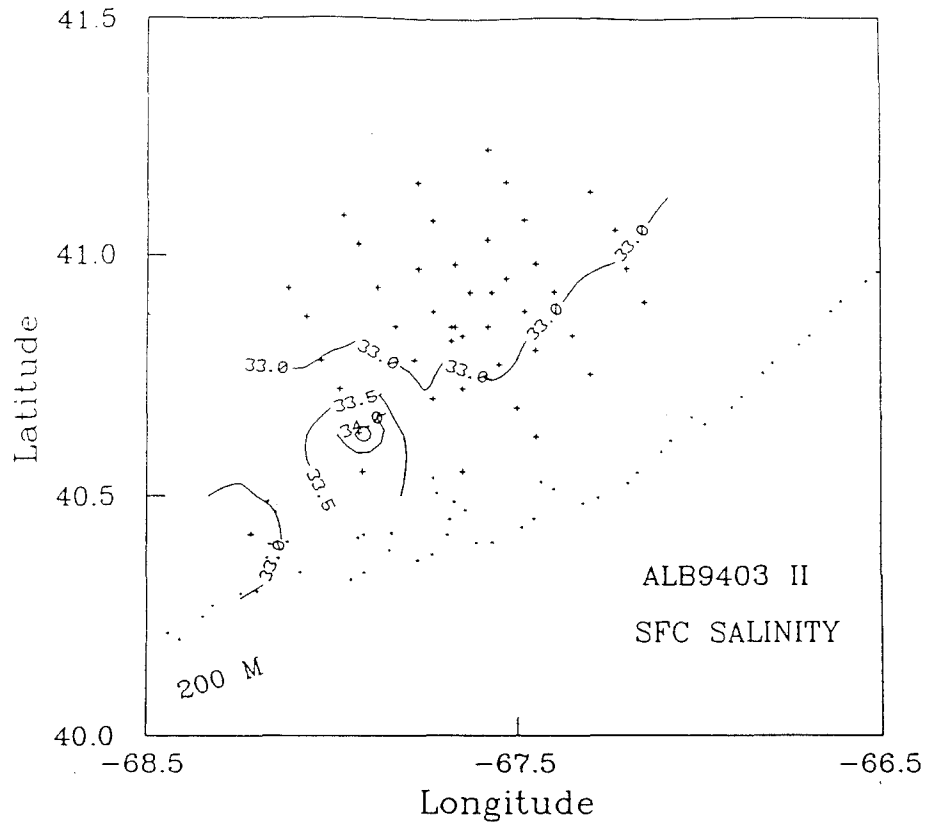


Figure 27. The surface and bottom salinity distributions during the GLOBEC cruise ALB9403 (II).

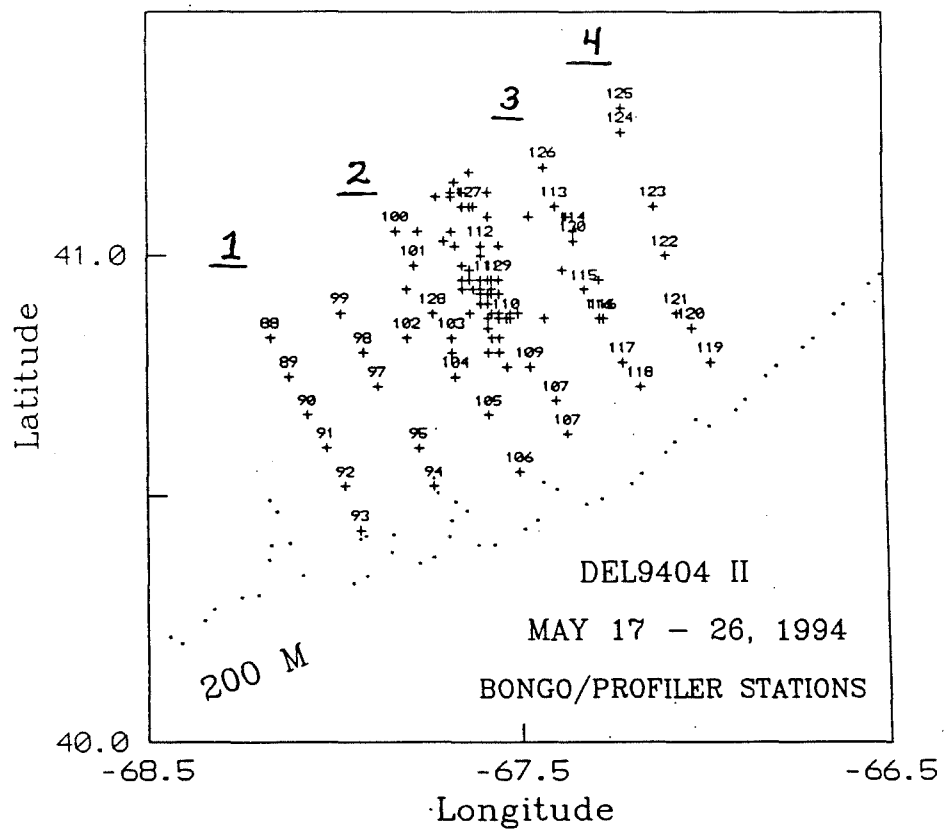
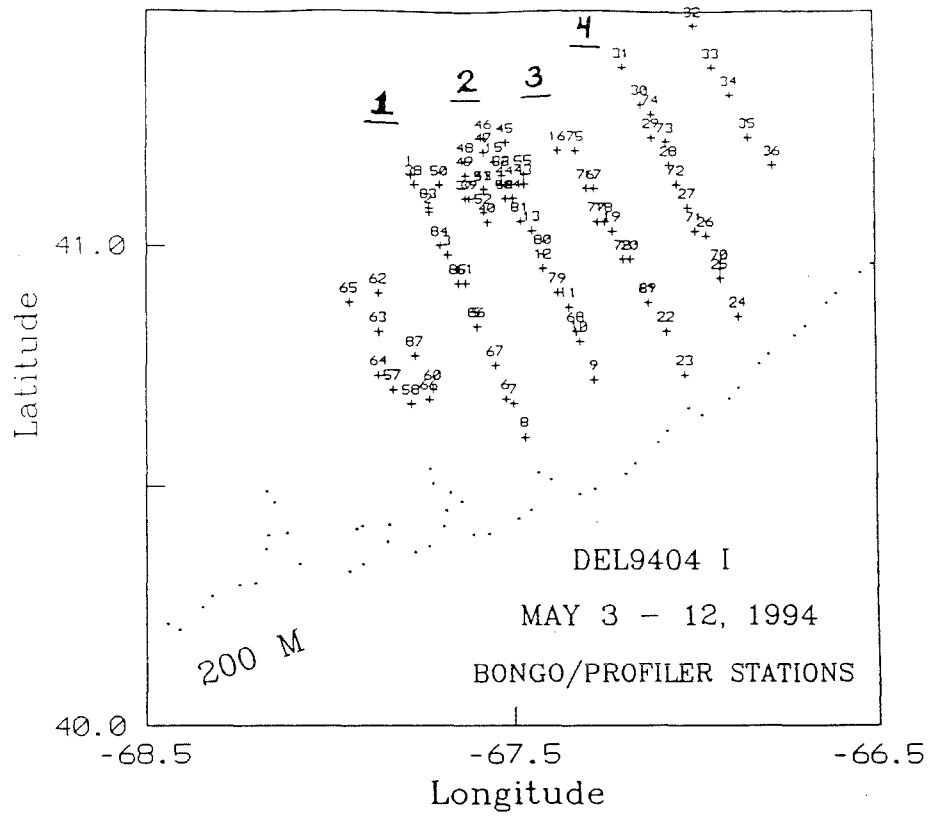


Figure 28. Hydrographic stations occupied during the predator/prey cruise DEL9404 (I & II).

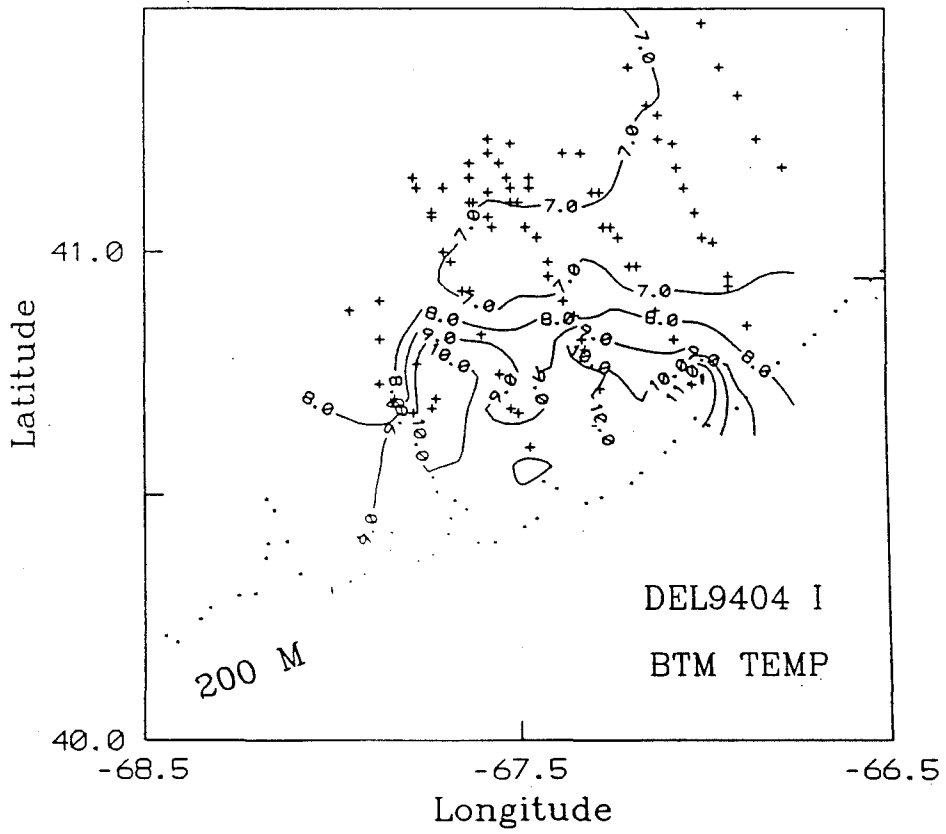
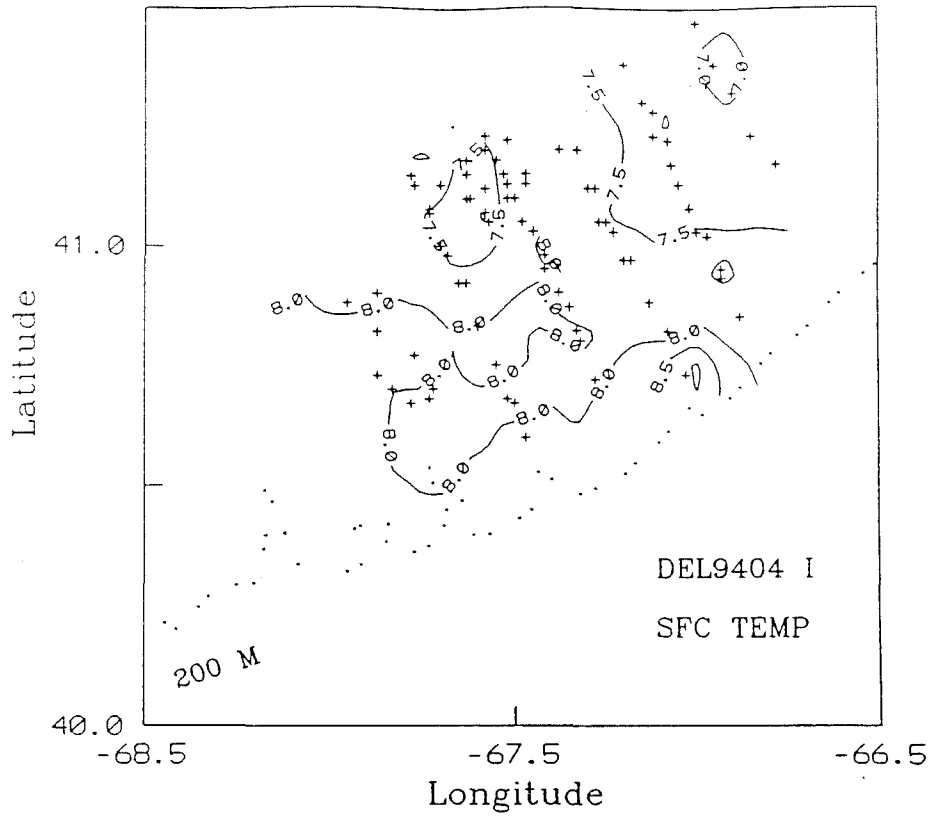


Figure 29. The surface and bottom temperature distributions during the predator/prey cruise DEL9404 (I).

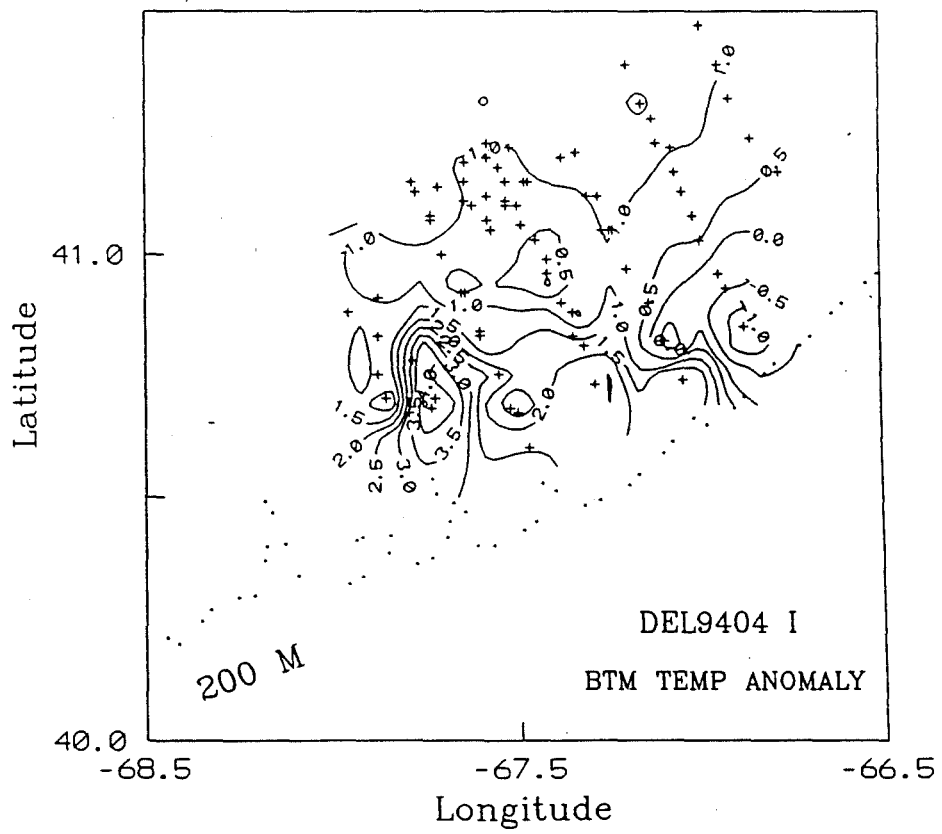
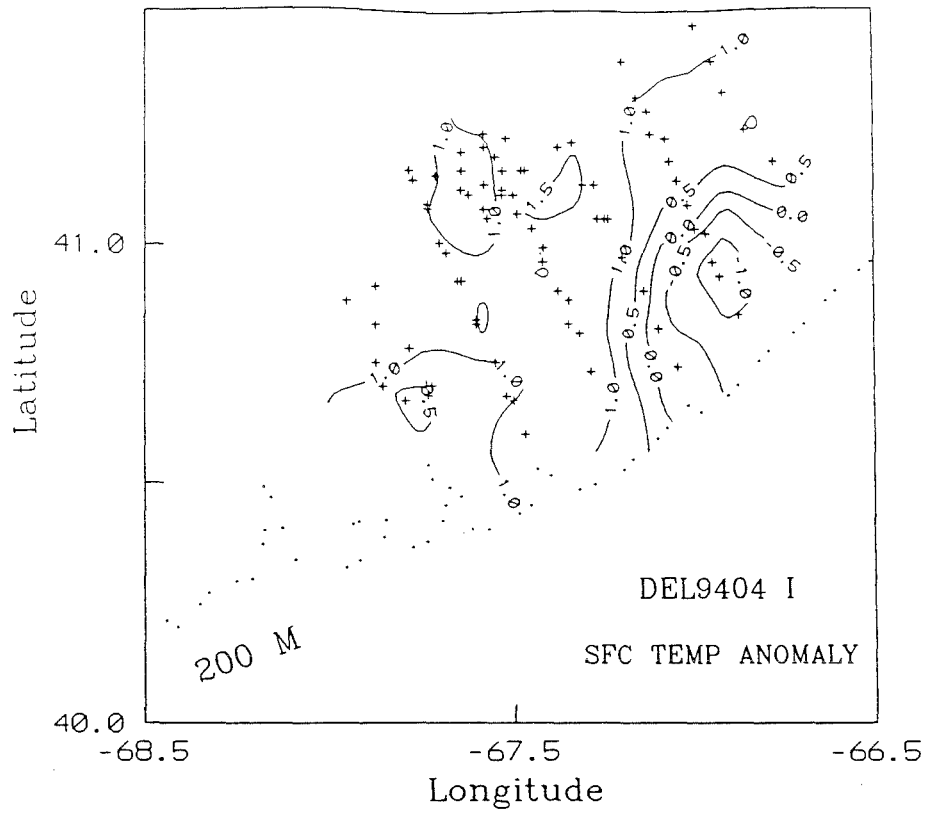


Figure 30. The surface and bottom temperature anomaly distribution for the predator/prey cruise DEL9404 (I).

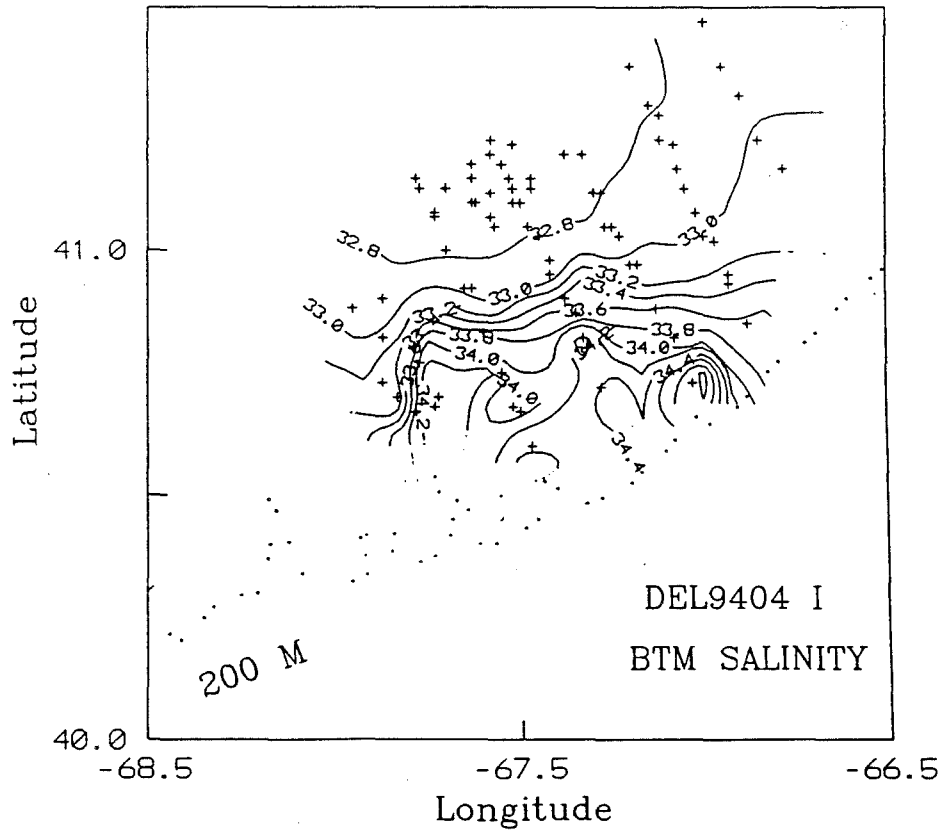
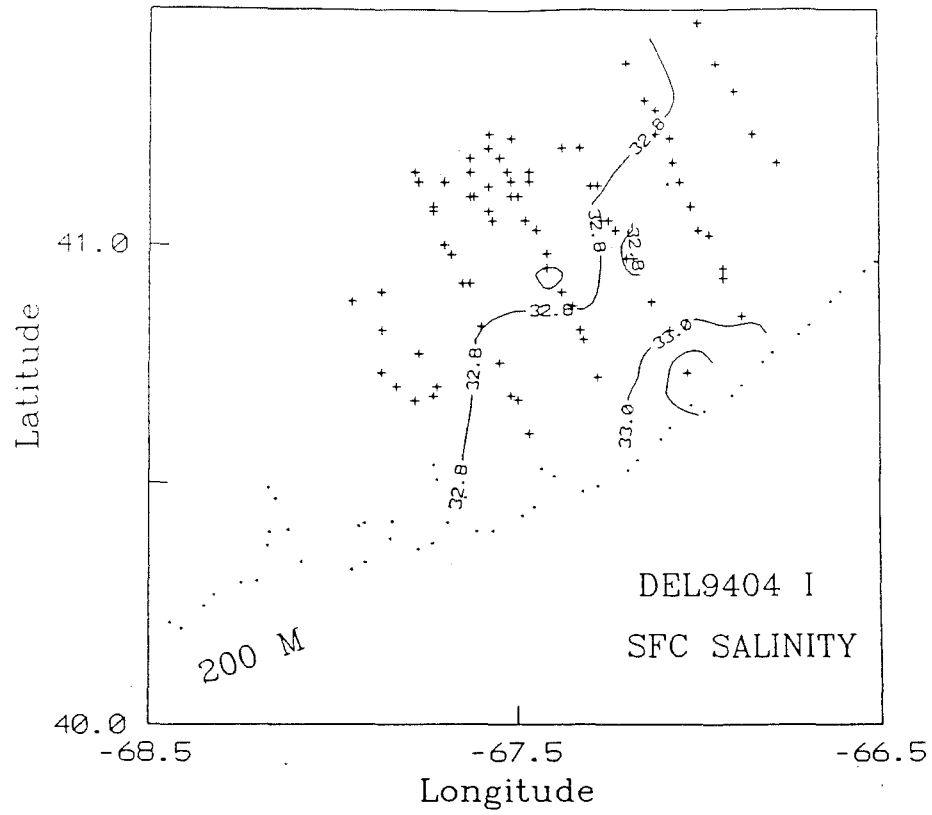


Figure 31. The surface and bottom salinity distribution for the predator/prey cruise DEL9404 (I).

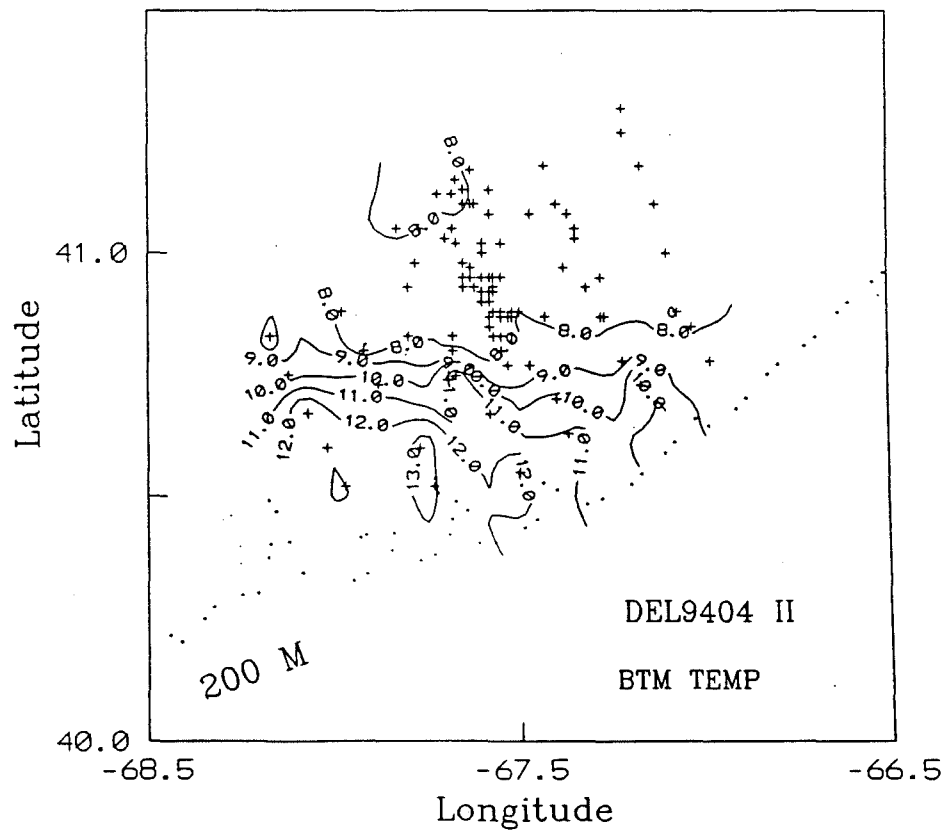
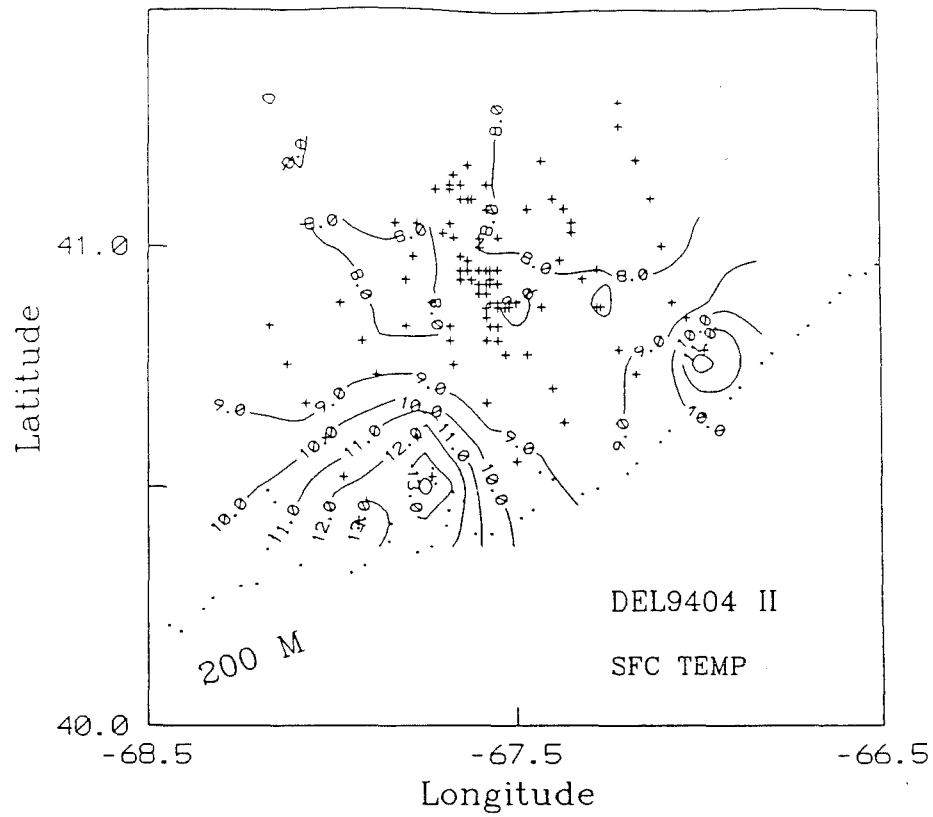


Figure 32. The surface and bottom temperature distribution during the predator/prey cruise DEL9404 (II).

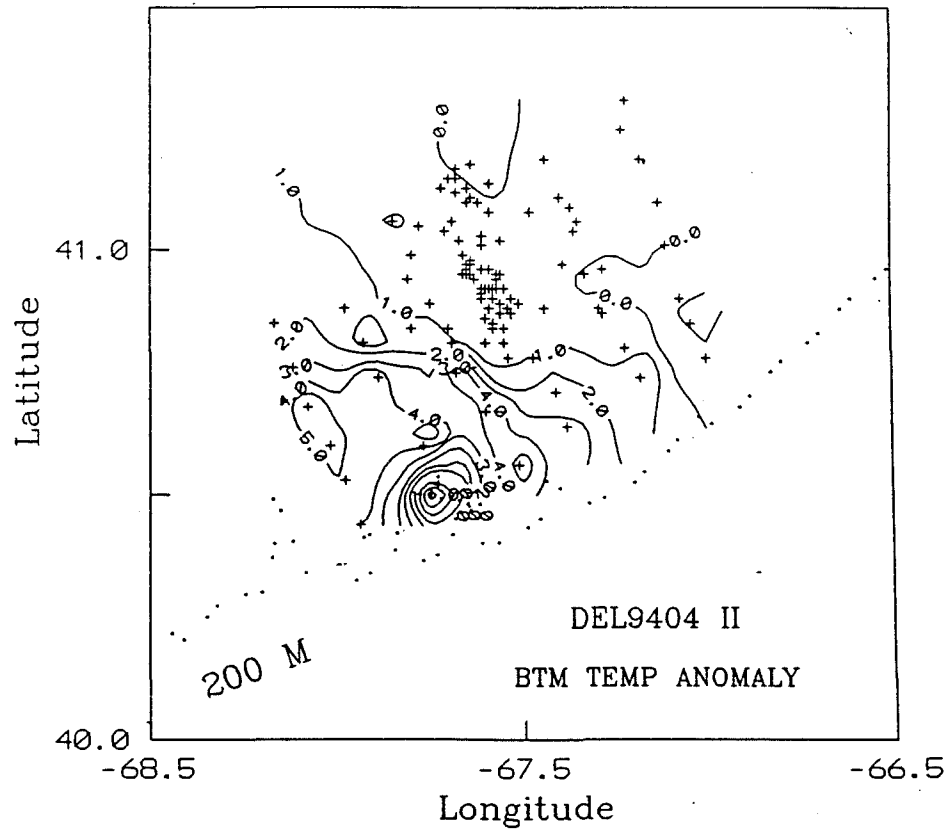
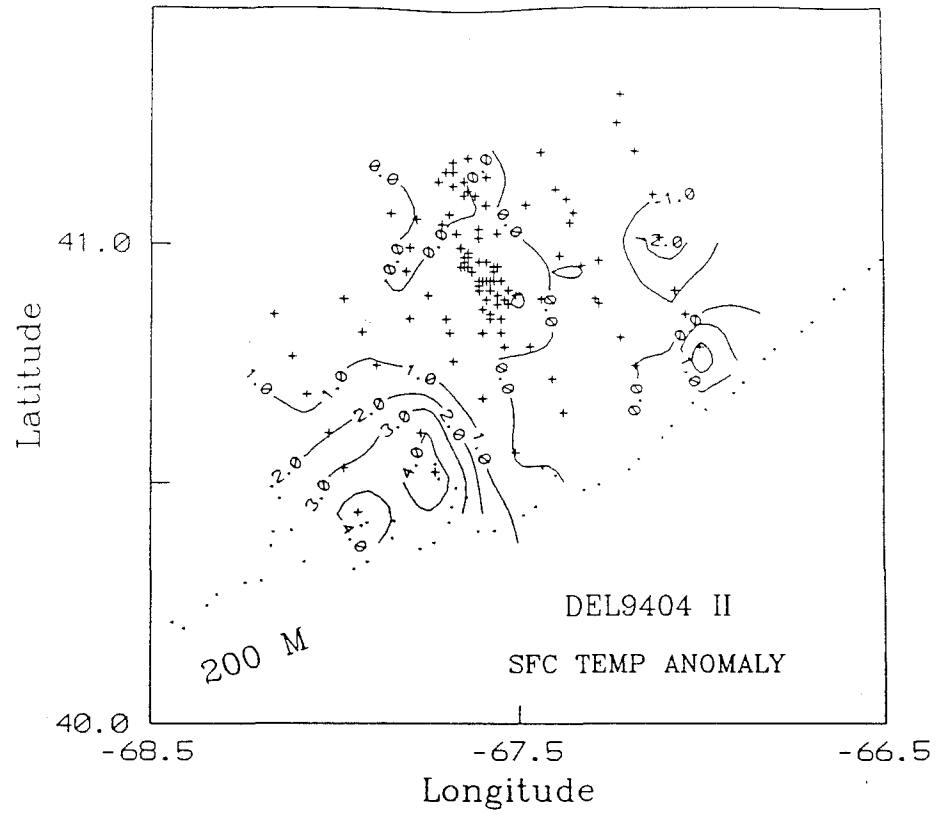


Figure 33. The surface and bottom temperature anomaly distributions during the predator/prey cruise DEL9404 (II).

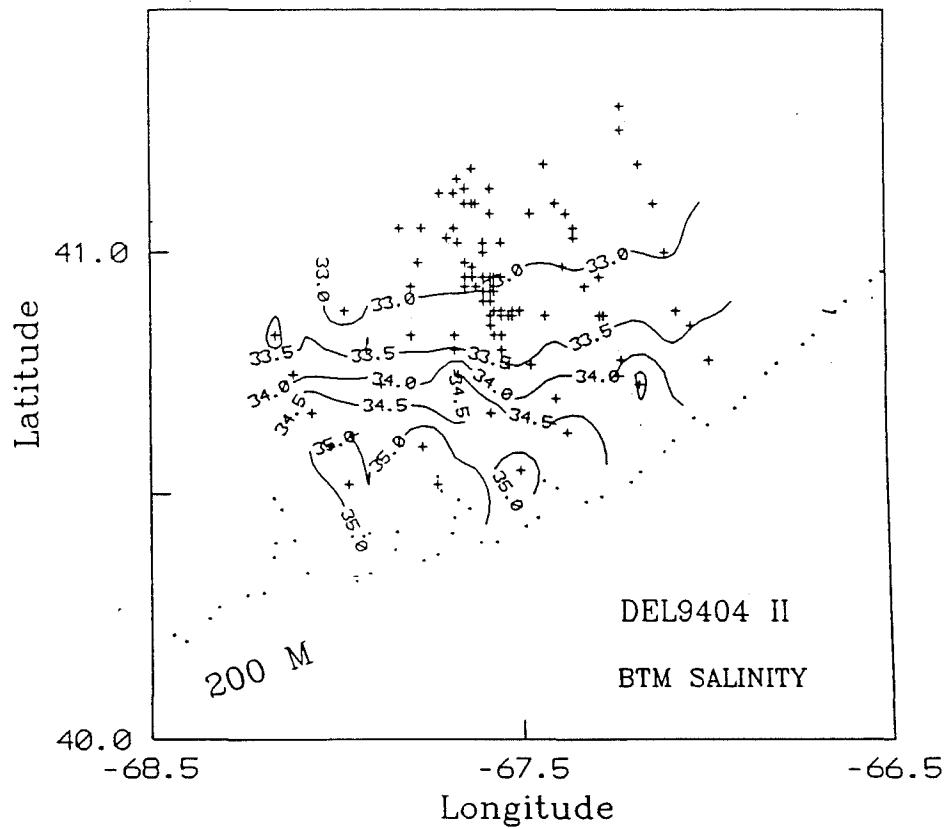
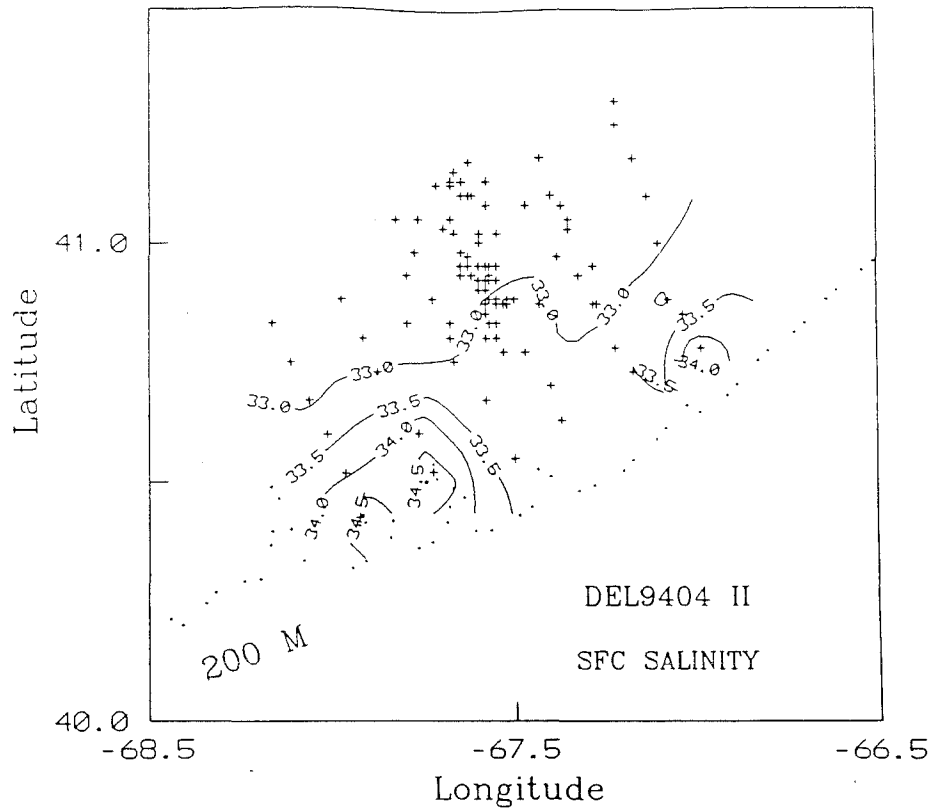


Figure 34. The surface and bottom salinity distributions during the predator/prey cruise DEL9404 (II).

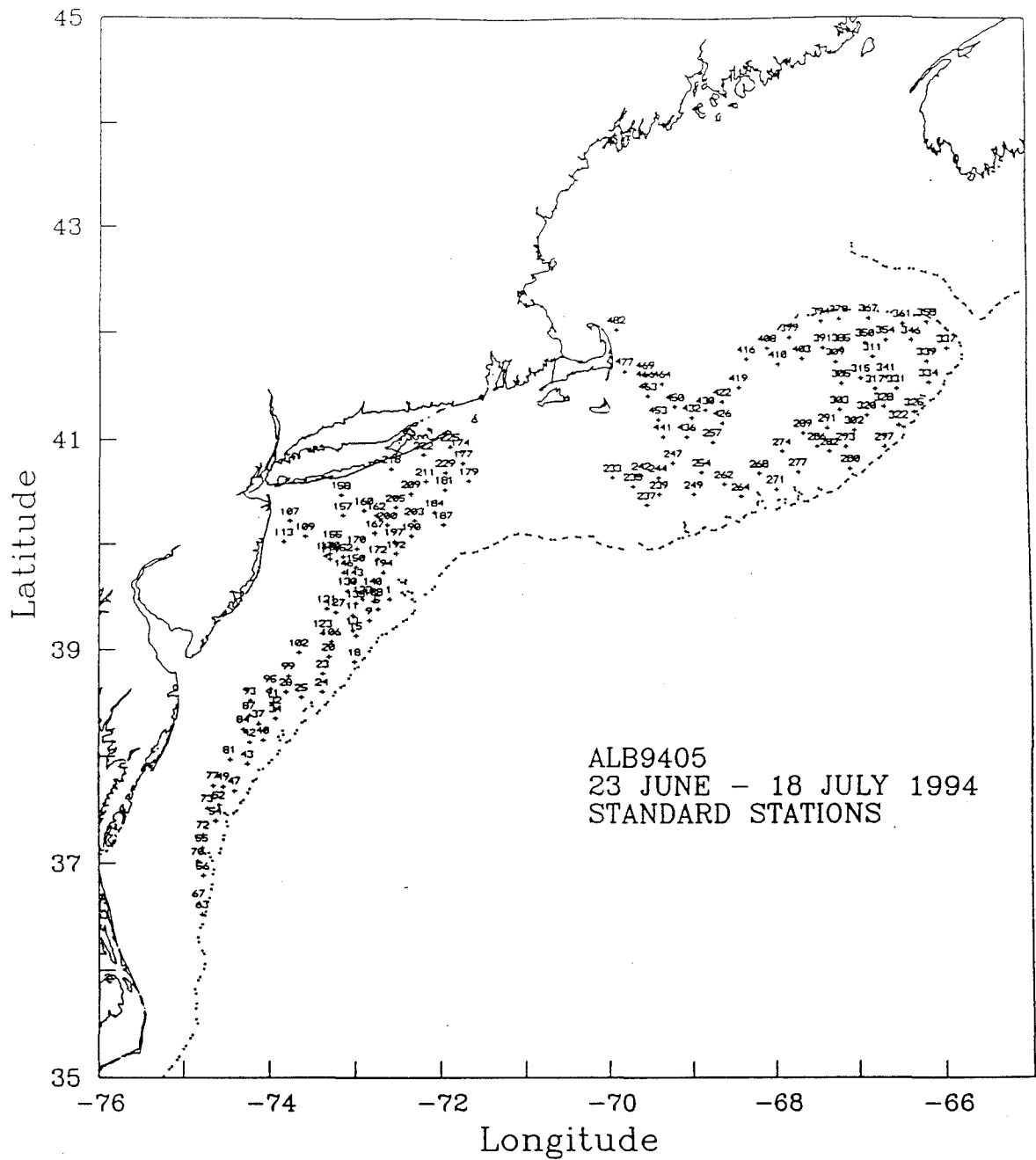


Figure 35. Hydrographic stations occupied during the sea scallop survey ALB9504.

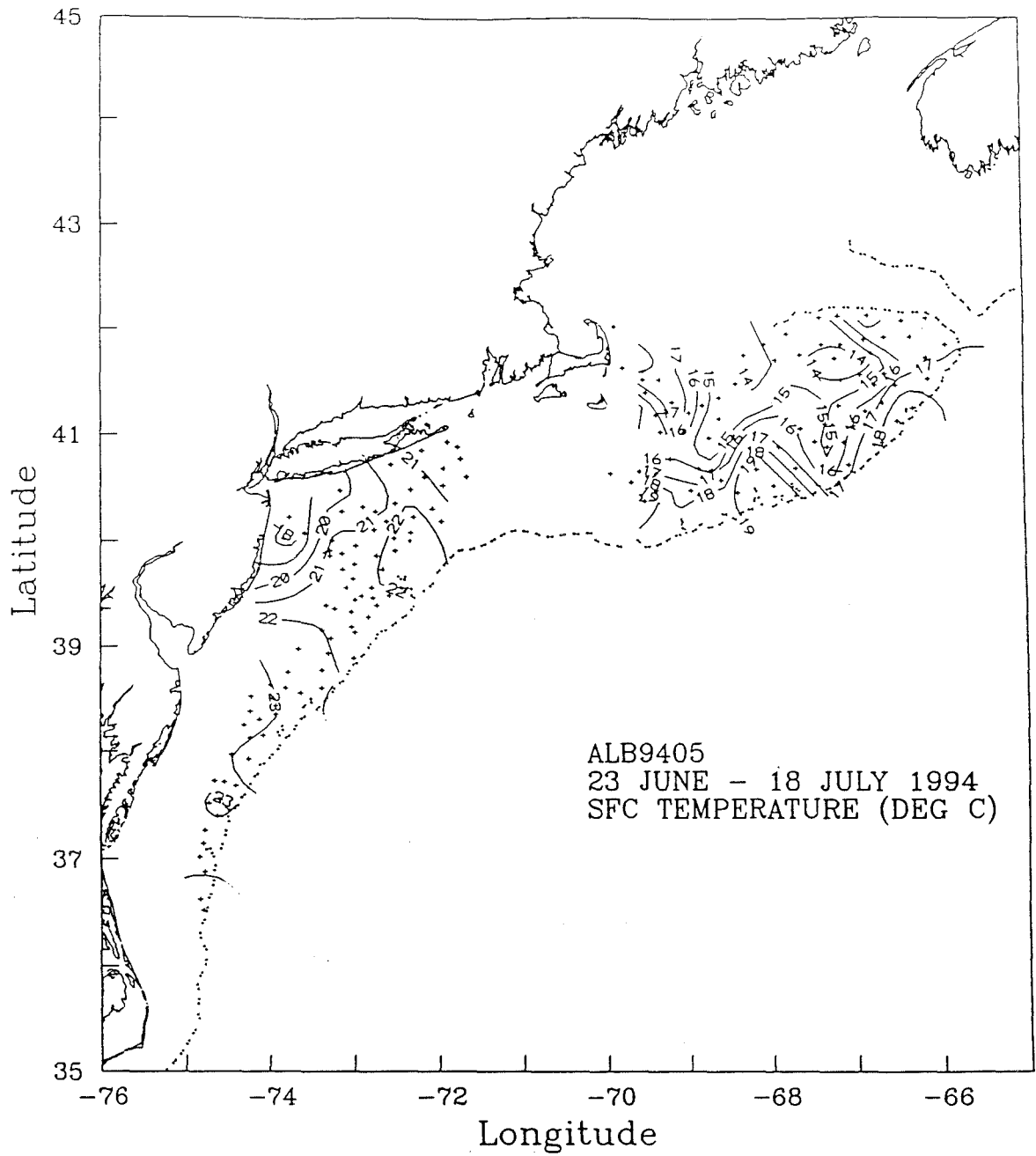


Figure 36. The surface temperature distribution for the sea scallop survey ALB9504.

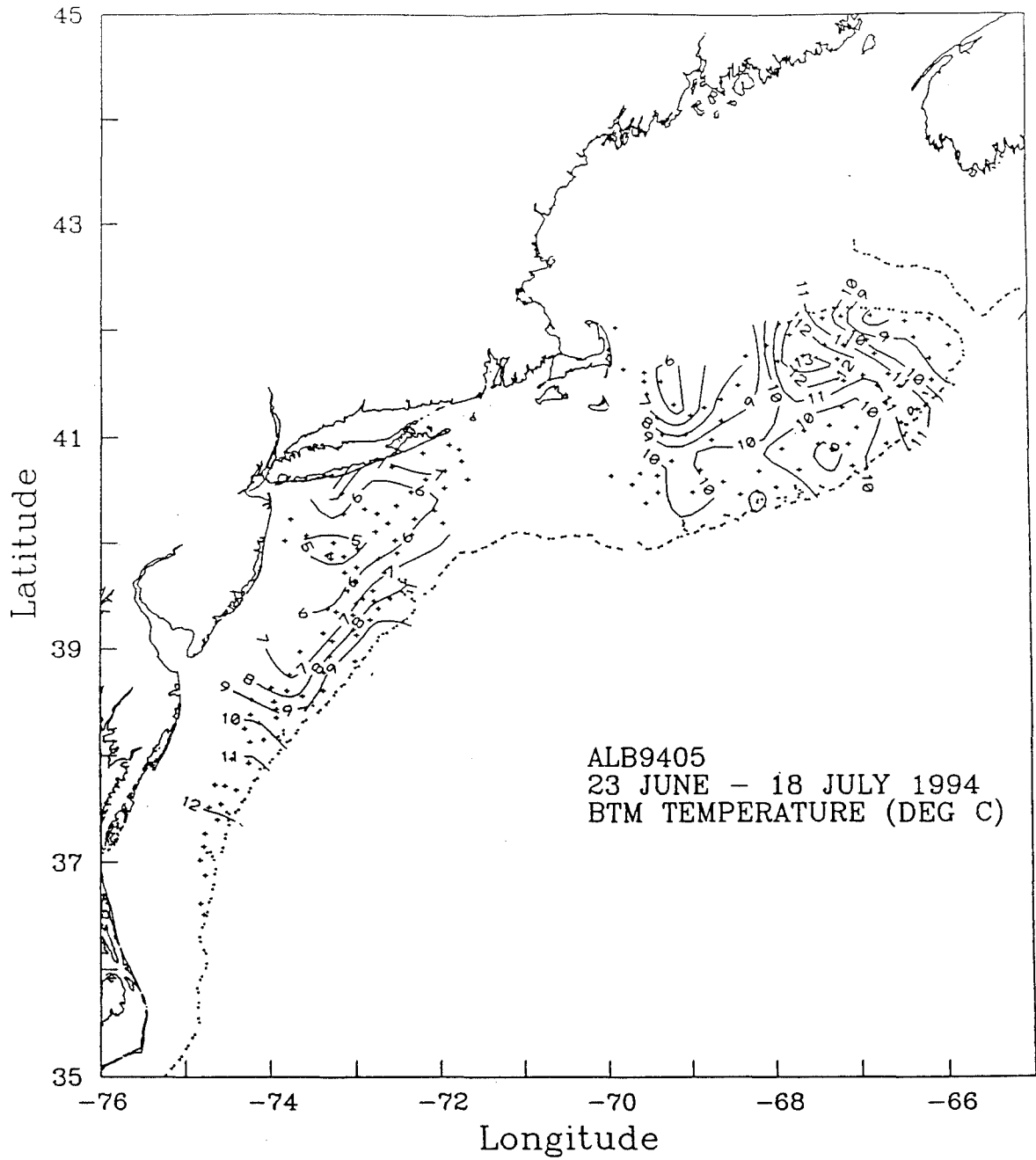


Figure 37. The bottom temperature distribution for the sea scallop survey ALB9405.

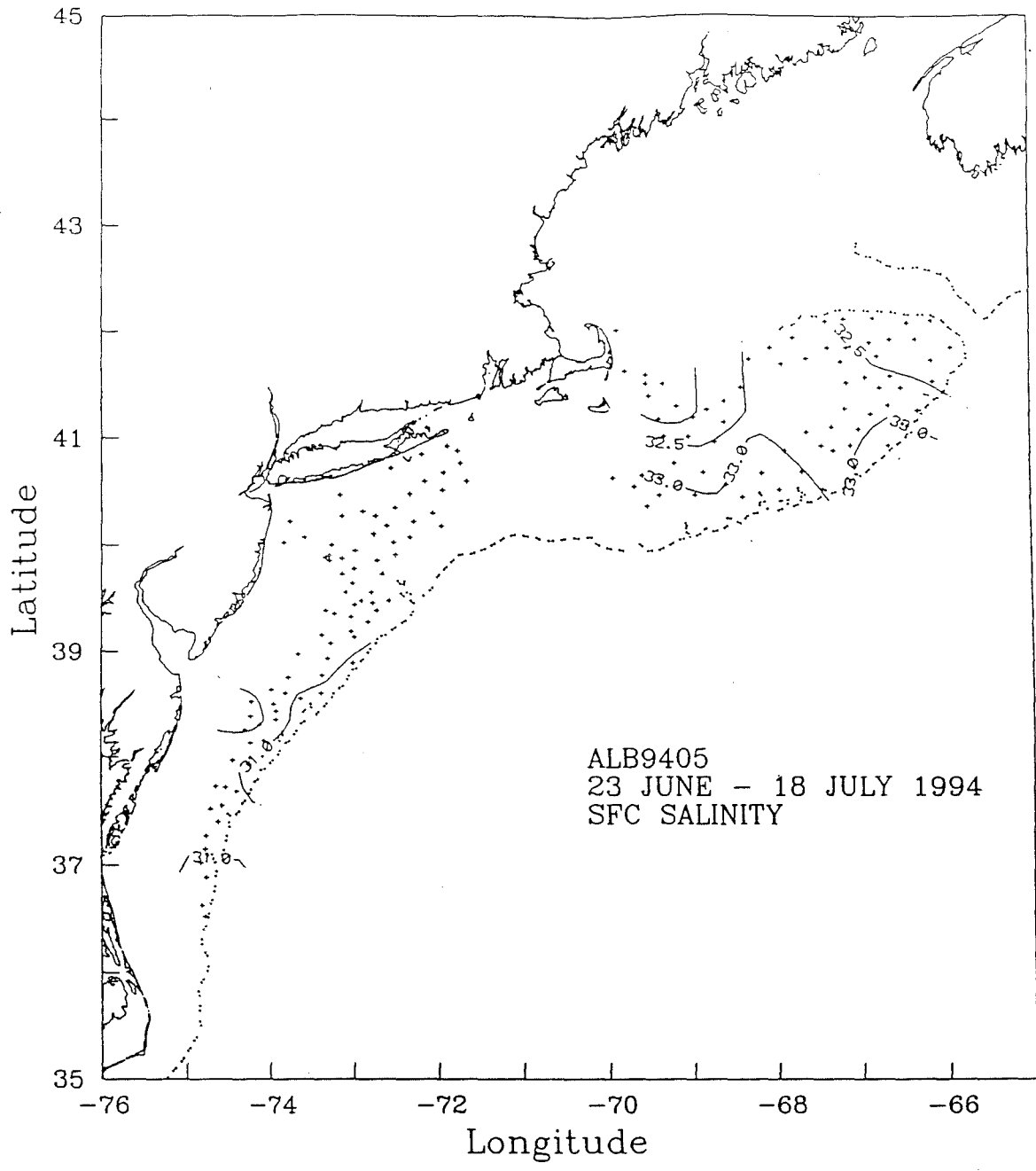


Figure 38. The surface salinity distribution for the sea scallop survey ALB9504.

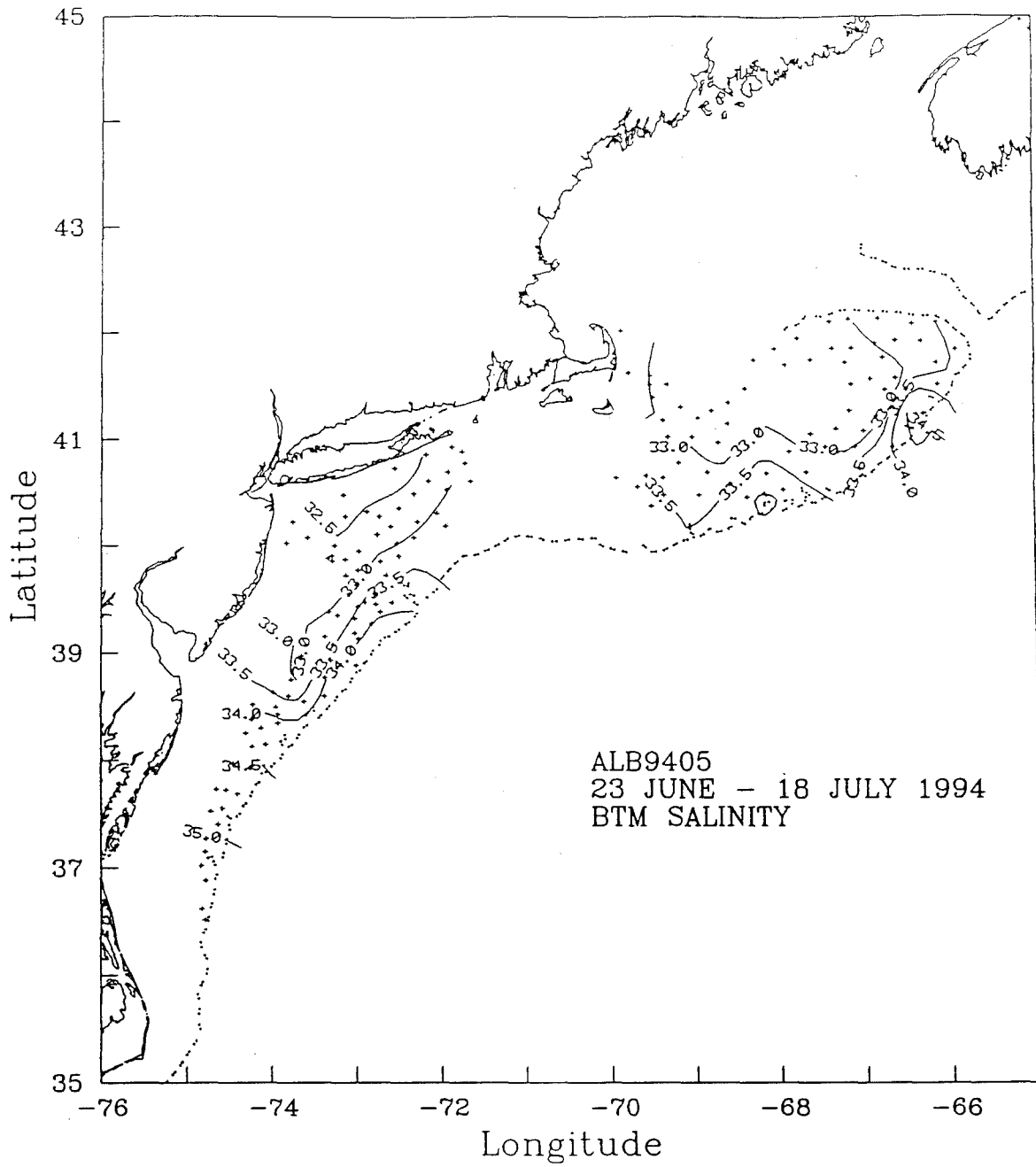


Figure 39. The bottom salinity distribution for the sea scallop survey ALB9504.

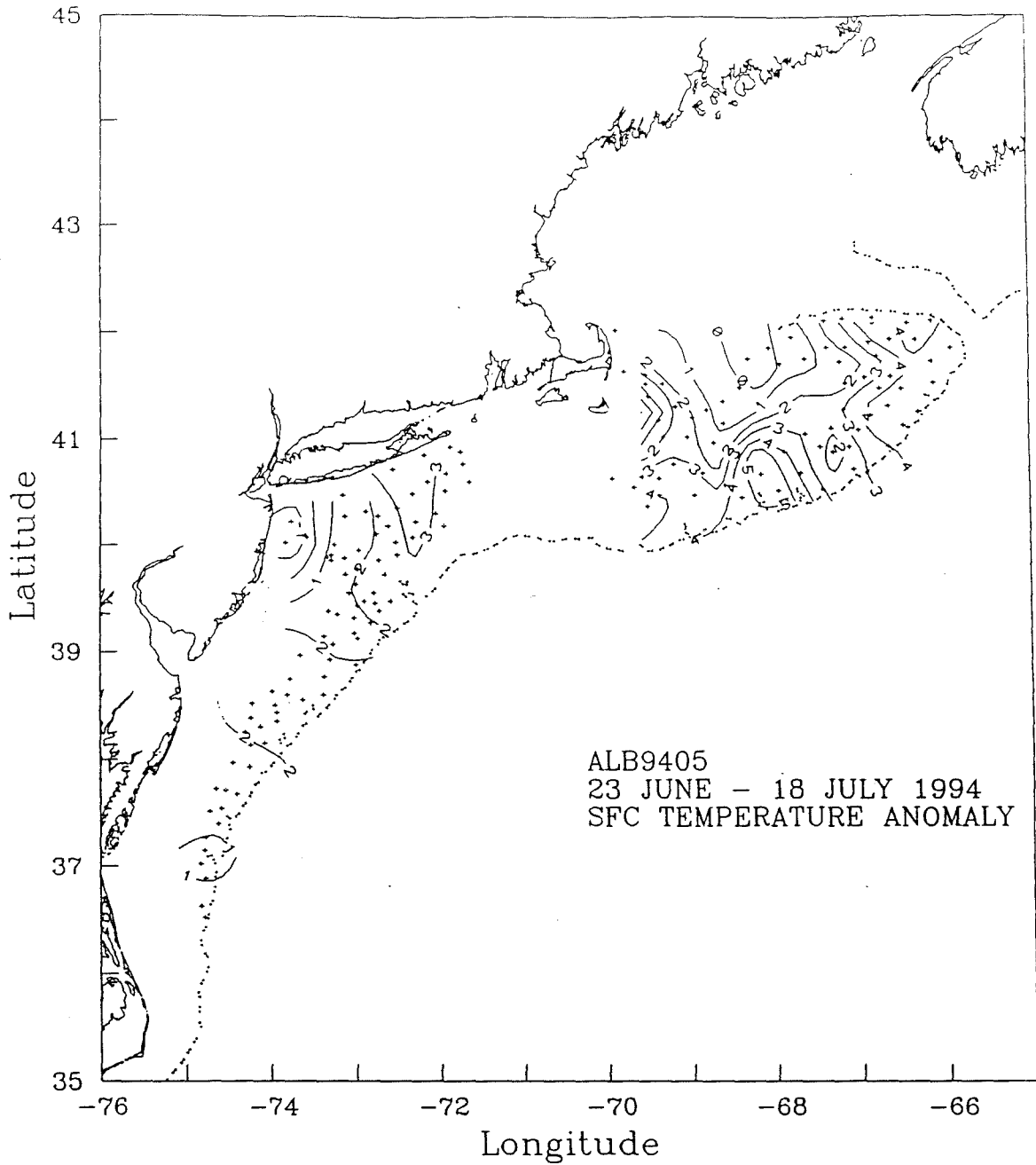


Figure 40. The surface temperature anomaly distribution for the sea scallop survey ALB9405.

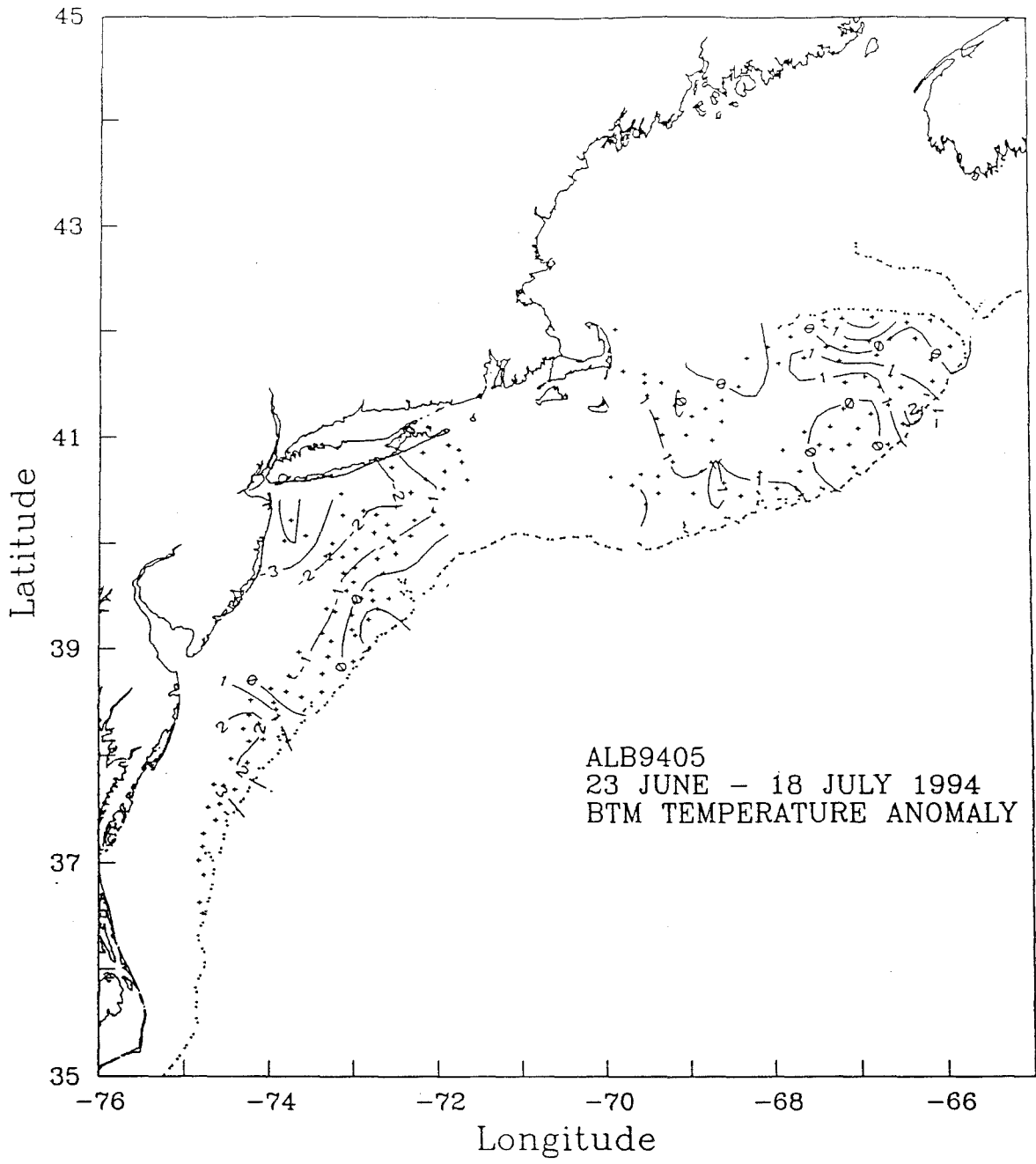


Figure 41. The bottom temperature anomaly distribution for the sea scallop survey ALB9405.

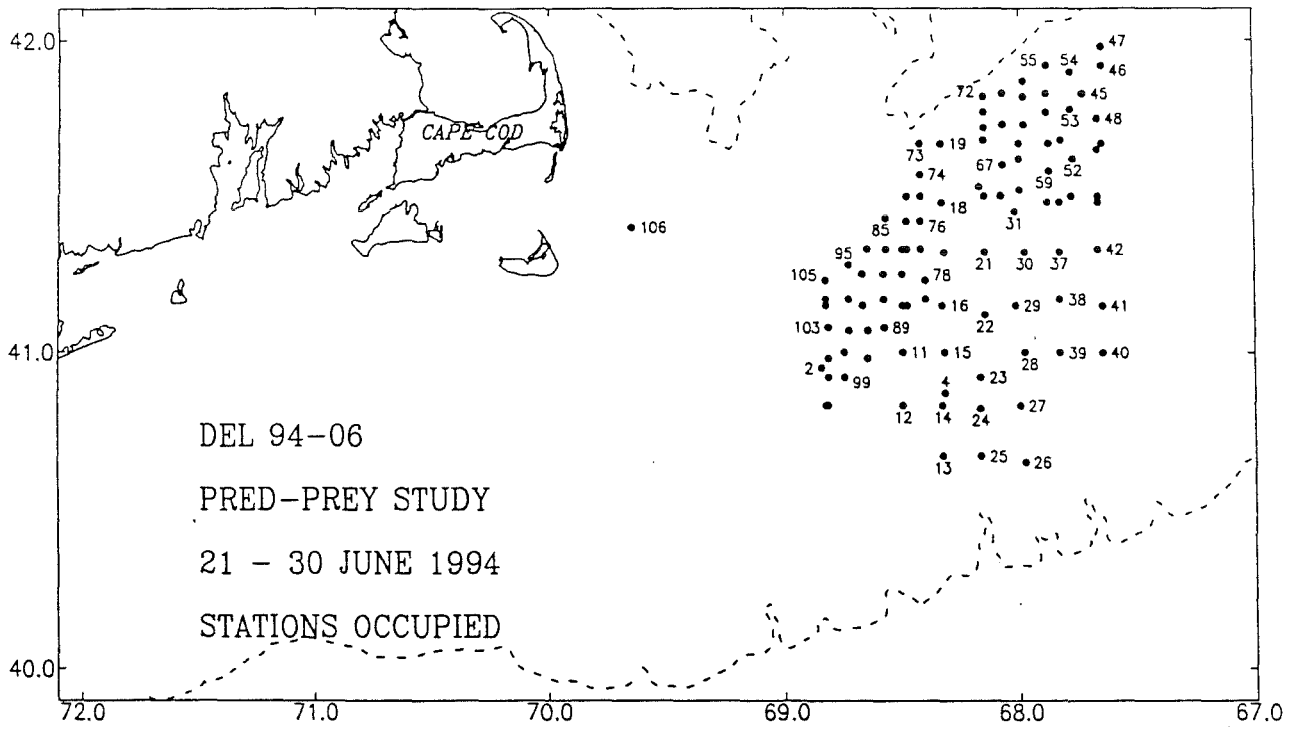


Figure 42. Hydrographic stations occupied during the predator/prey study DEL9406.

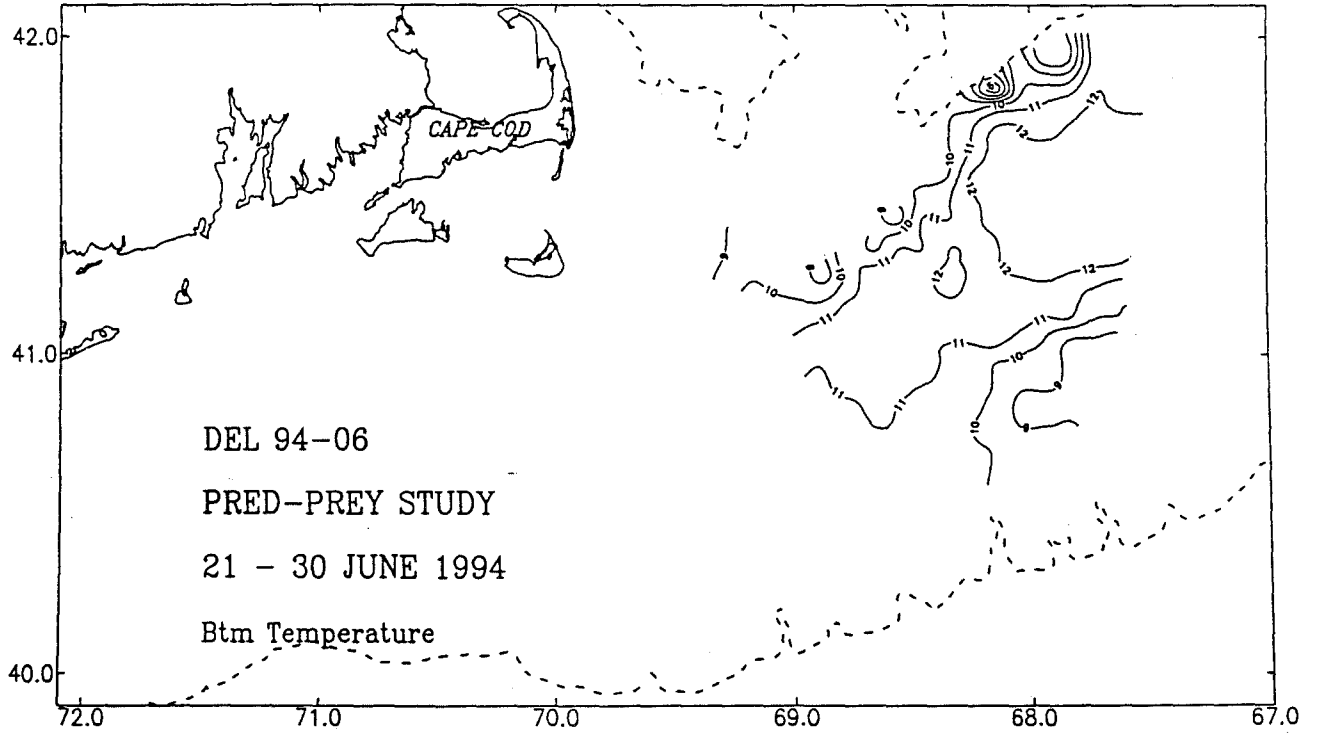
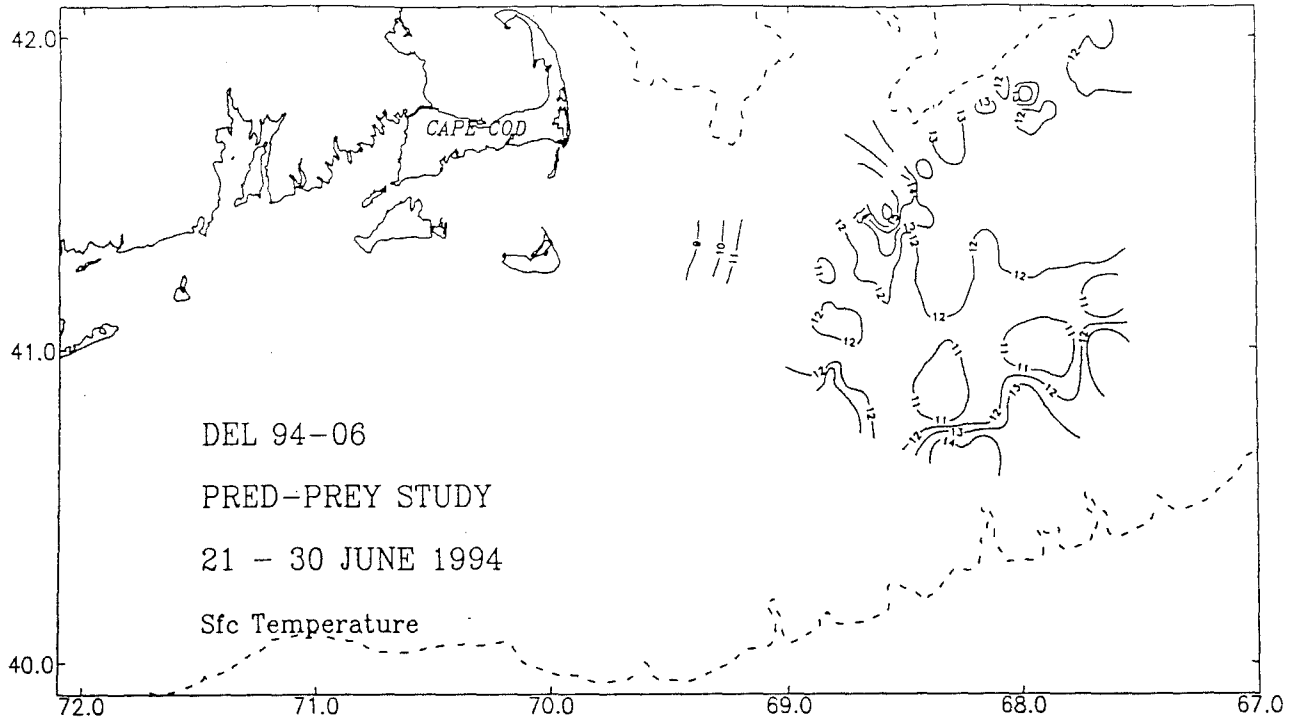


Figure 43. The surface and bottom temperature distribution for the predator/prey study DEL9406.

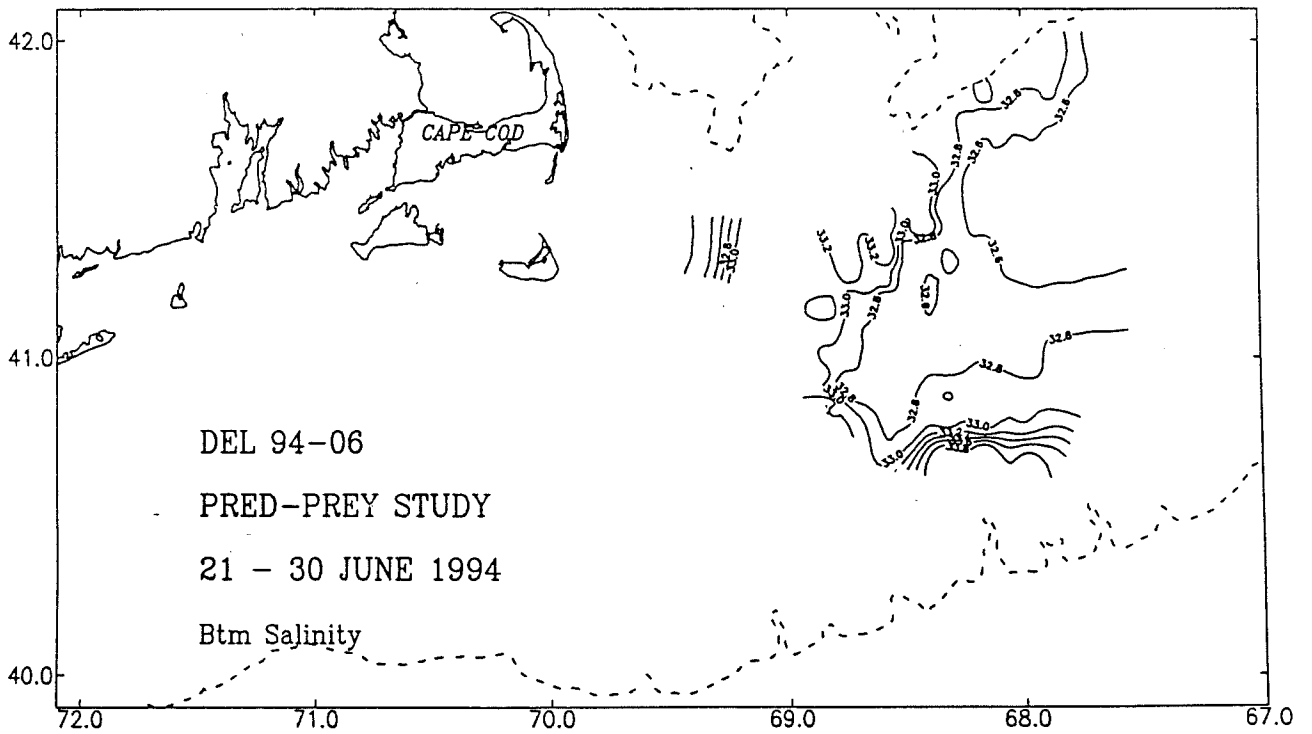
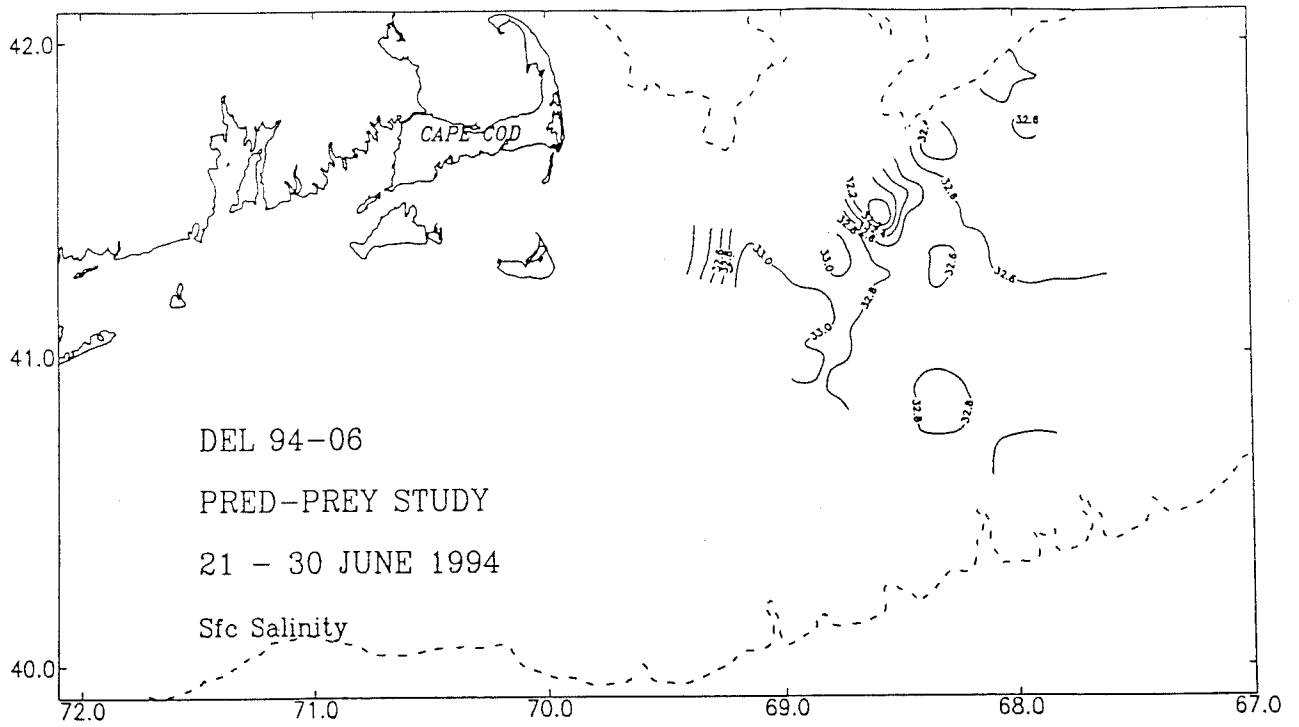


Figure 44. The surface and bottom salinity distribution for the predator/prey study DEL9406.

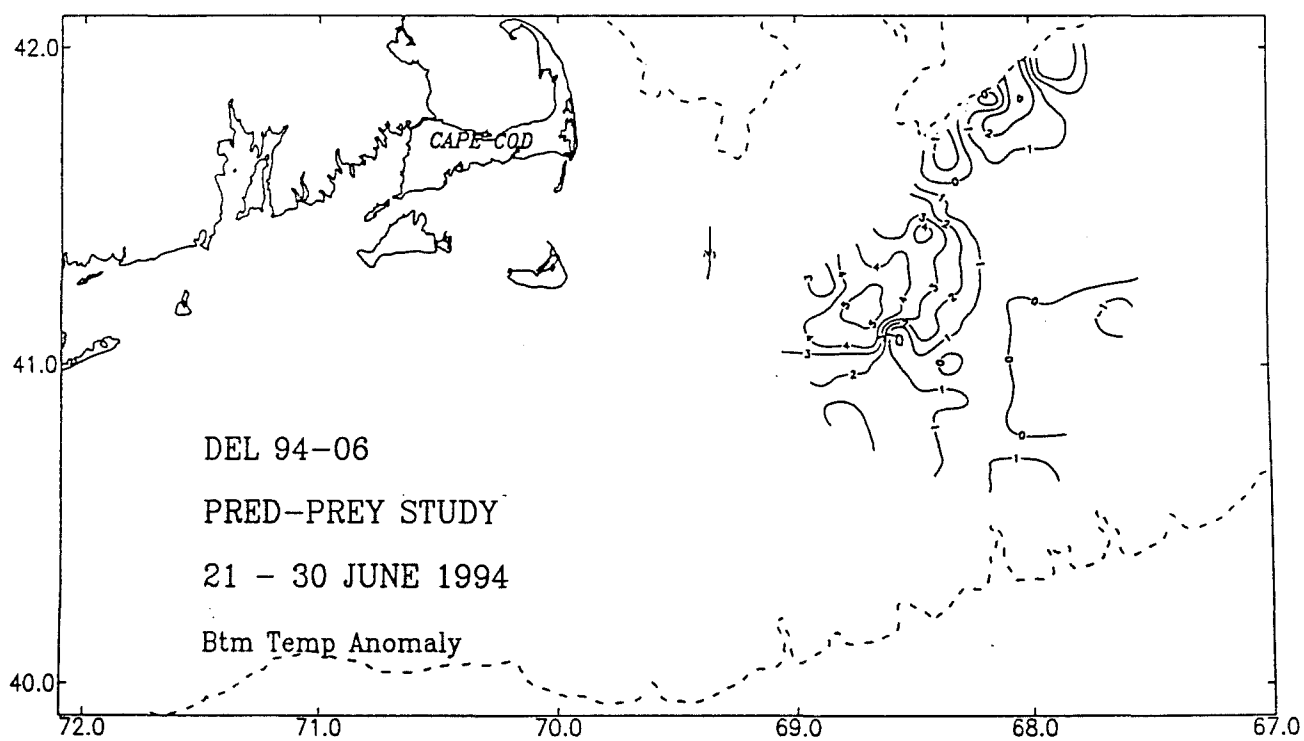
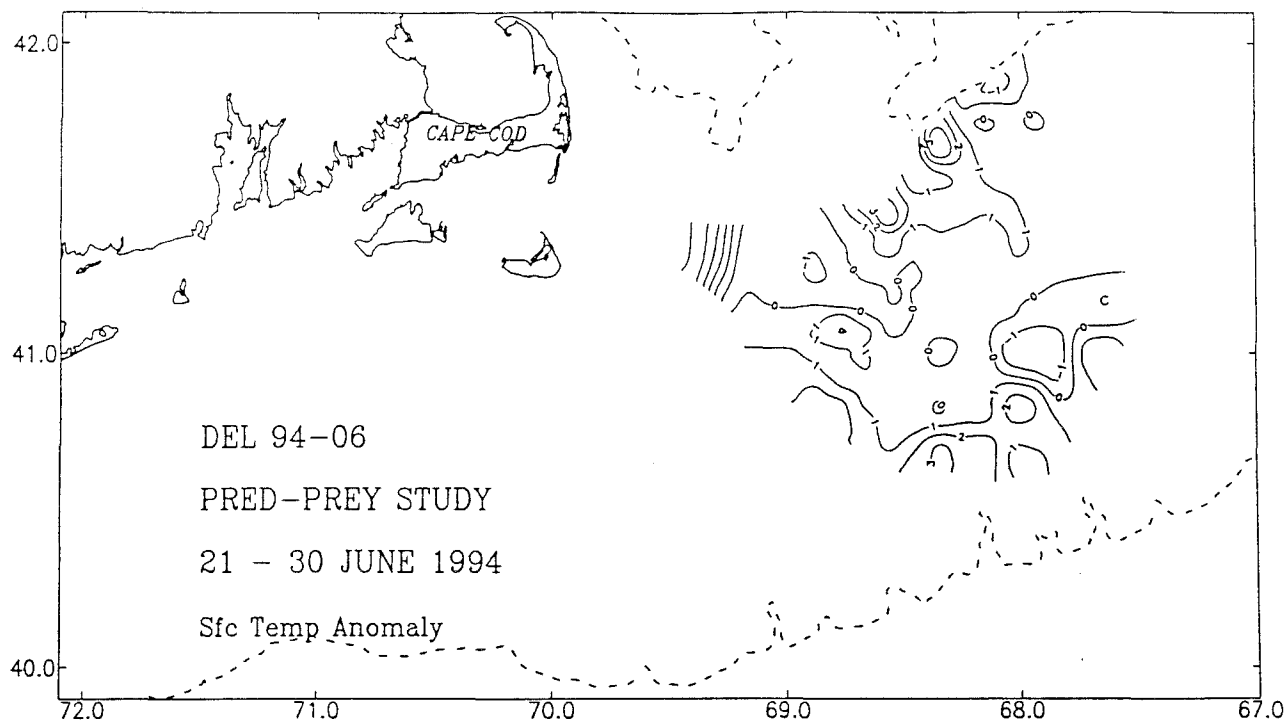


Figure 45. The surface and bottom temperature anomaly distribution for the predator/prey study DEL9406.

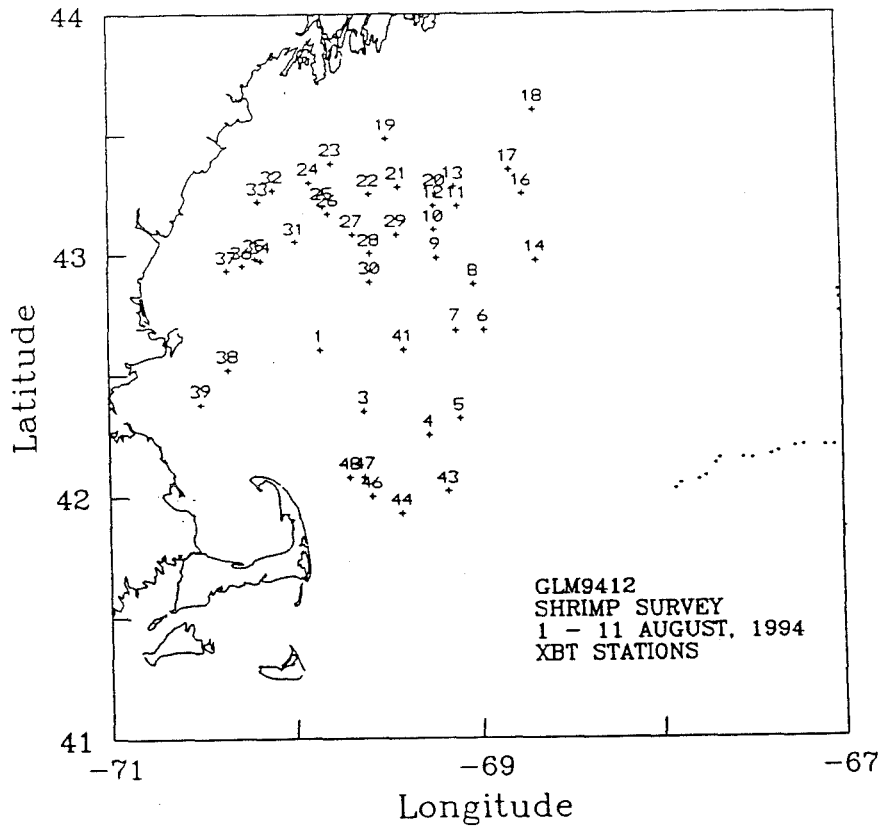


Figure 46. Hydrographic stations occupied during the shrimp survey GLM9412.

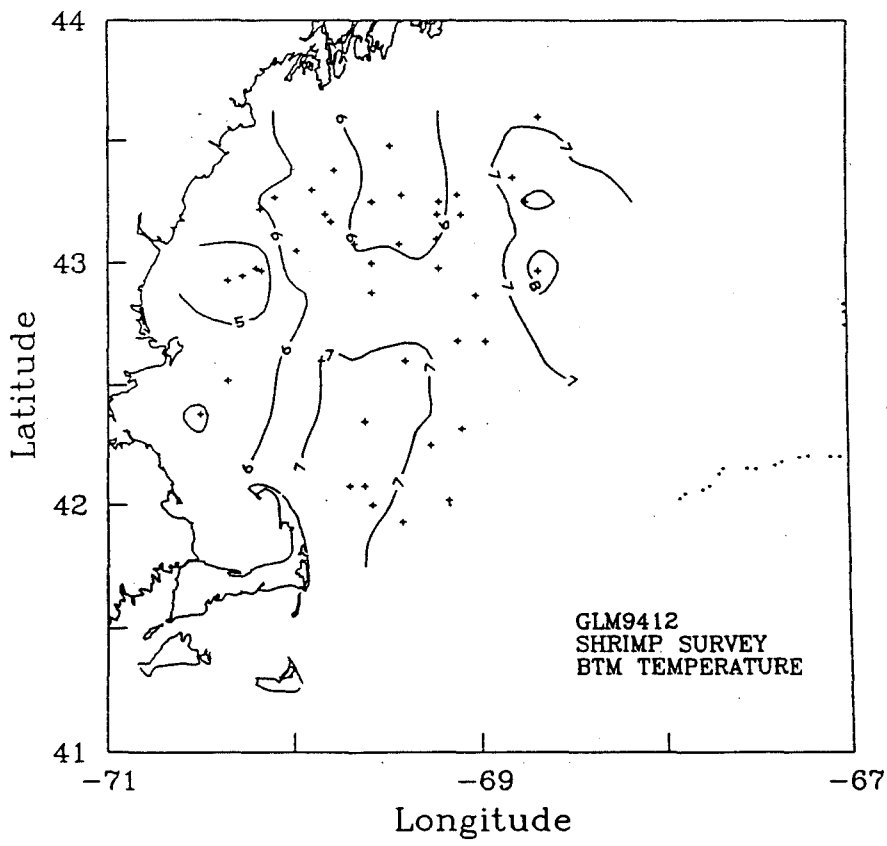
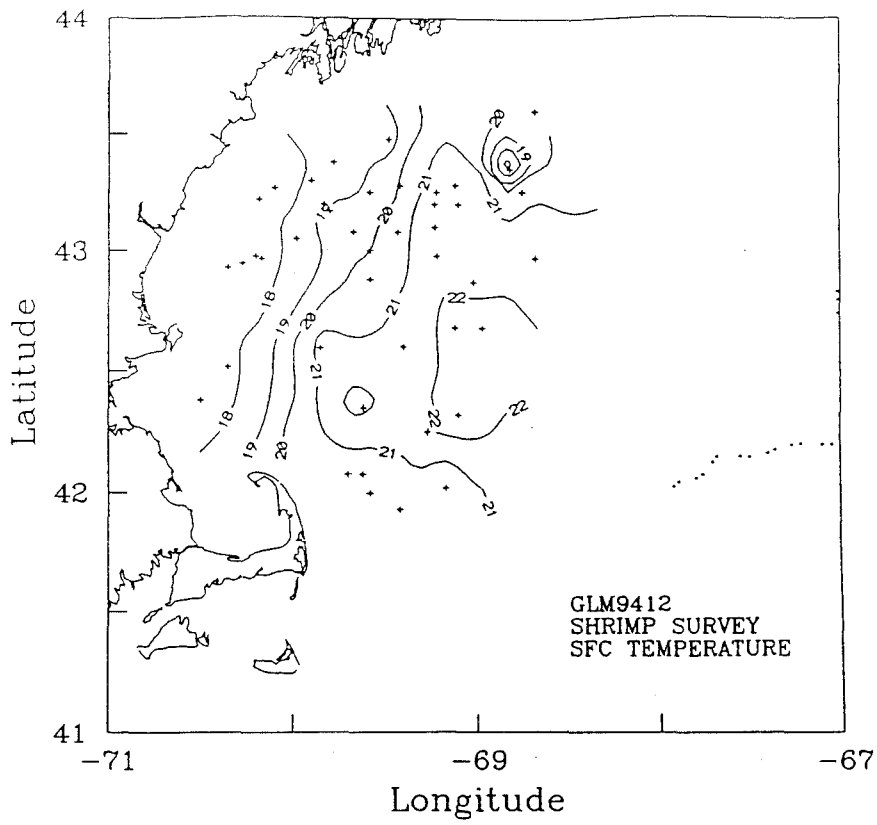


Figure 47. The surface and bottom temperature distribution for the shrimp survey GLM9412.

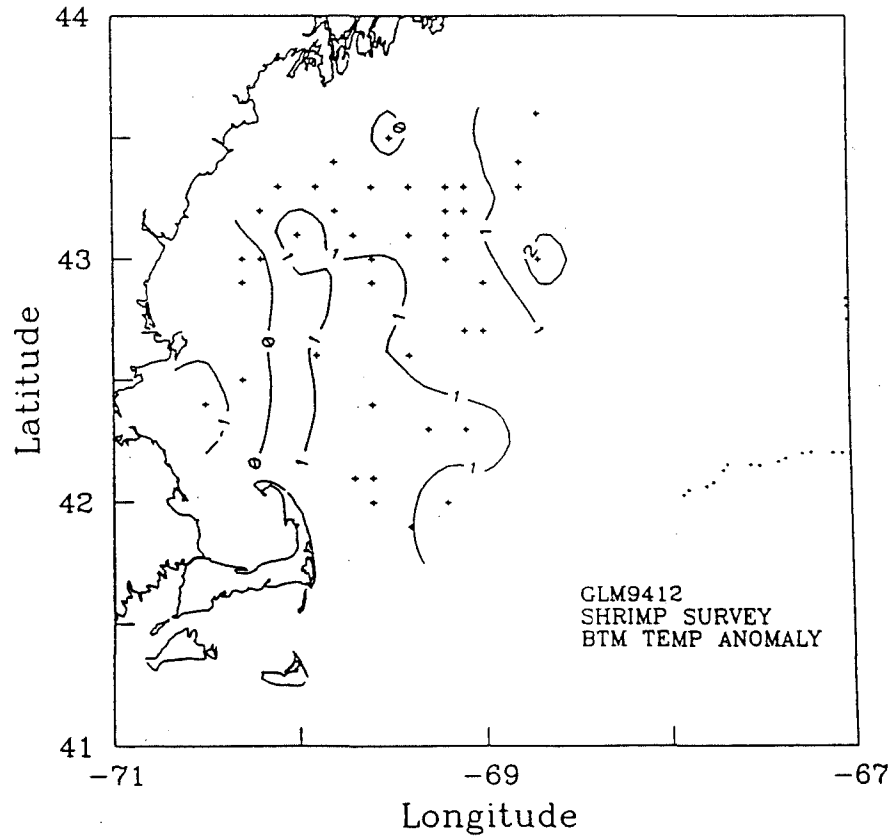
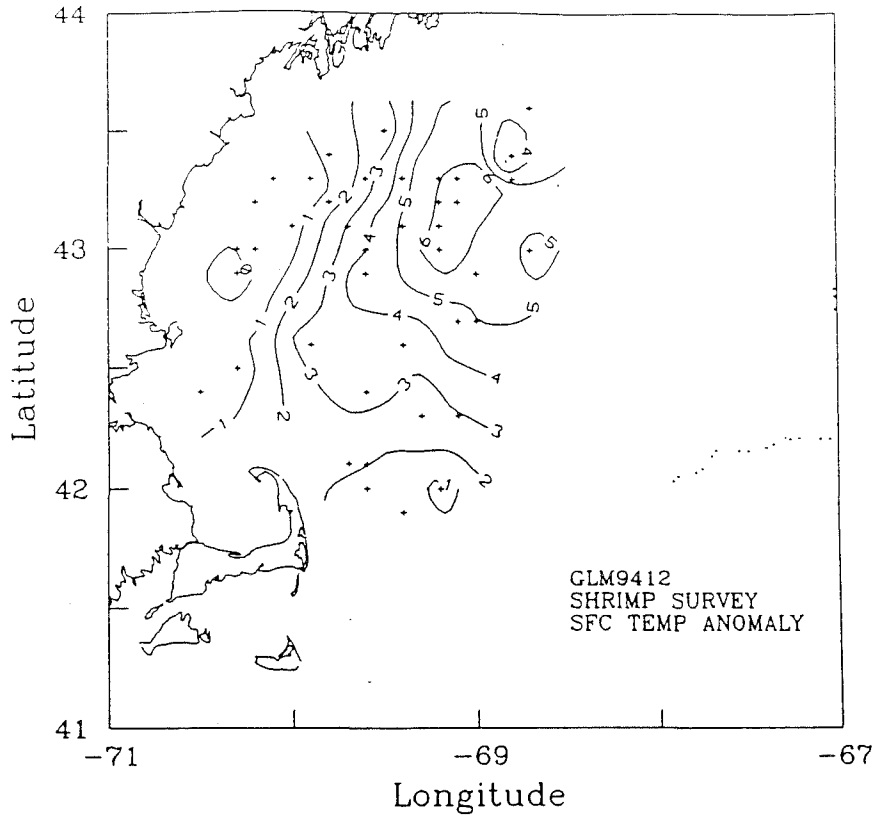


Figure 48. The surface and bottom temperature anomaly distribution for the shrimp survey GLM9412.

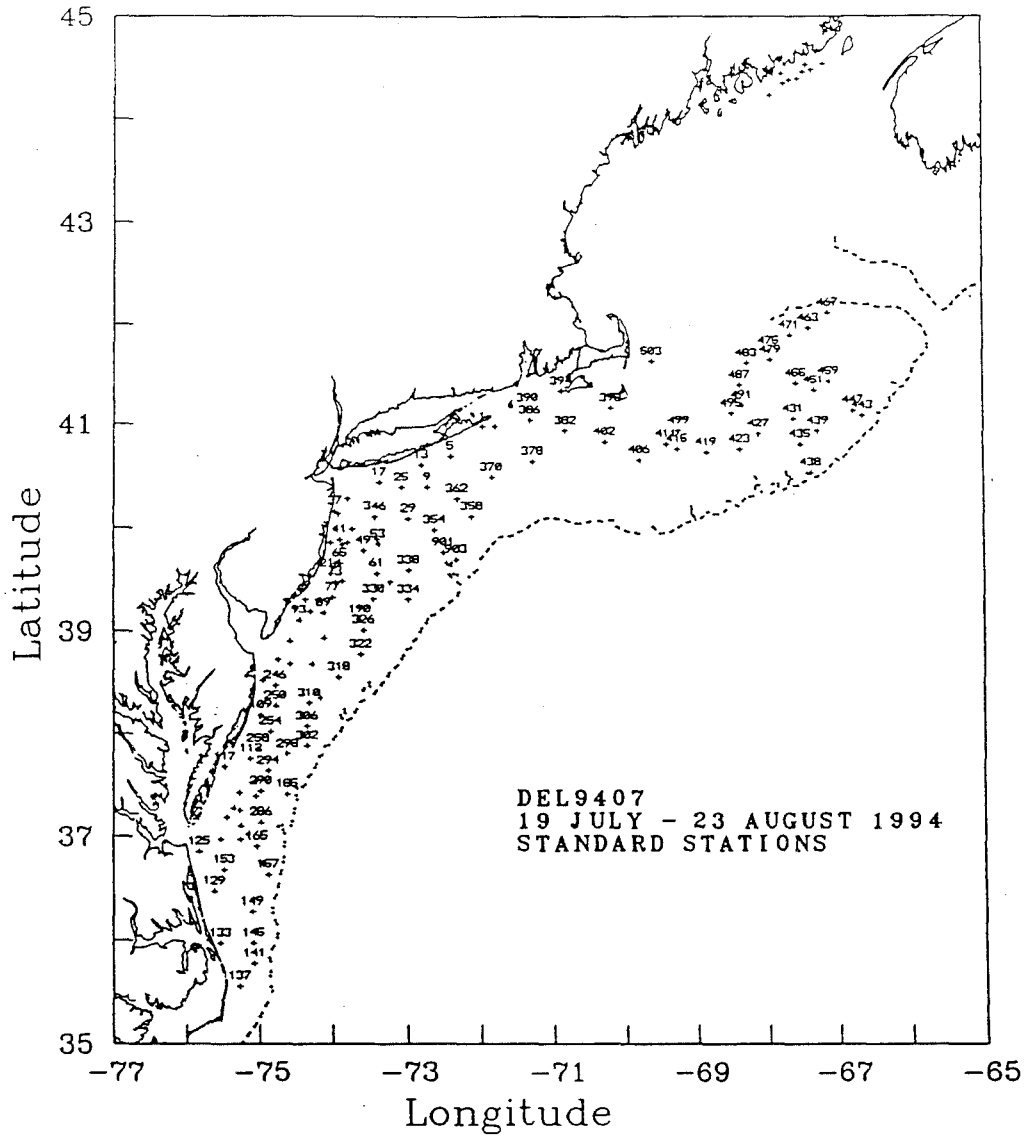


Figure 49. Hydrographic stations occupied during the clam survey DEL9407.

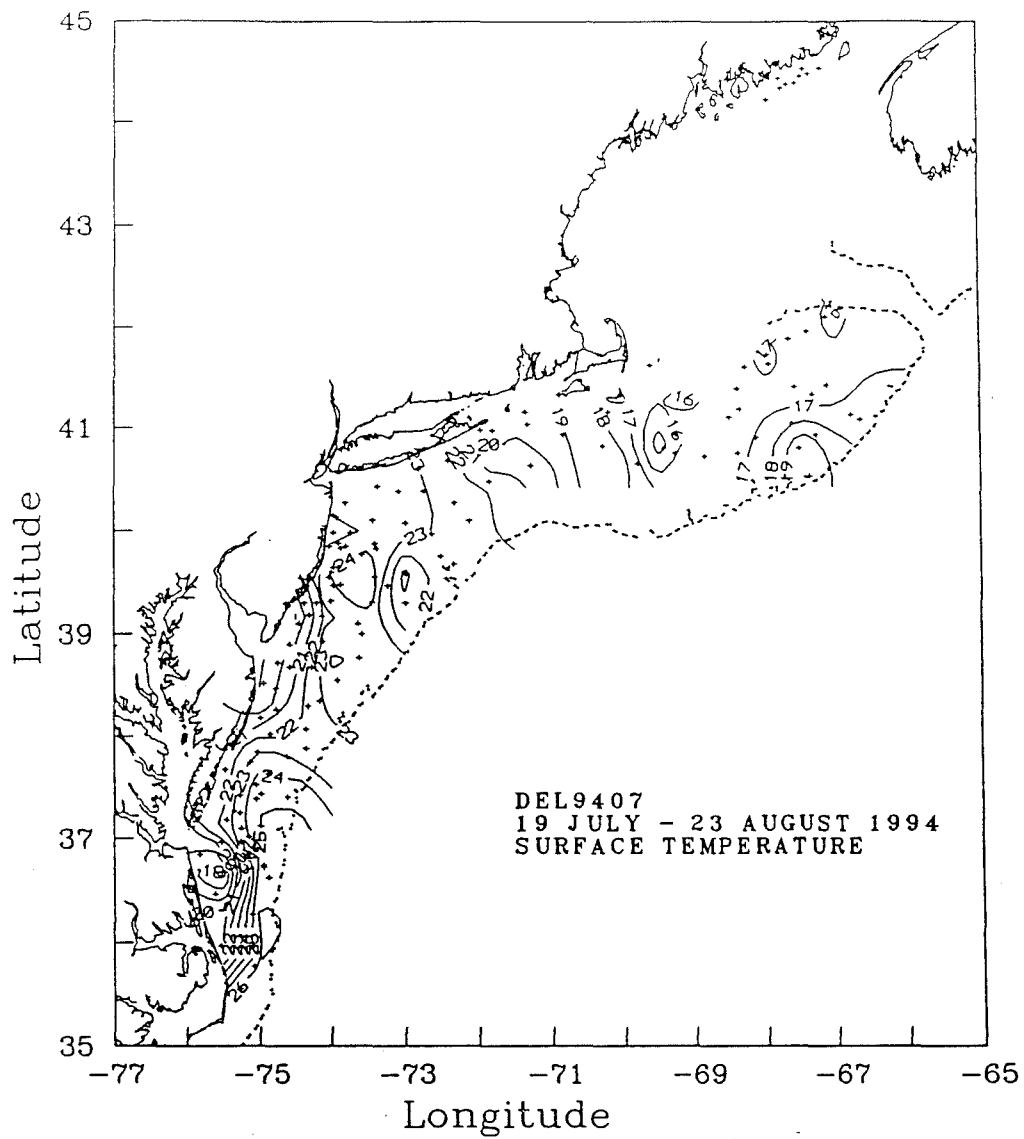


Figure 50. The surface temperature distribution for the clam survey DEL9407.

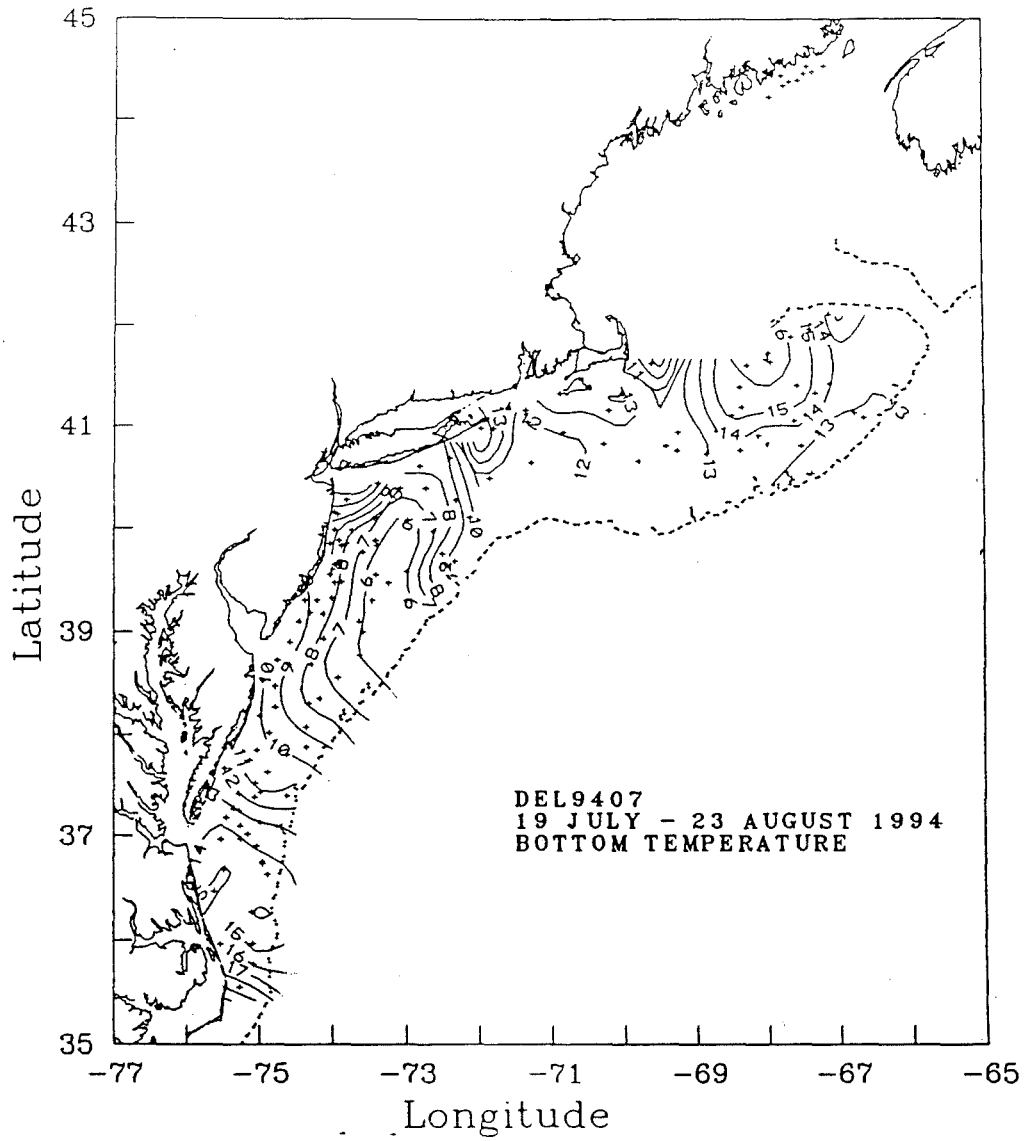


Figure 51. The bottom temperature distribution during the clam survey DEL9407.

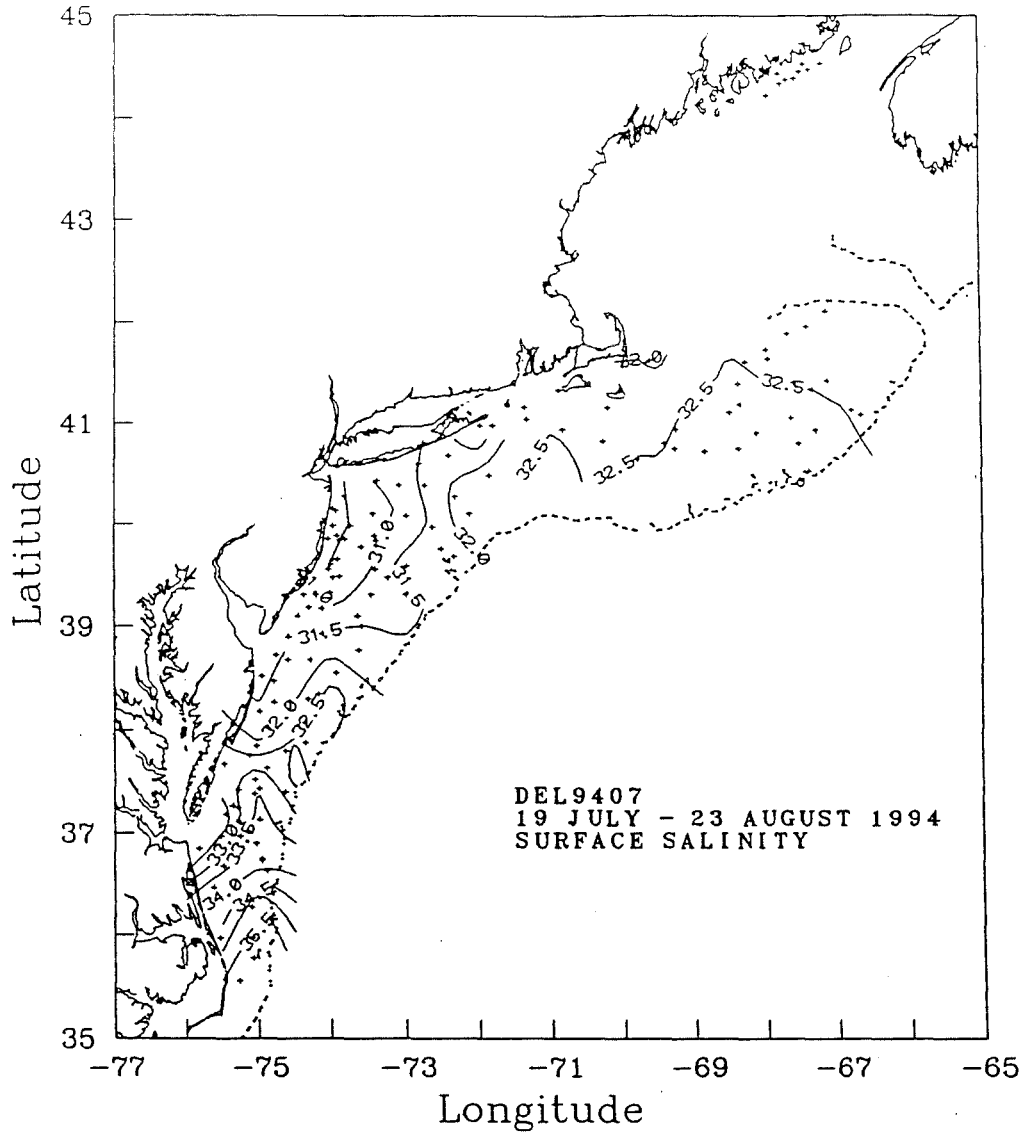


Figure 52. The surface salinity distribution during the clam survey DEL9407.

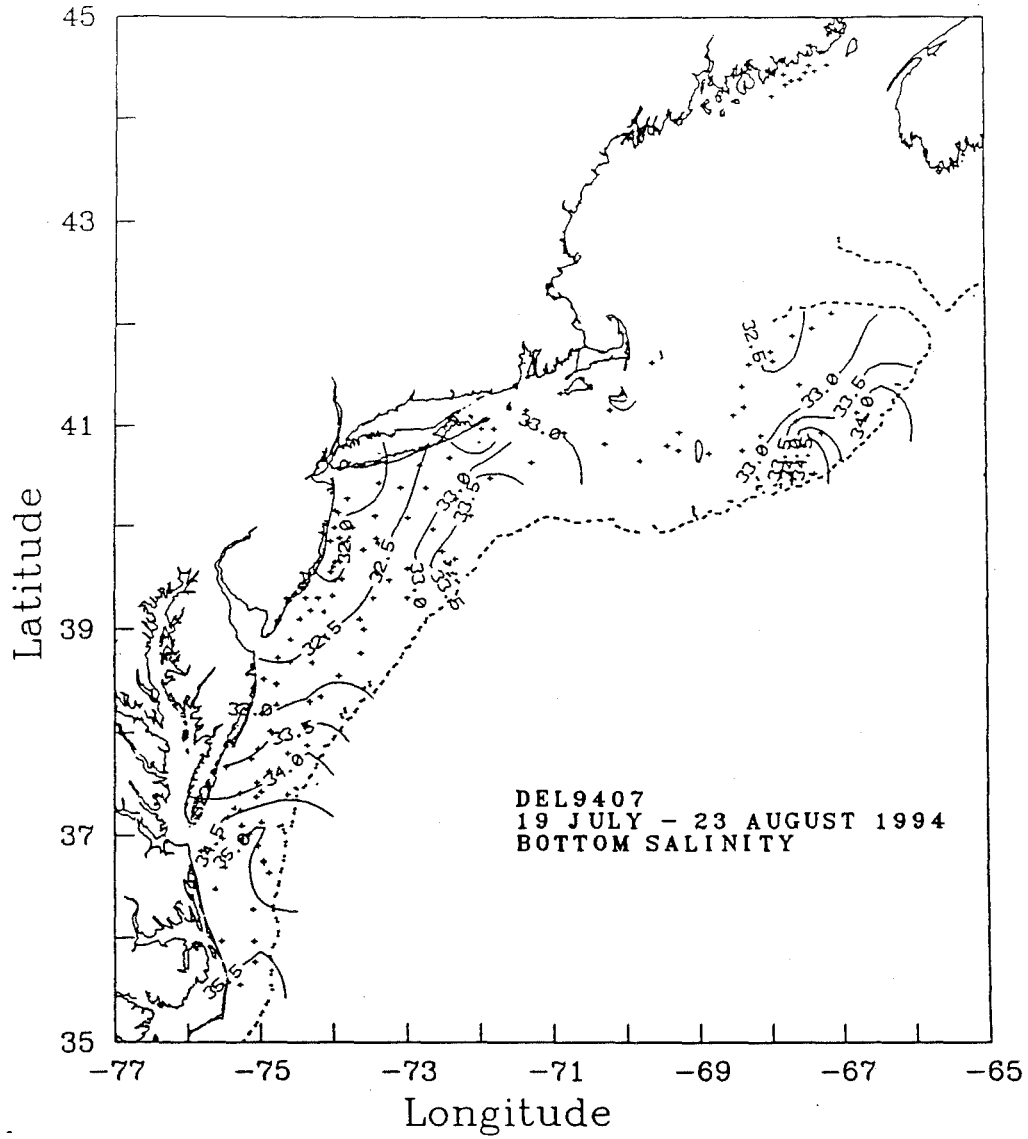


Figure 53. The bottom salinity distribution during the clam survey DEL9407.

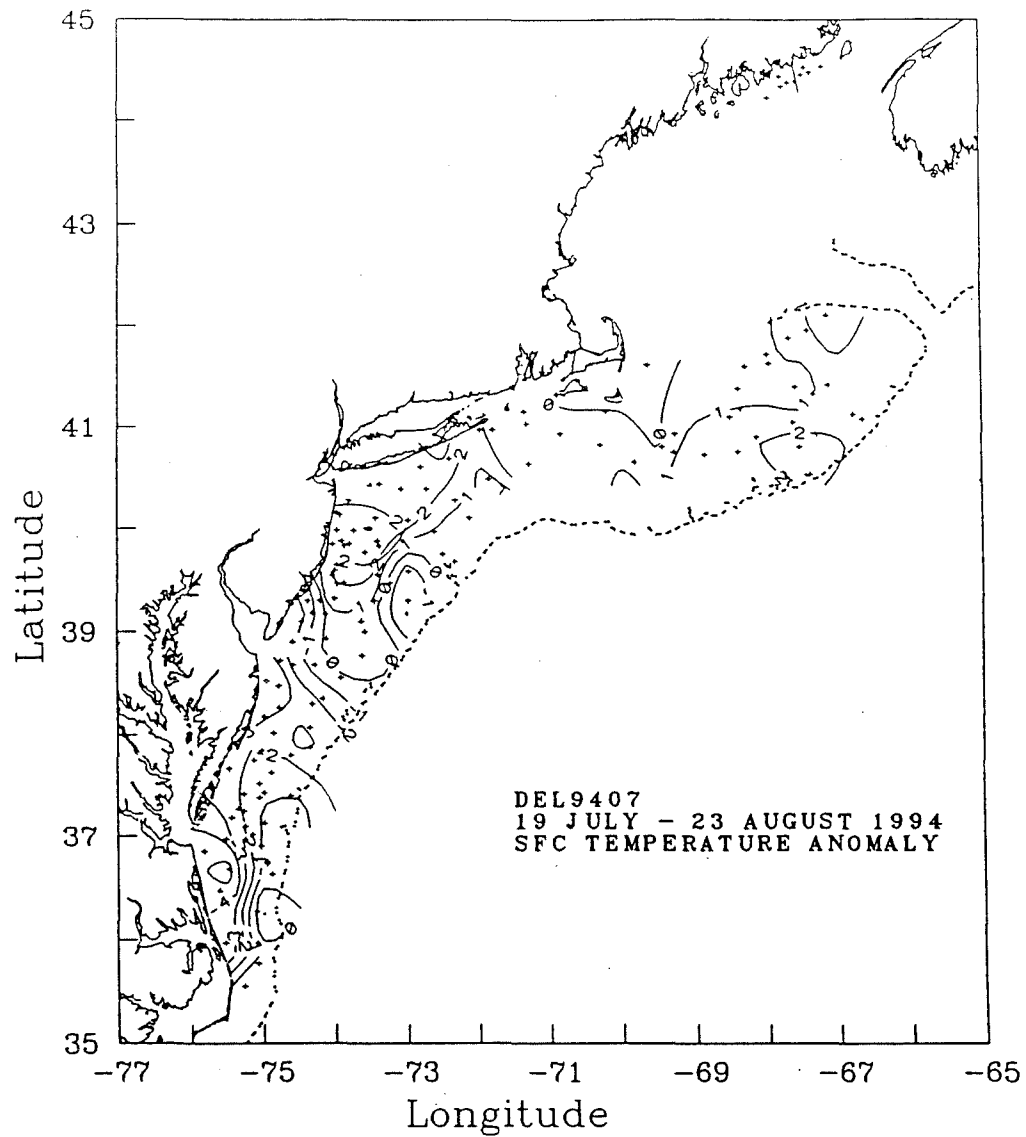


Figure 54. The surface temperature anomaly distribution during the clam survey DEL9407.

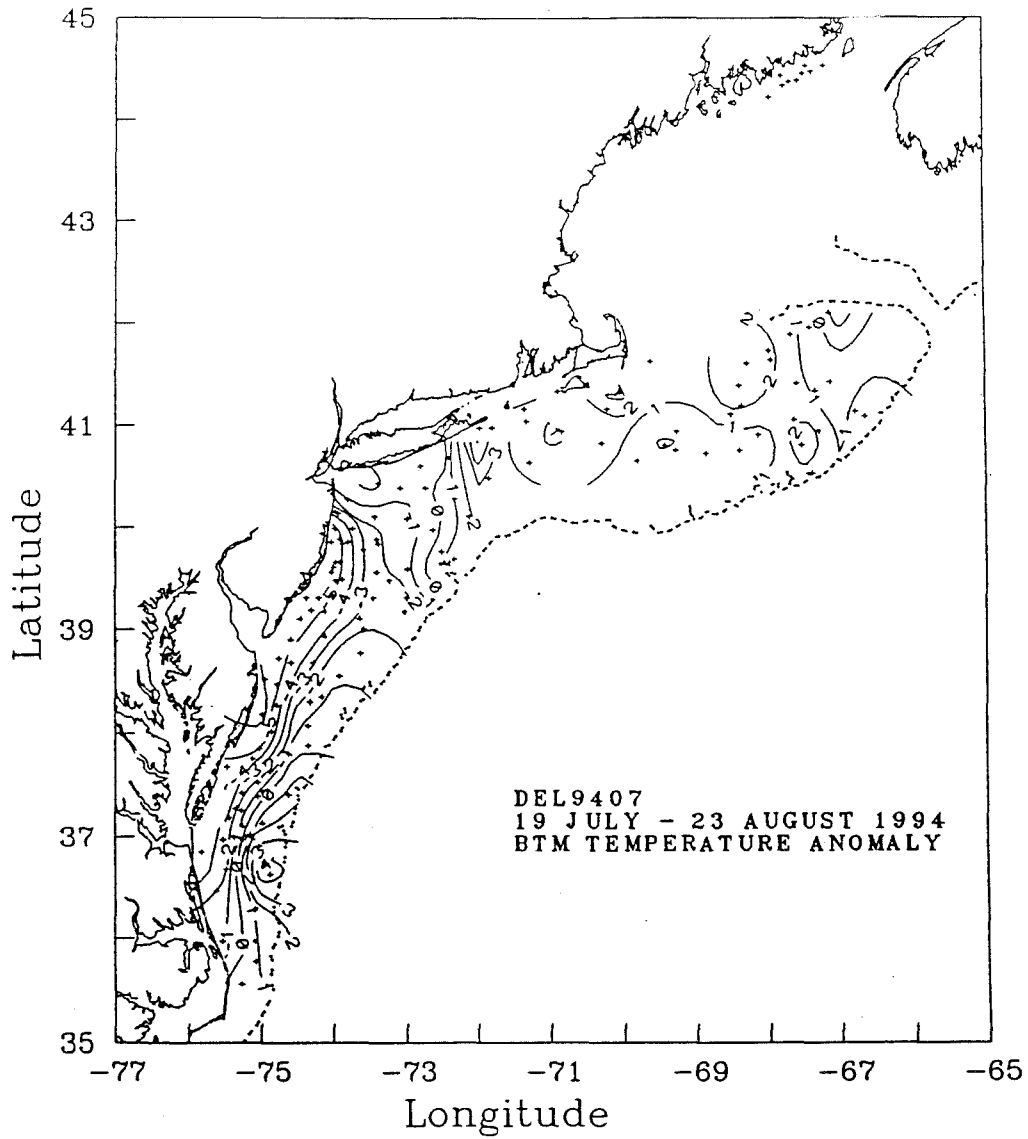


Figure 55. The bottom temperature anomaly distribution during the clam survey DEL9407.

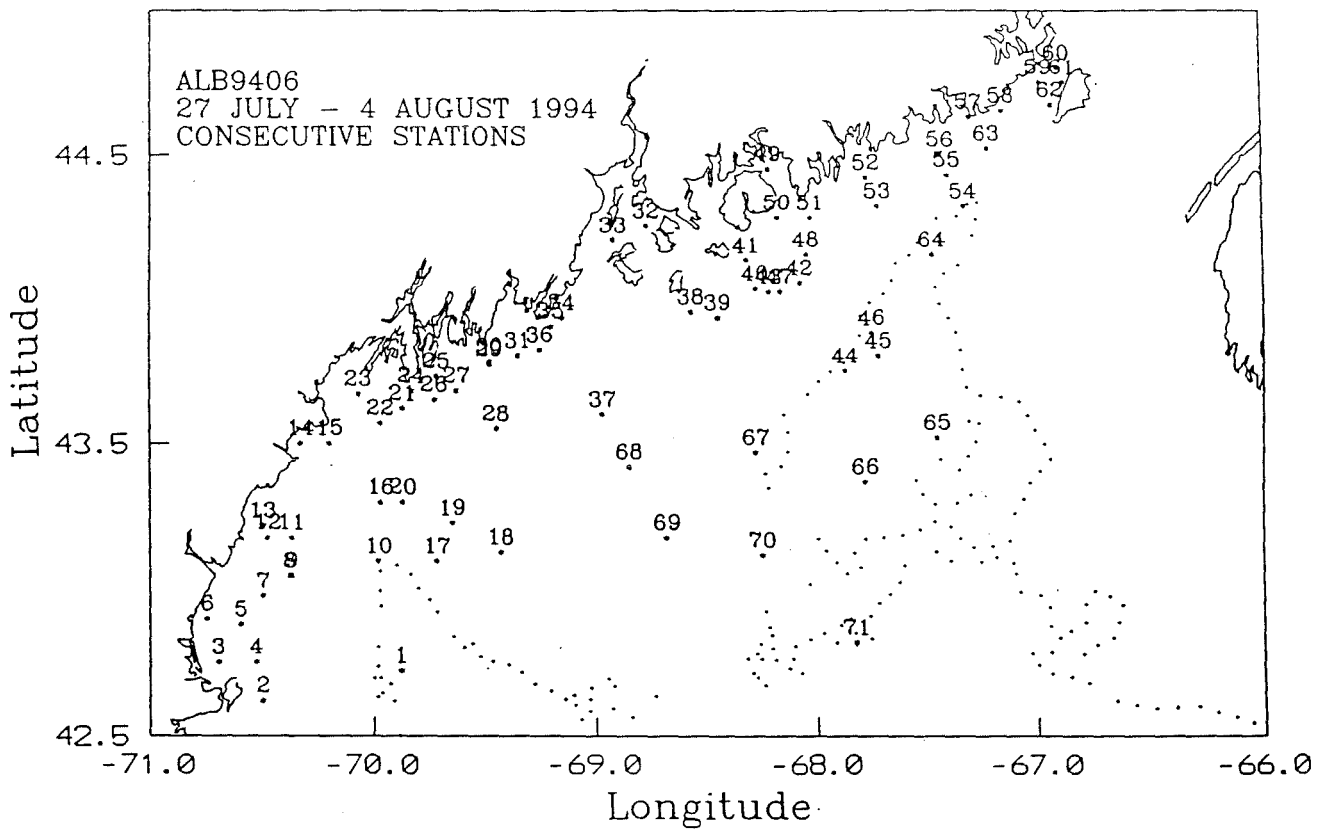


Figure 56. Hydrographic stations occupied during the summer bottom trawl survey ALB9406.

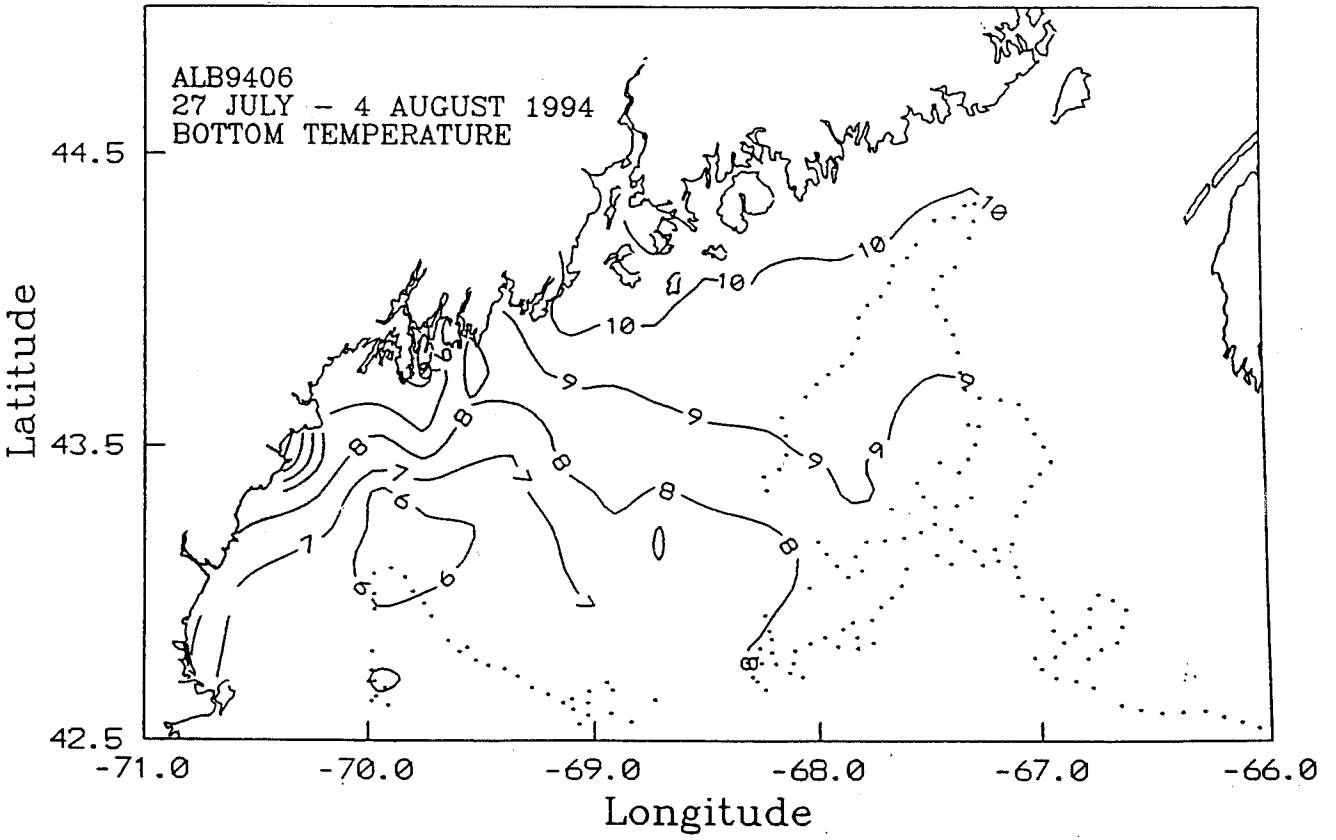
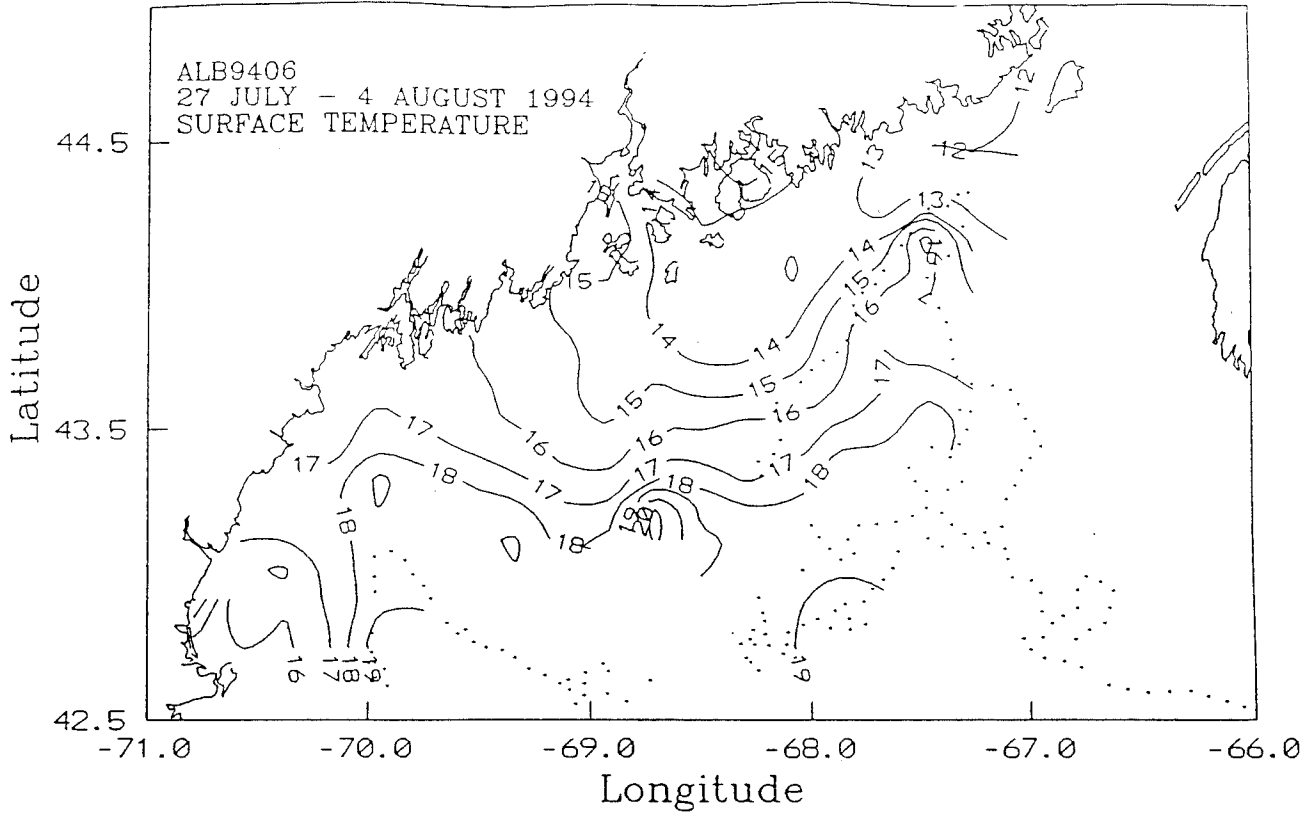


Figure 57. Surface and bottom temperature distributions during the summer bottom trawl survey ALB9406.

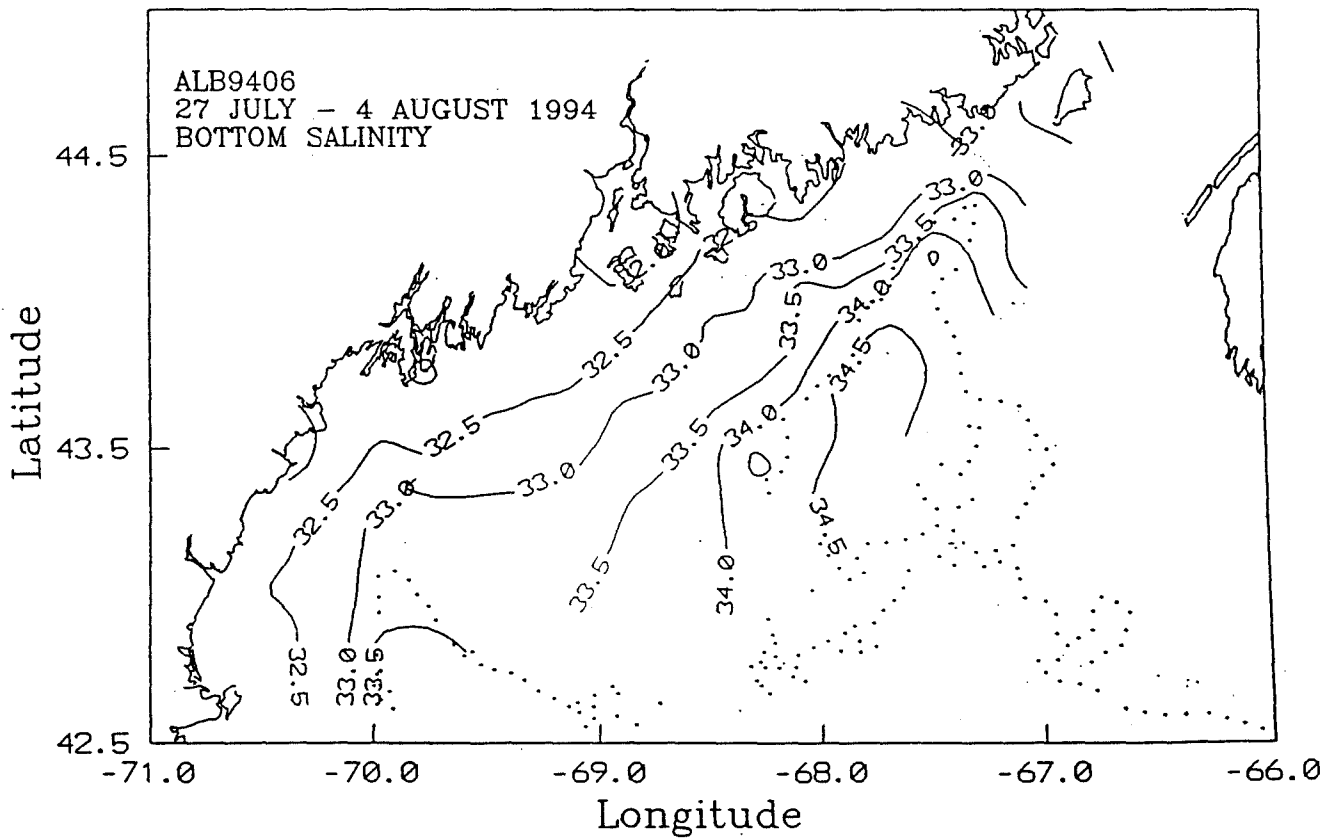
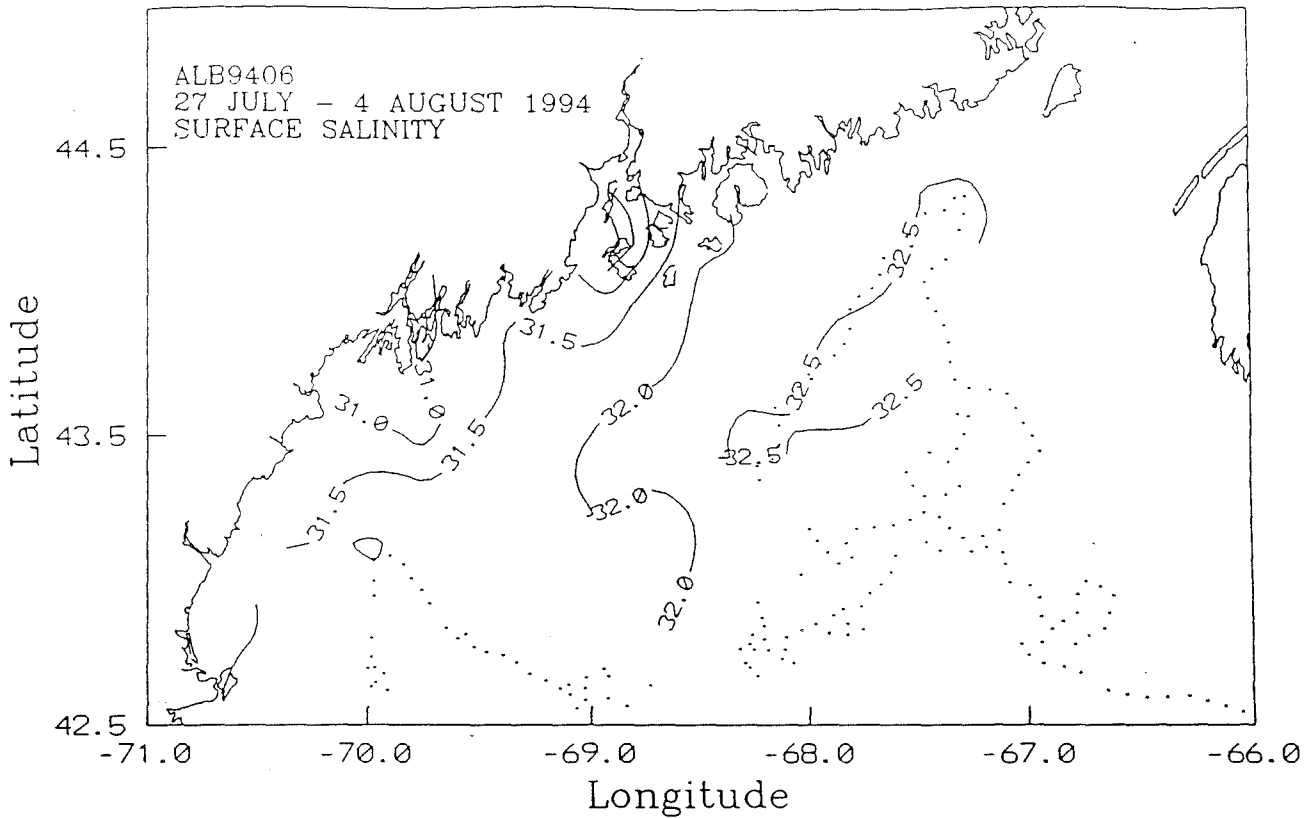


Figure 58. Surface and bottom salinity distributions during the summer bottom trawl survey ALB9406.

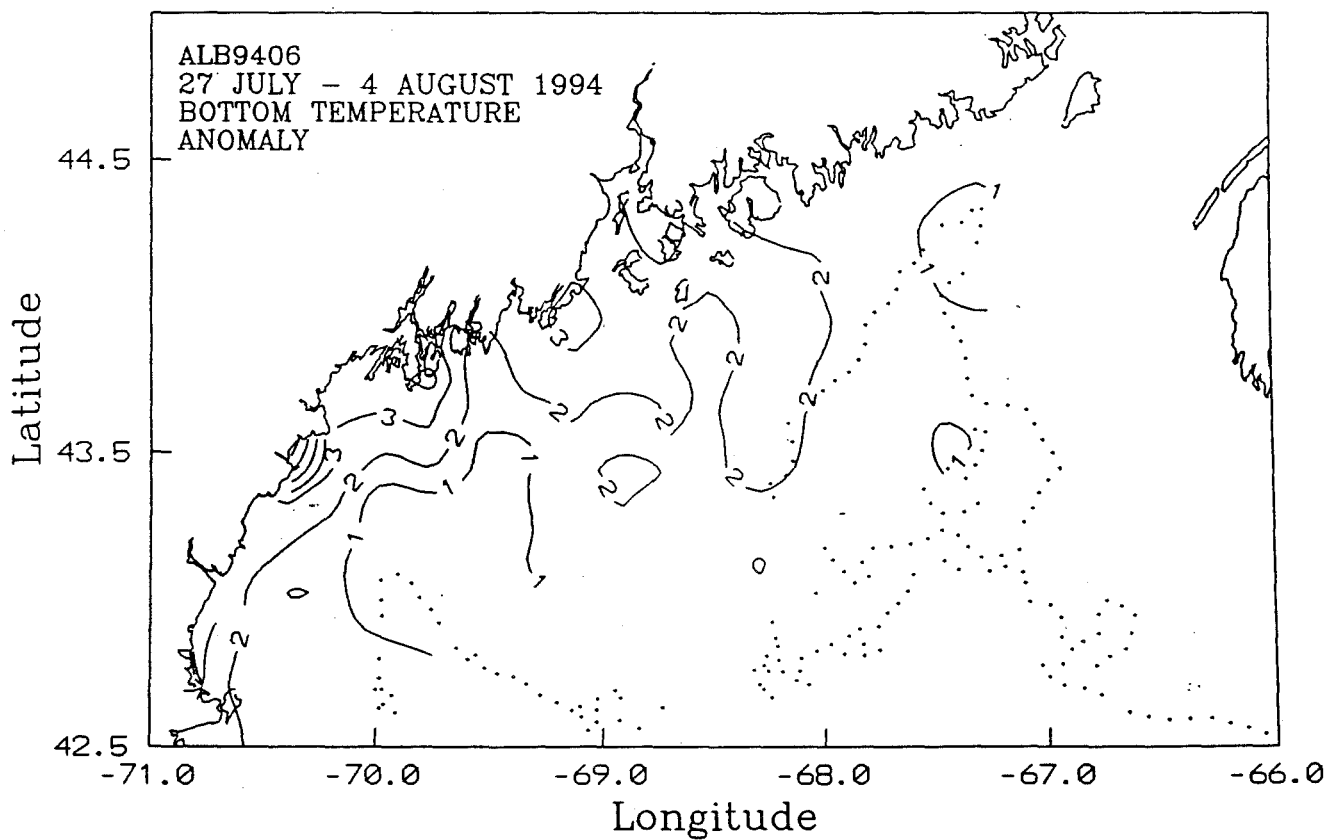
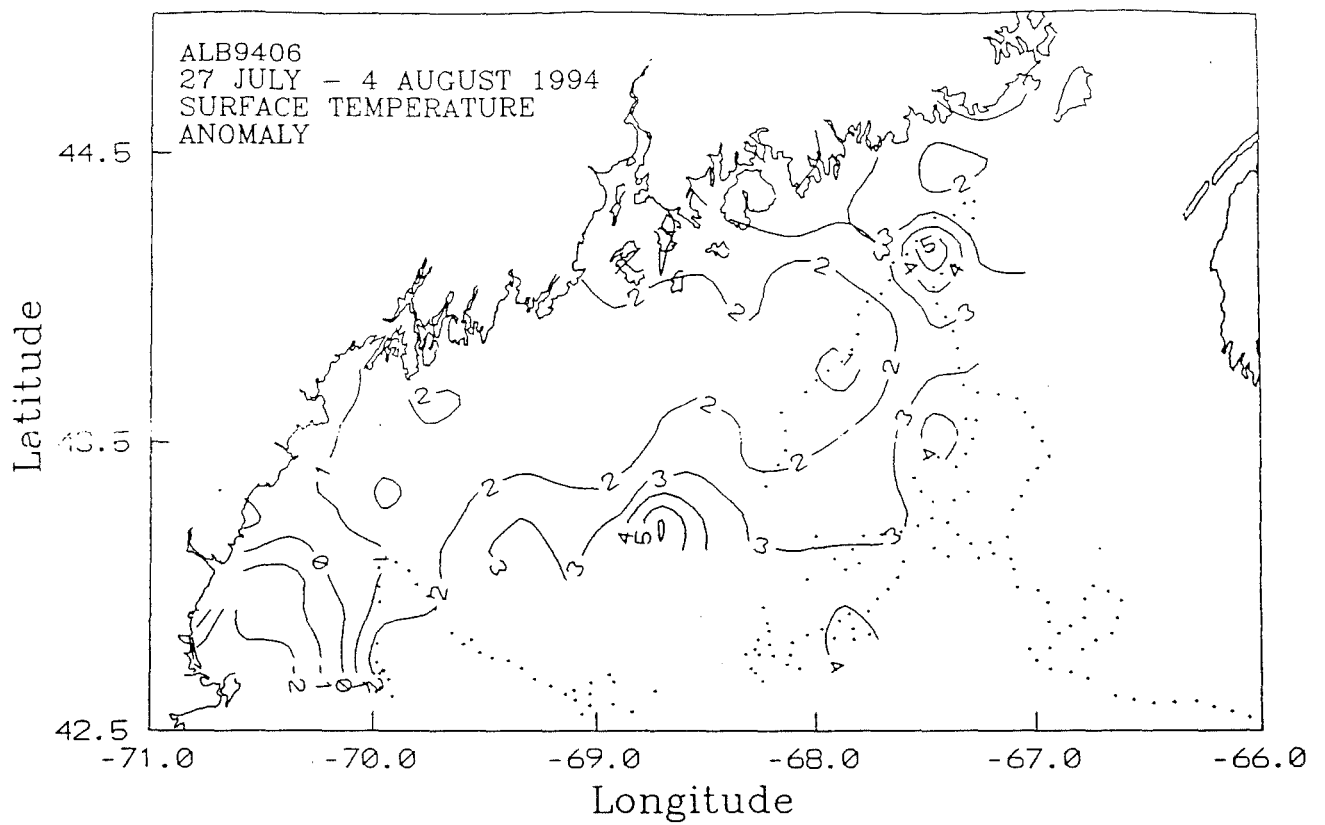


Figure 59. The surface and bottom temperature anomaly distribution during the summer bottom trawl survey ALB9406.

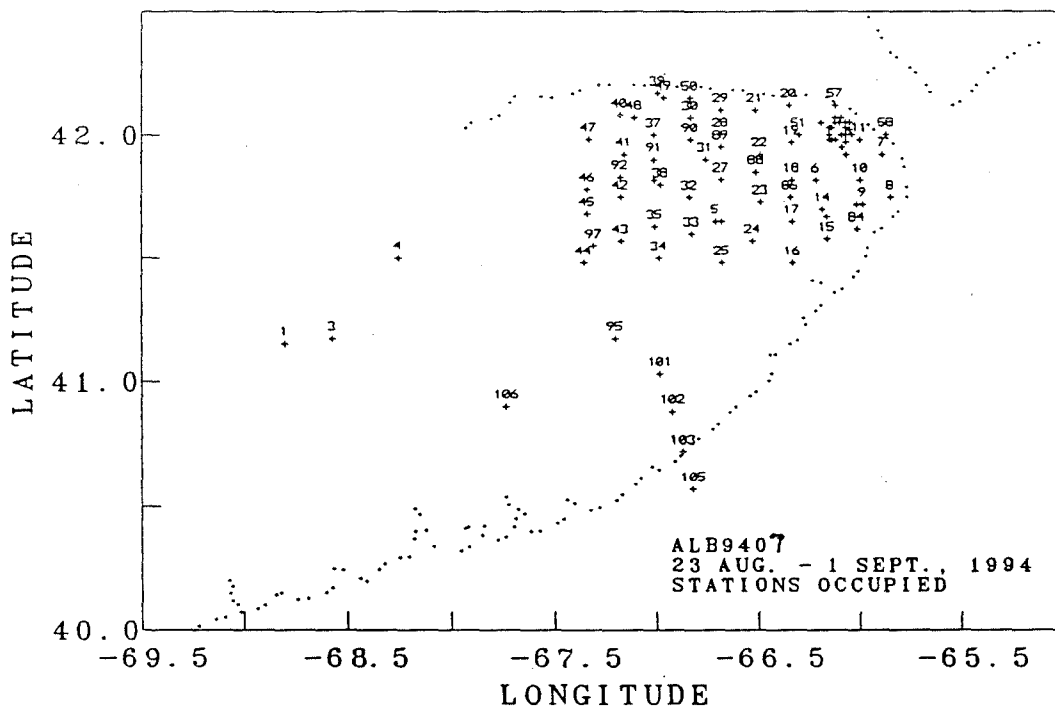


Figure 60. Hydrographic stations occupied during the predator/prey cruise ALB9407.

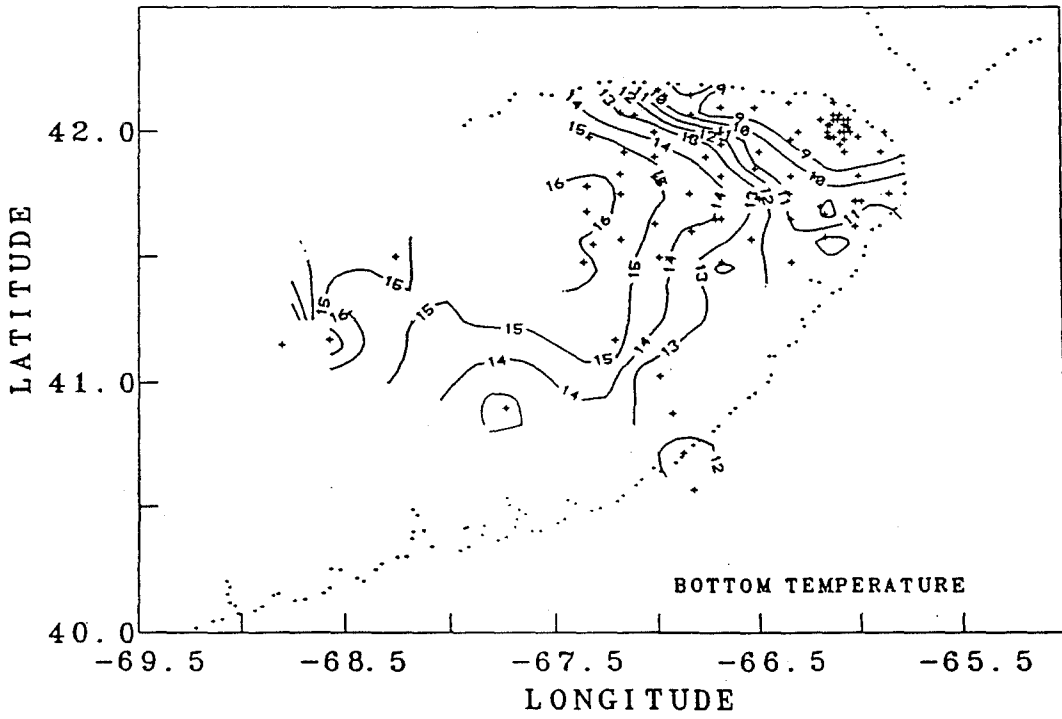
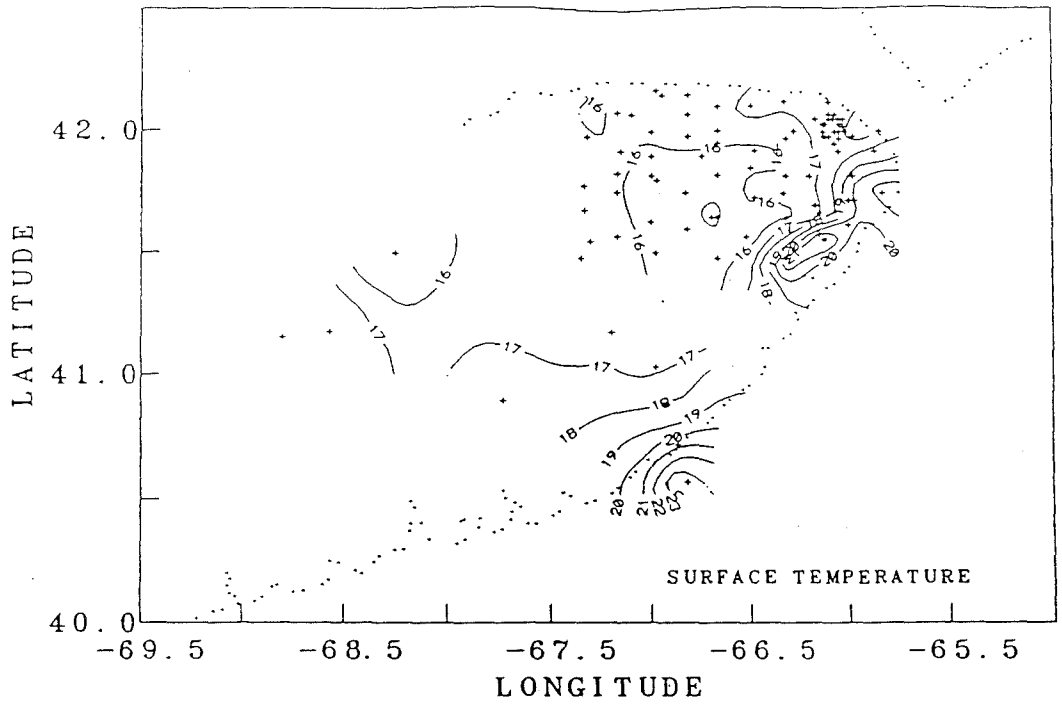


Figure 61. The surface and bottom temperature distributions during the predator/prey cruise ALB9407.

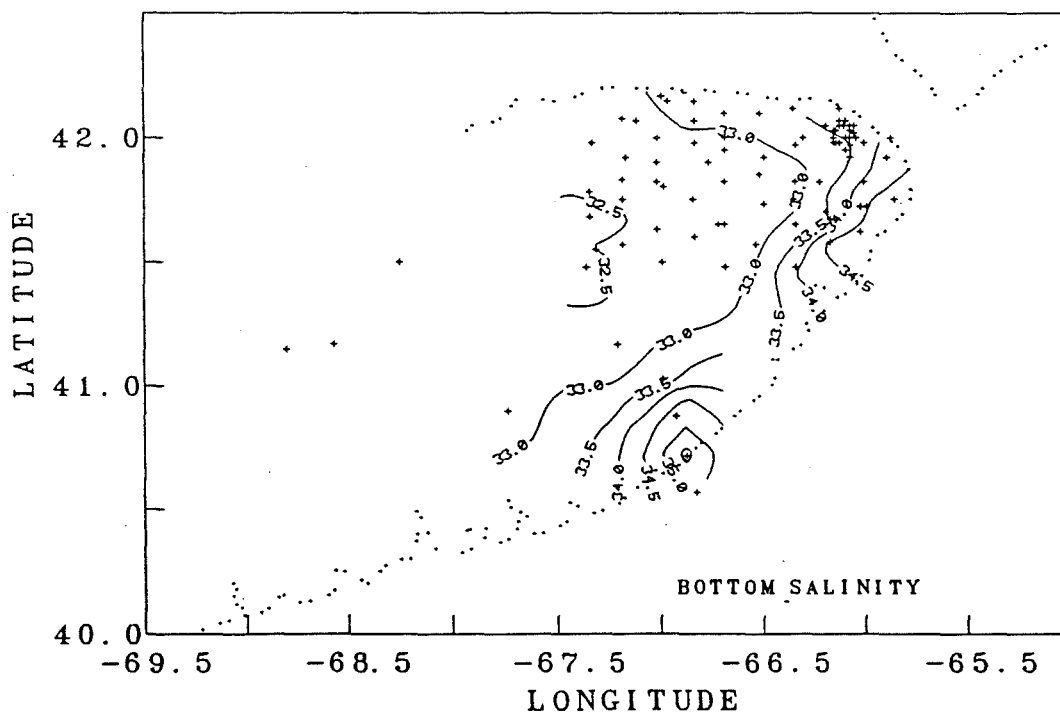
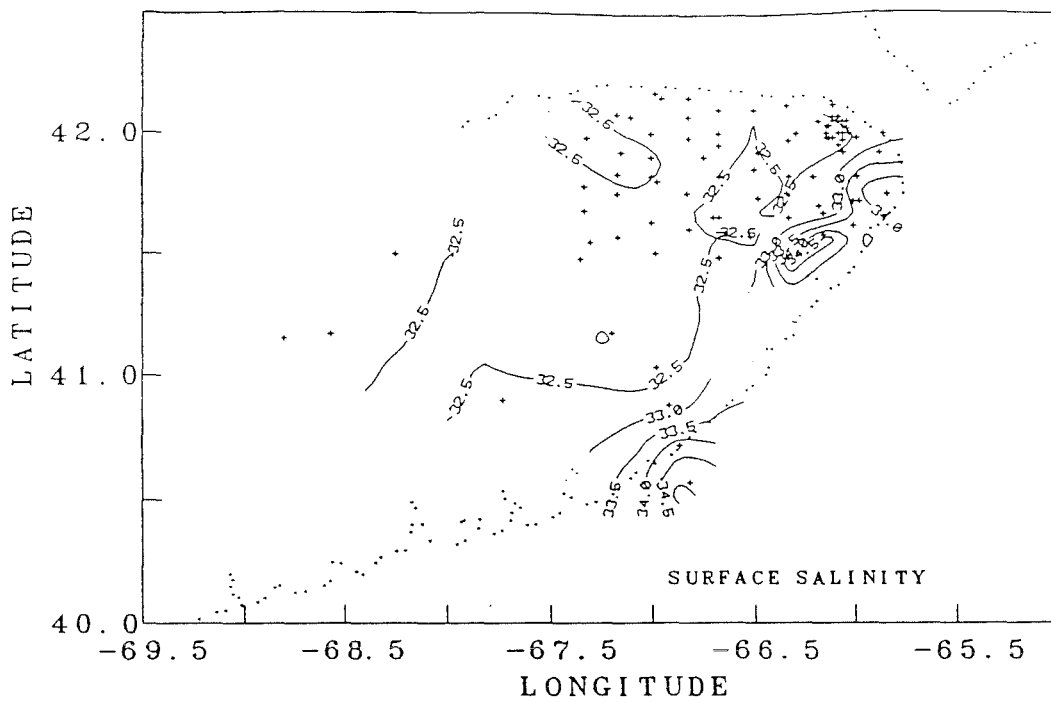


Figure 62. The surface and bottom salinity distribution during the predator/prey cruise ALB9407.

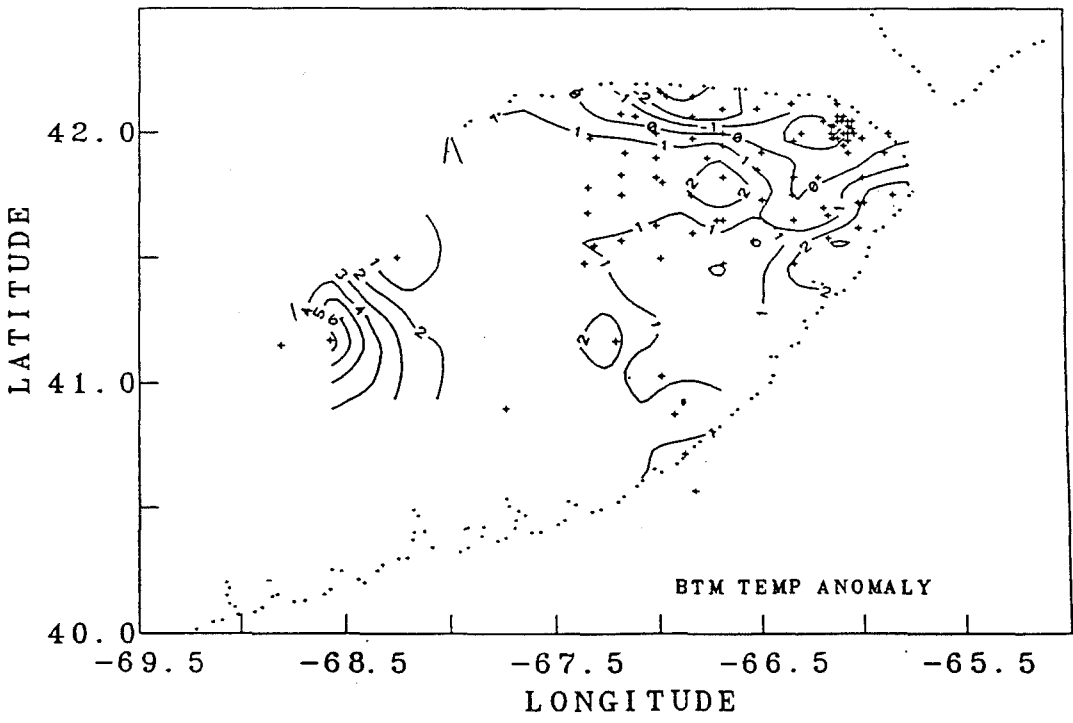
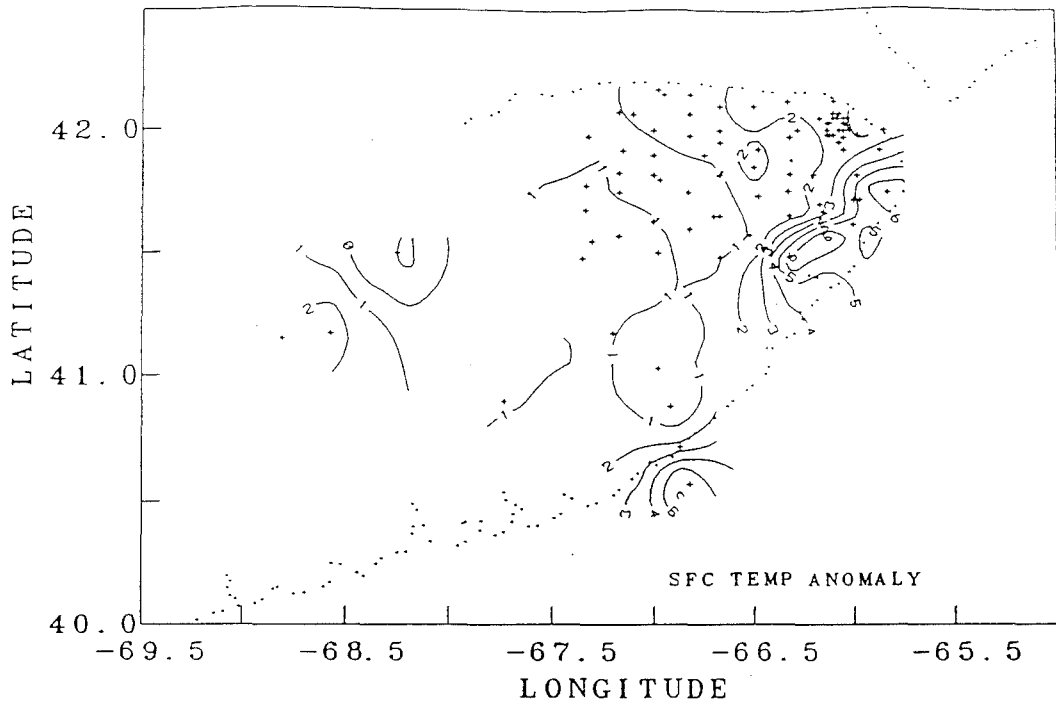


Figure 63. The surface and bottom temperature anomaly distribution during the predator/prey cruise ALB9407.

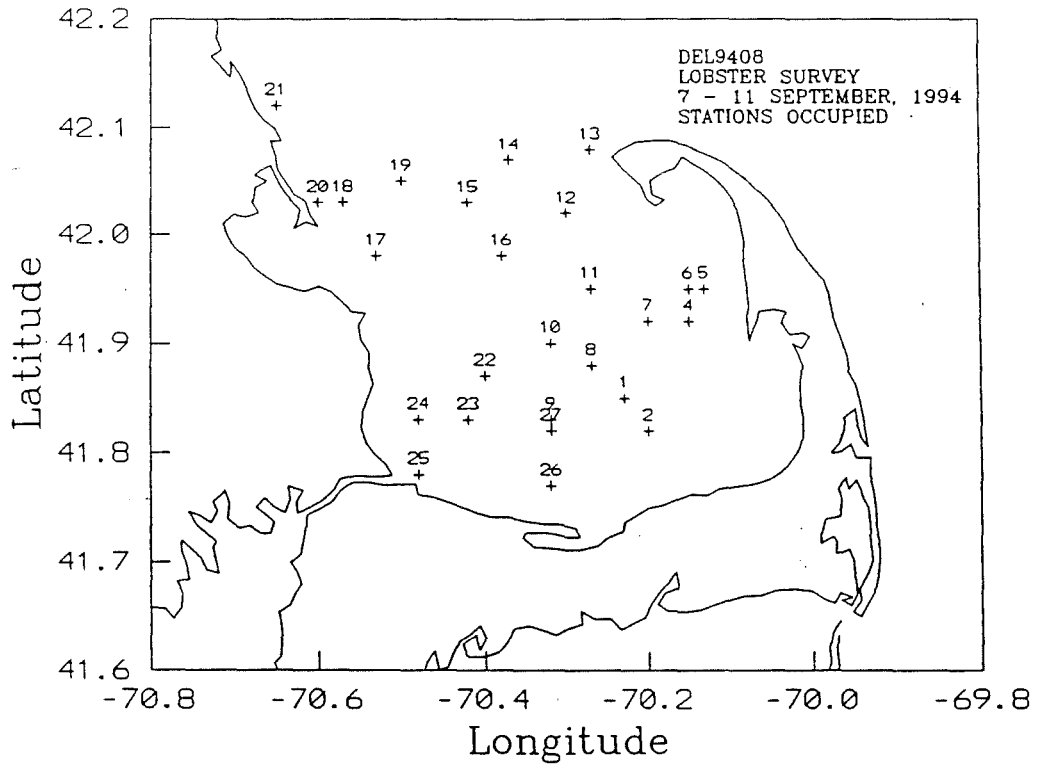


Figure 64. Hydrographic stations occupied during the lobster survey DEL9408.

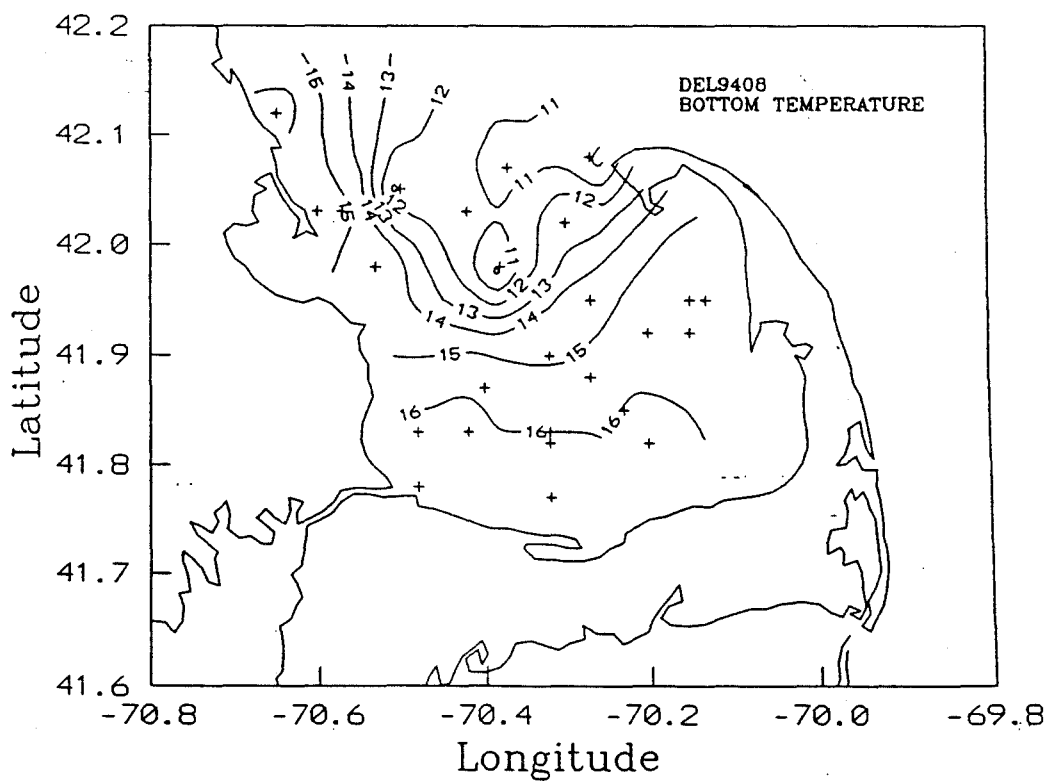
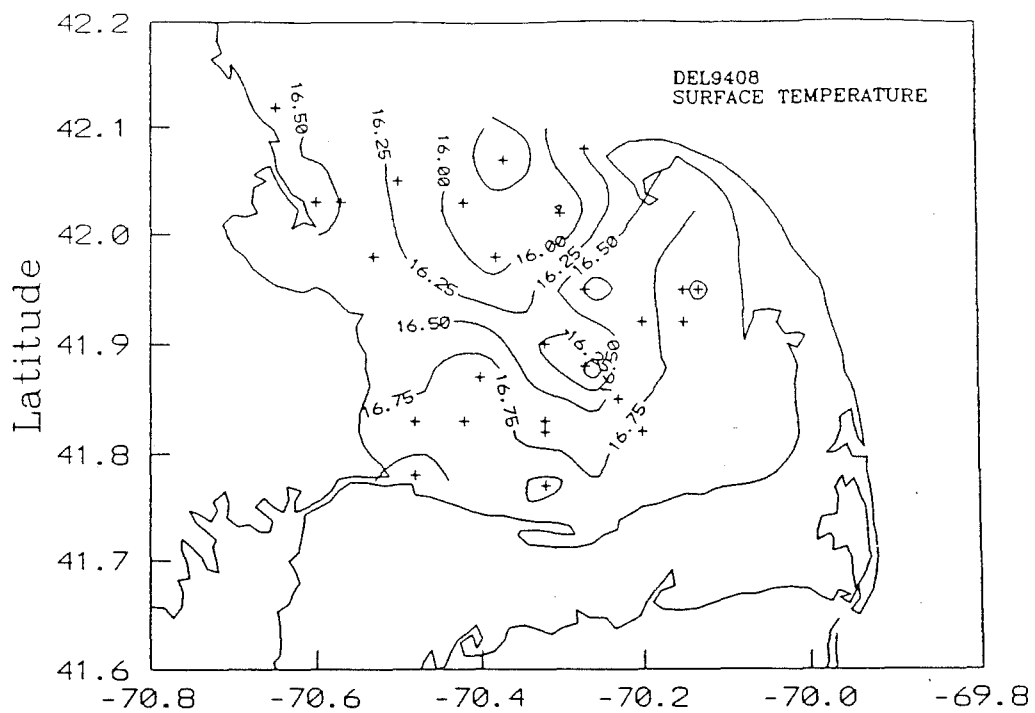


Figure 65. The surface and bottom temperature distribution during the lobster survey DEL9408.

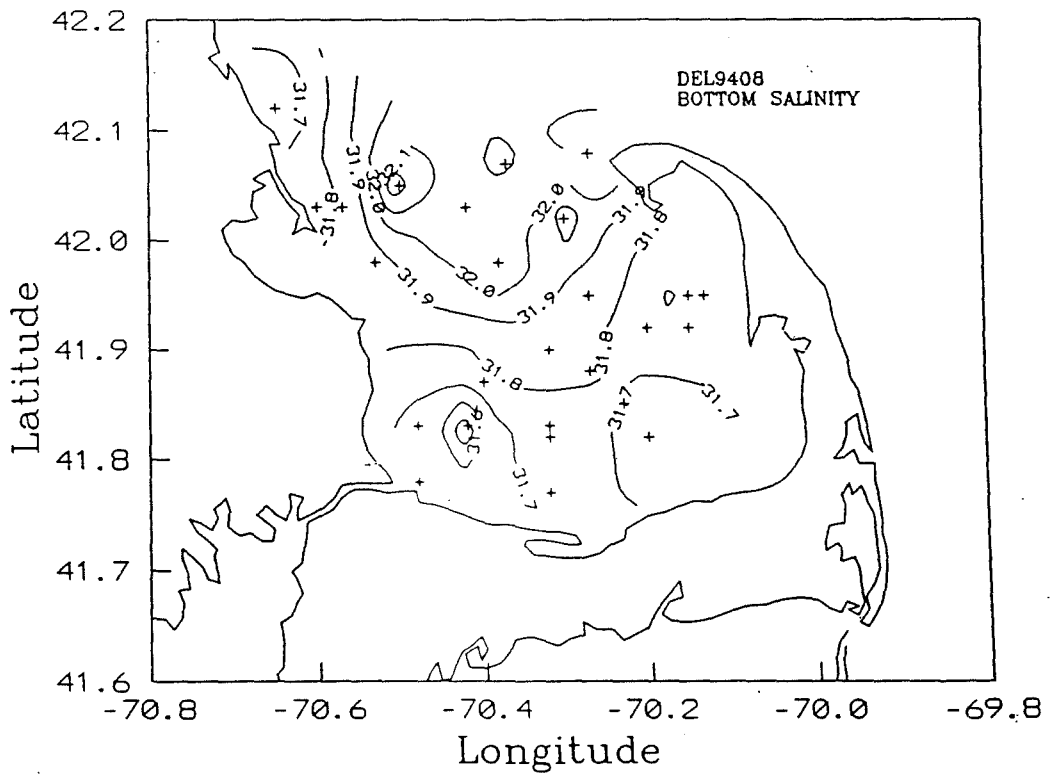
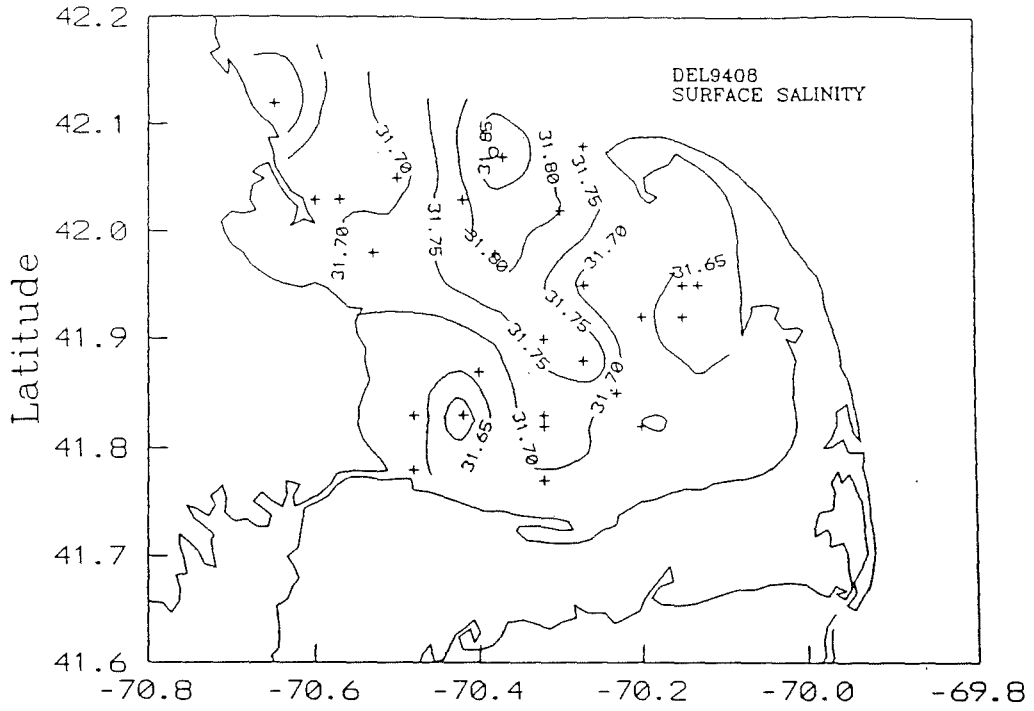


Figure 66. The surface and bottom salinity distribution during the lobster survey DEL9408.

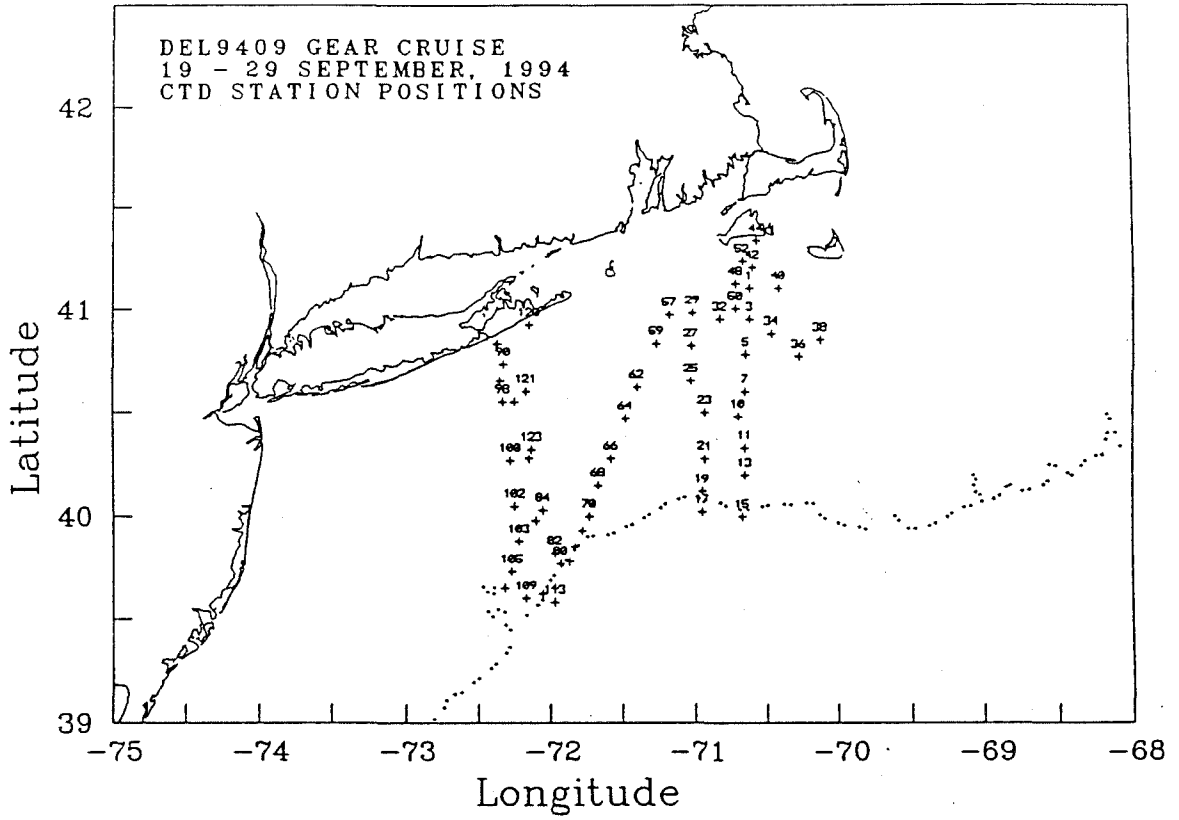


Figure 67. Hydrographic stations occupied during the gear cruise DEL9409.

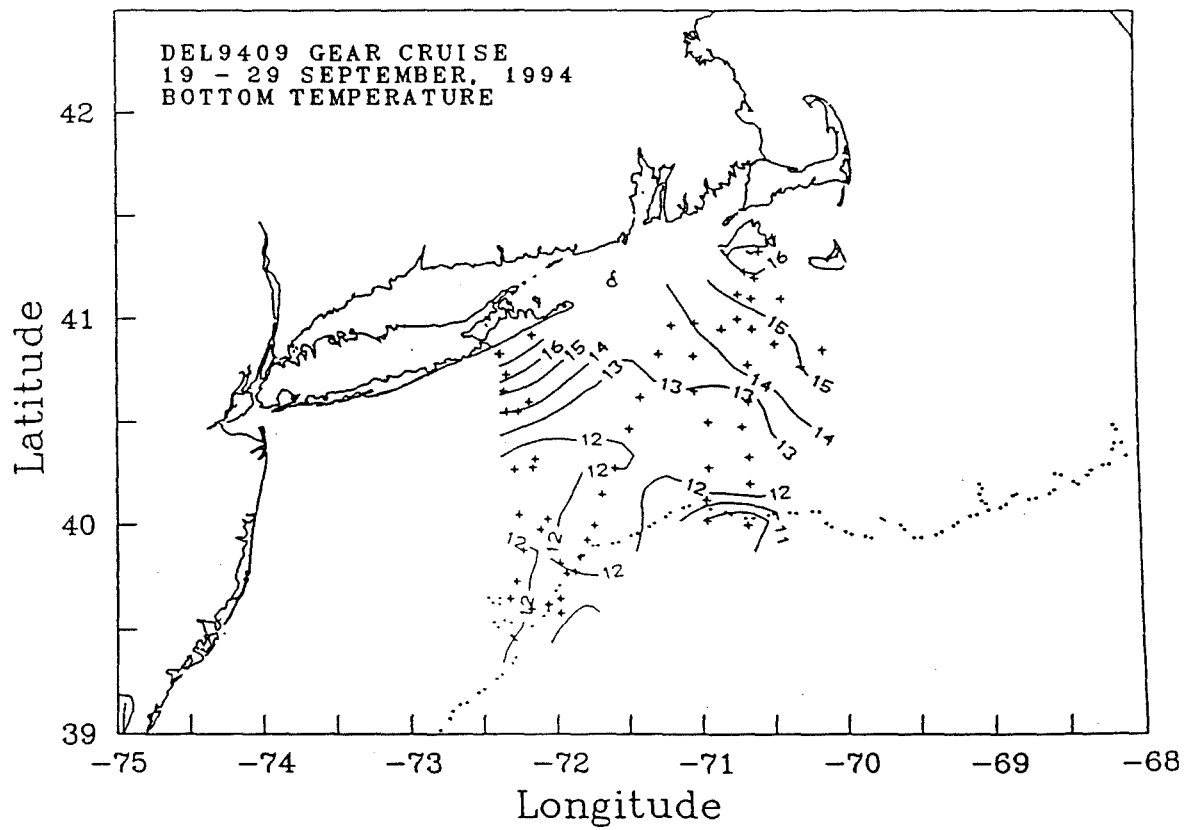
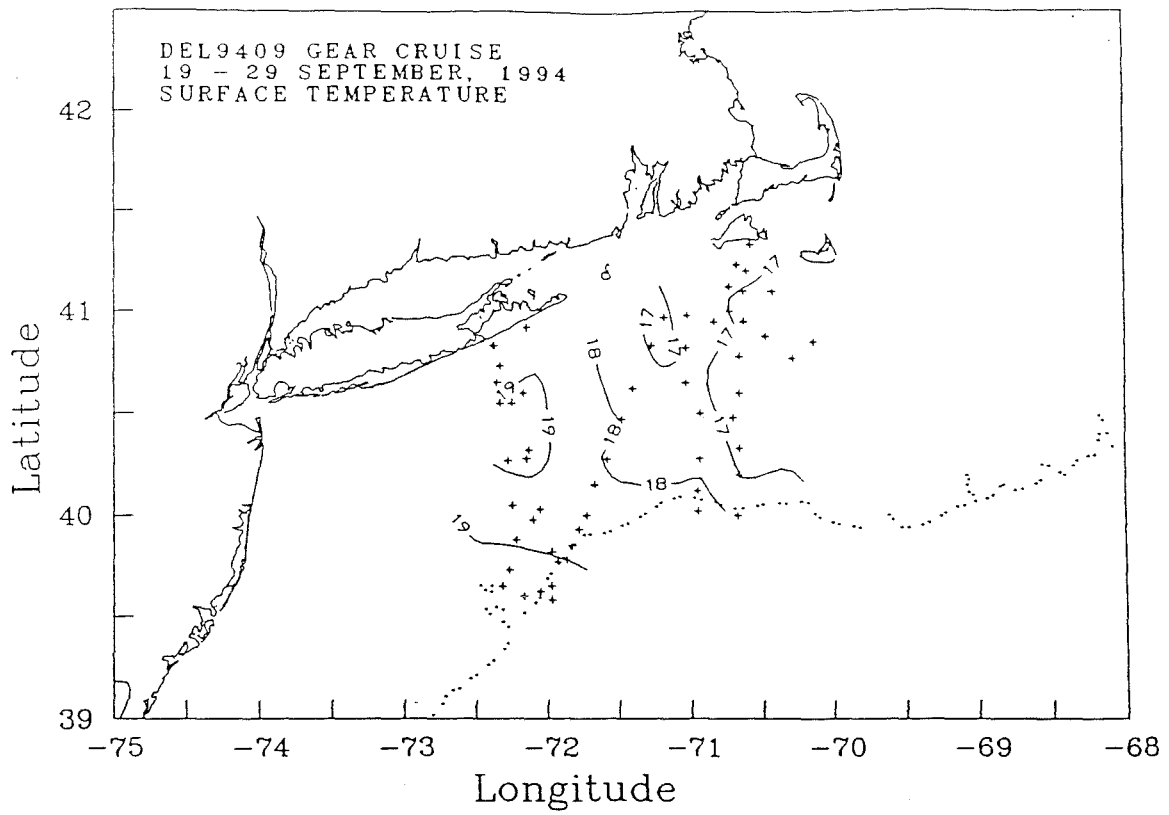


Figure 68. Surface and bottom temperature distribution during the gear cruise DEL9409.

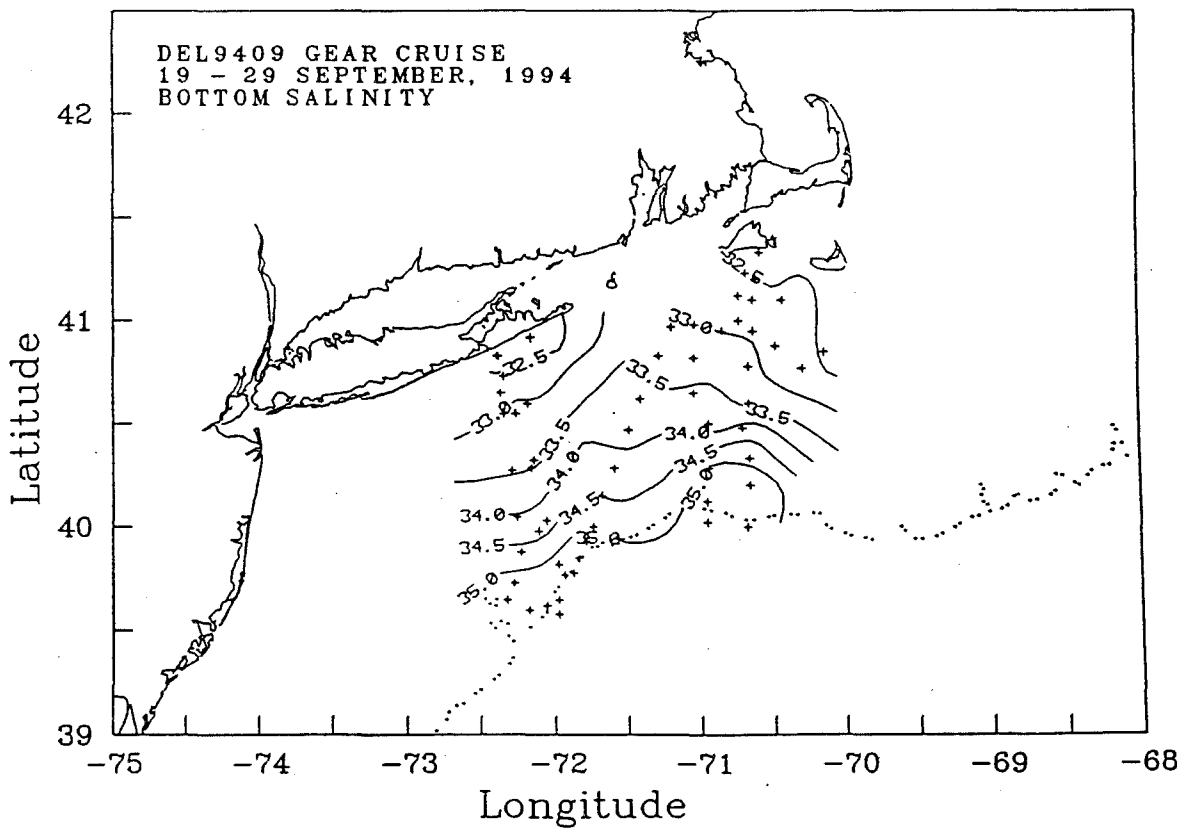
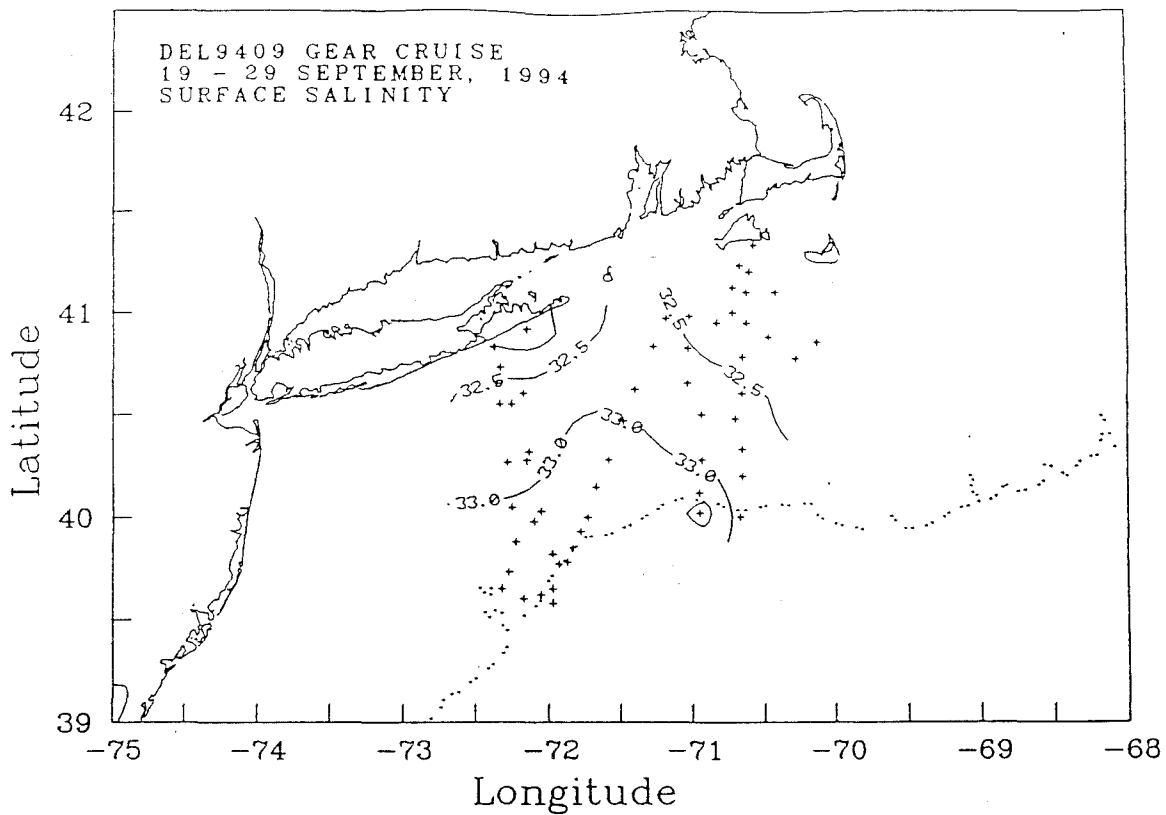


Figure 69. Surface and bottom salinity distribution during the gear cruise DEL9409.

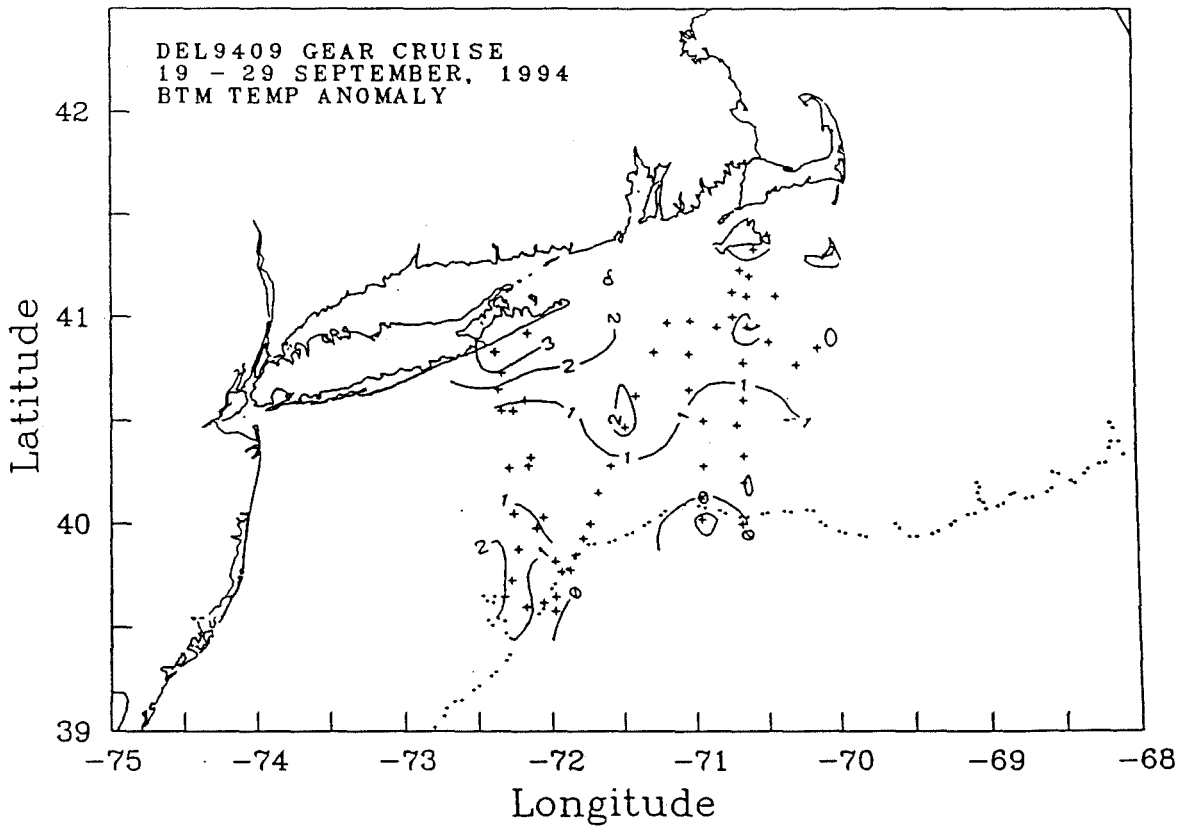
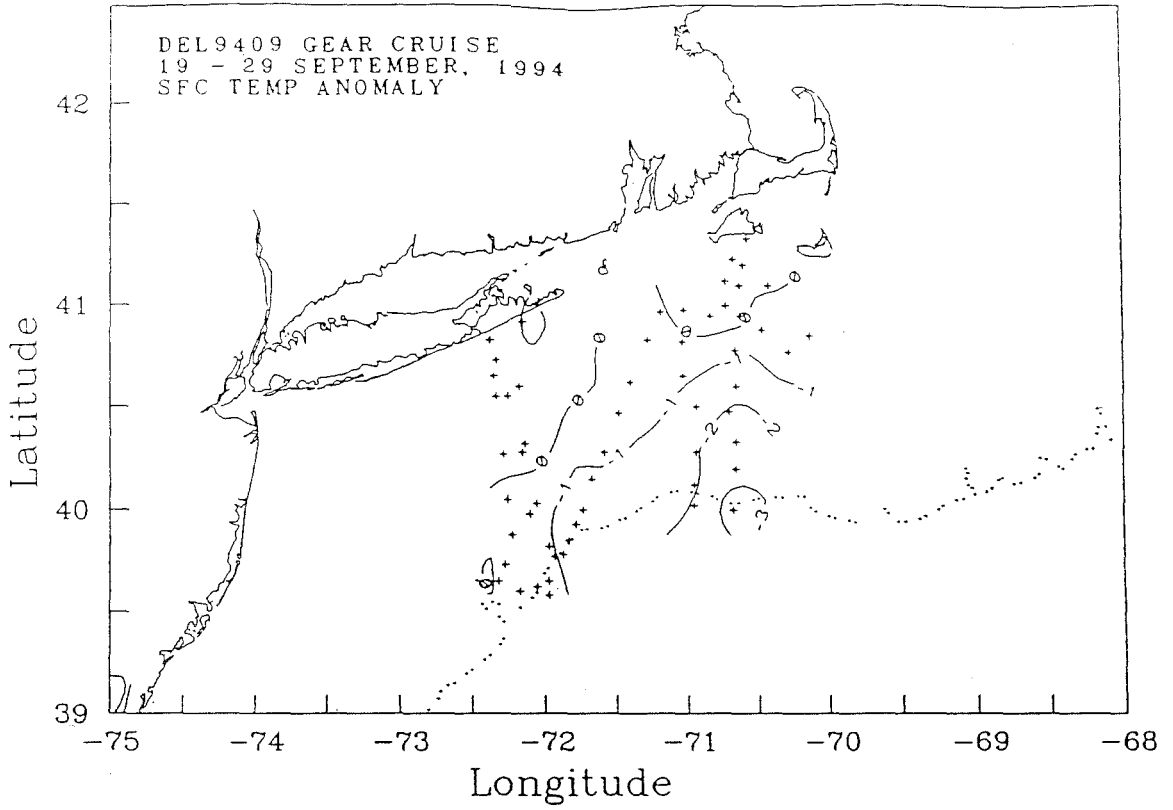


Figure 70. Surface and bottom temperature anomaly distribution during the gear cruise DEL9409.

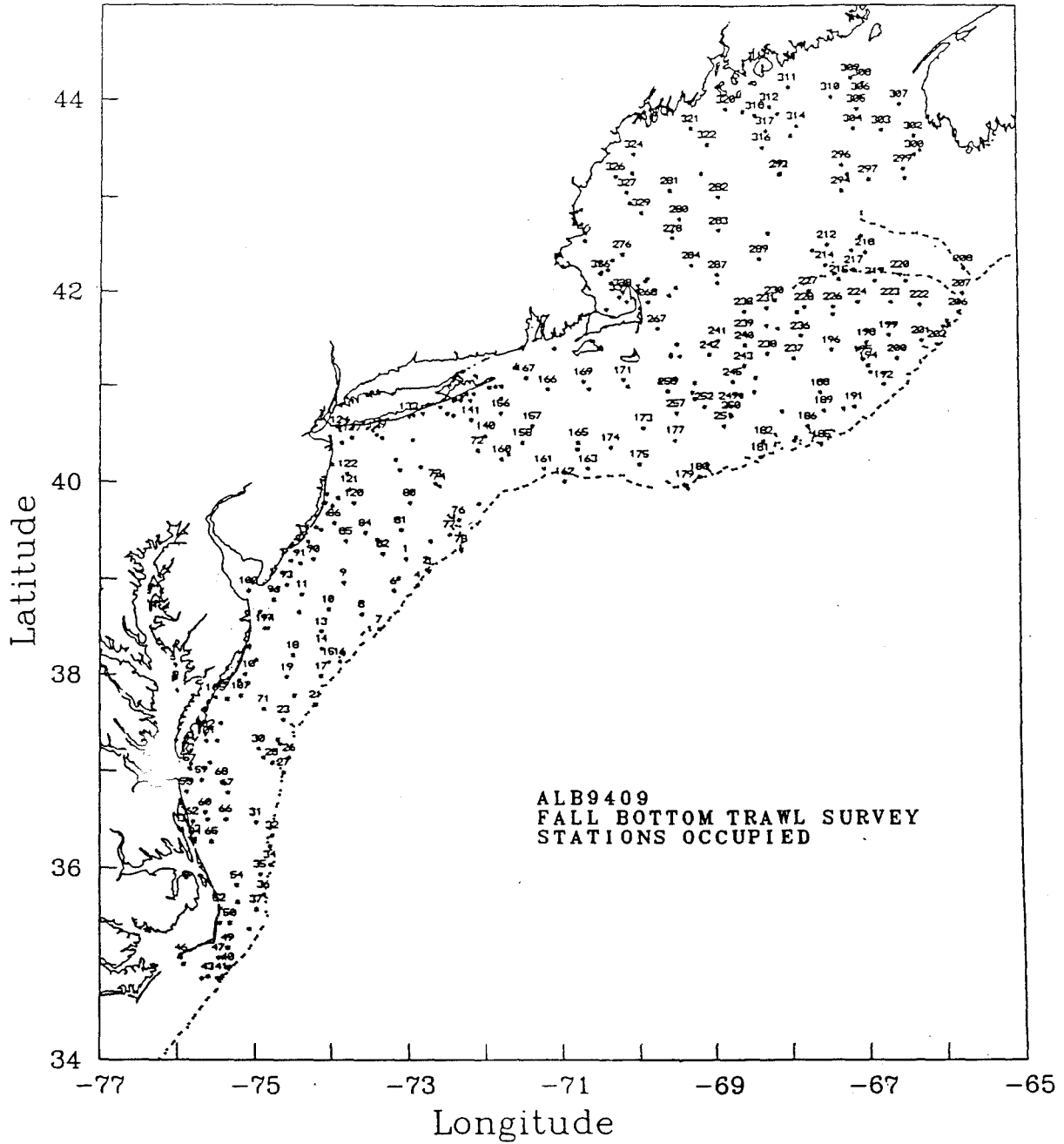


Figure 71. Hydrographic stations occupied during the fall bottom trawl survey ALB9409.

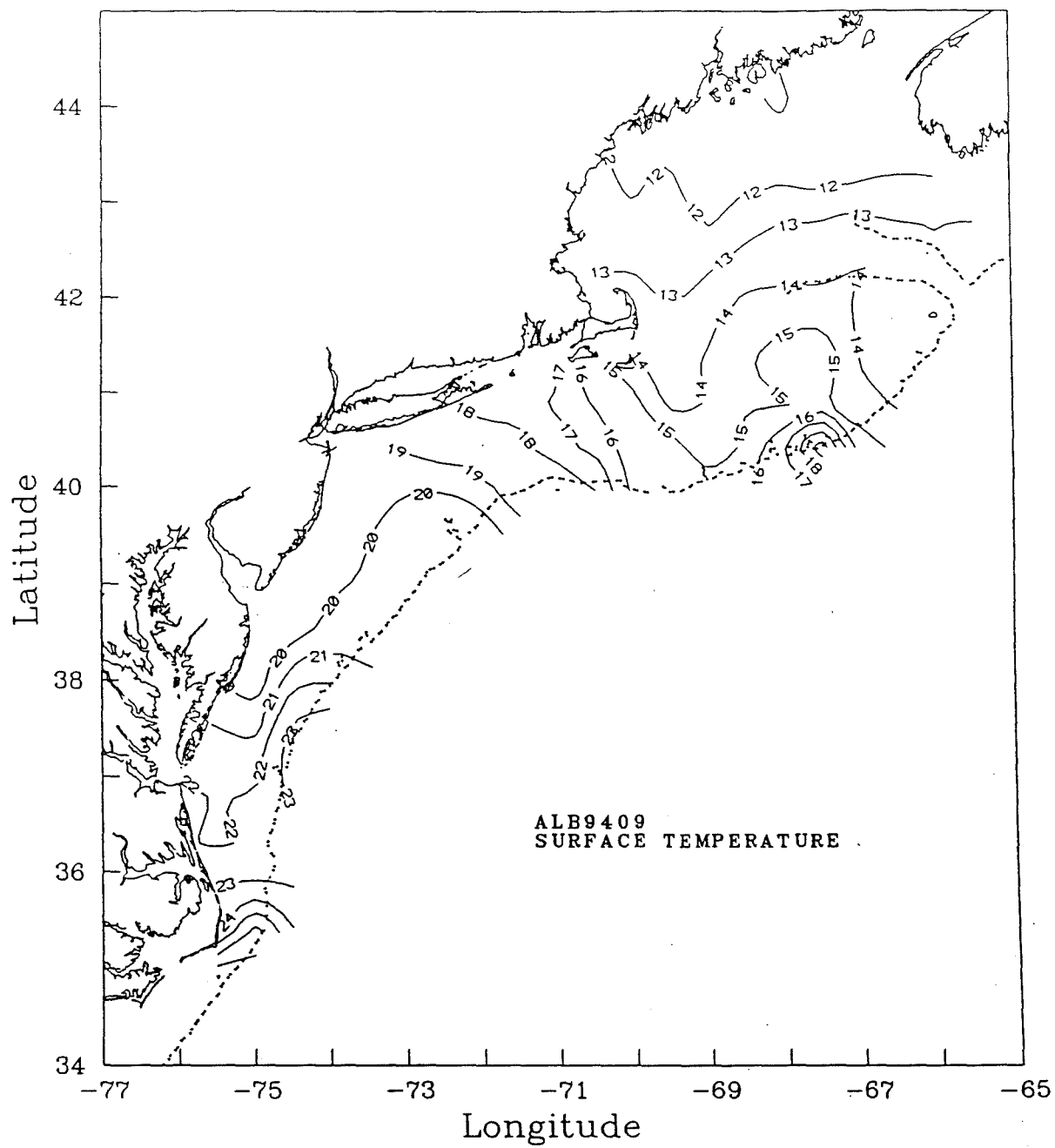


Figure 72. The surface temperature distribution during the fall bottom trawl survey ALB9409.

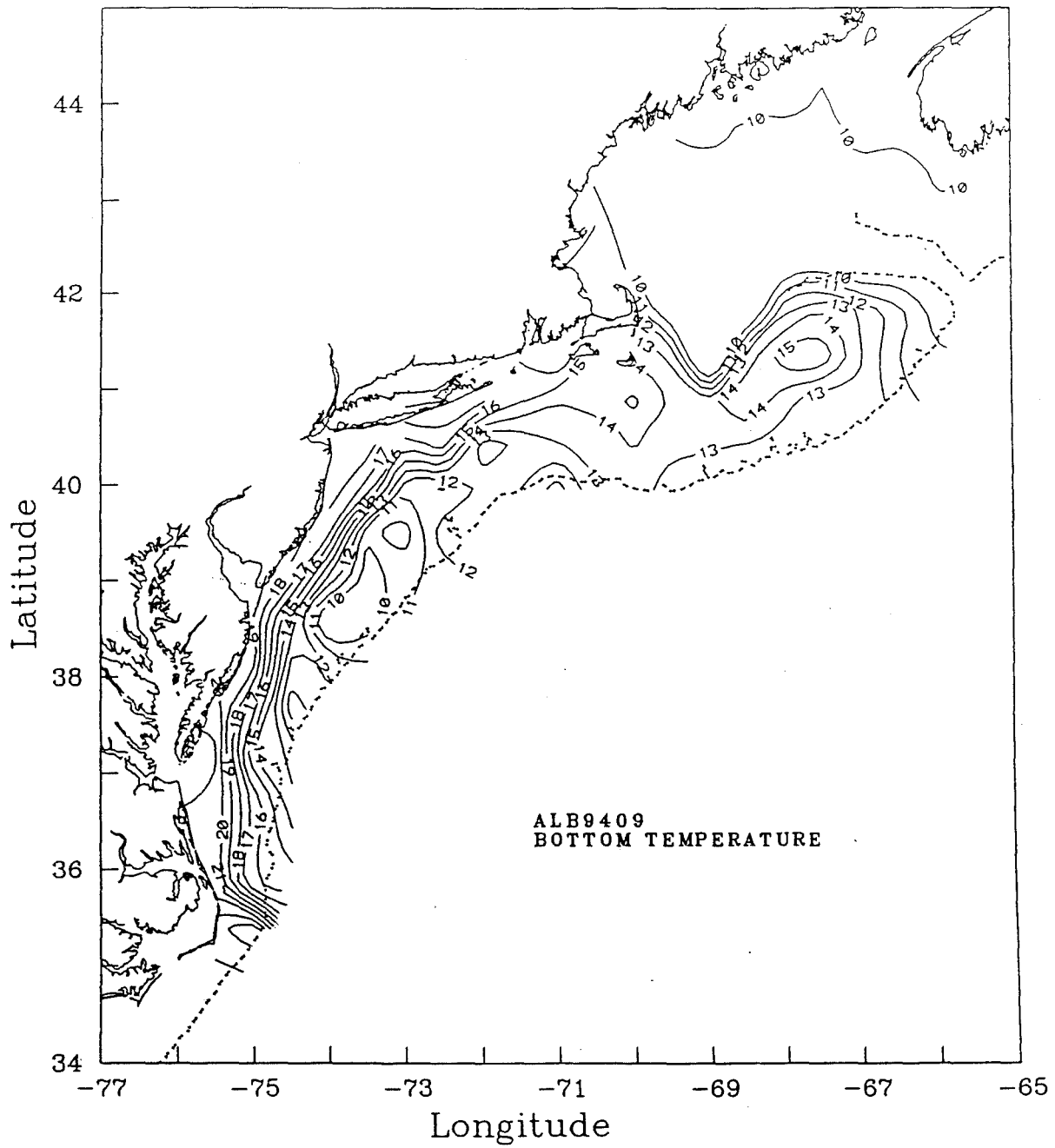


Figure 73. The bottom temperature distribution during the fall bottom trawl survey ALB9409.

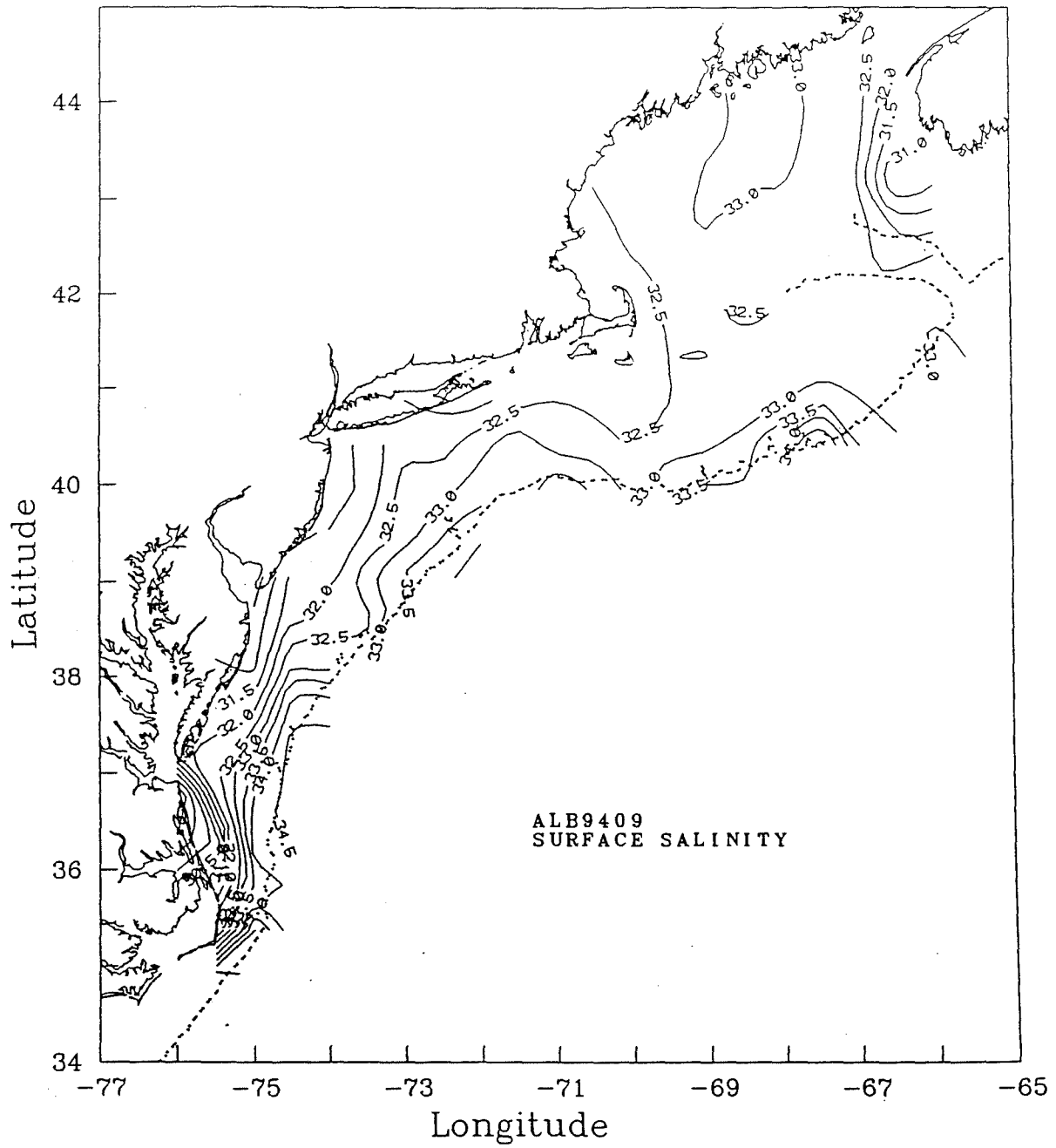


Figure 74. The surface salinity distribution during the fall bottom trawl survey ALB9409.

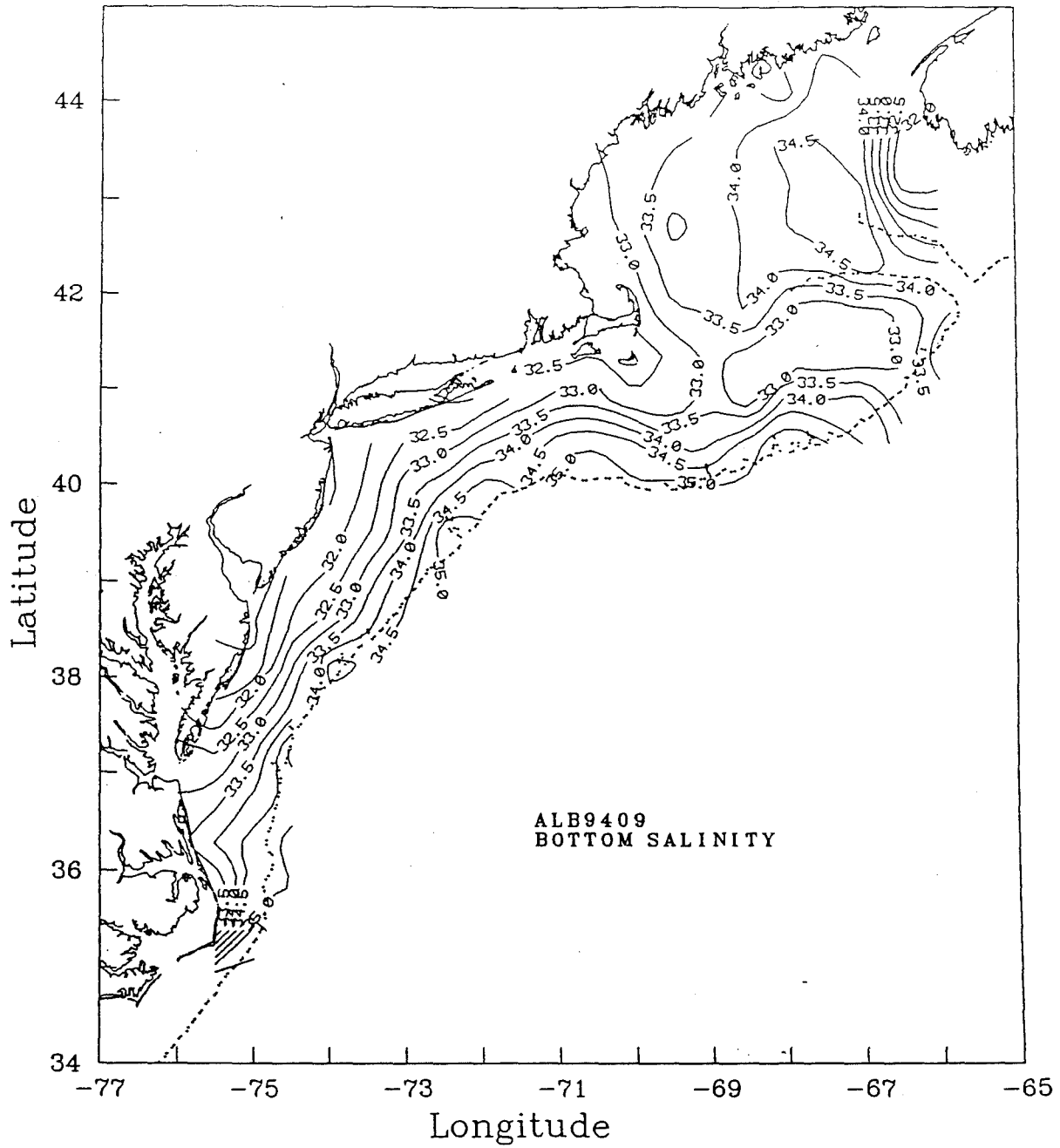


Figure 75. The bottom salinity distribution during the fall bottom trawl survey ALB9409.

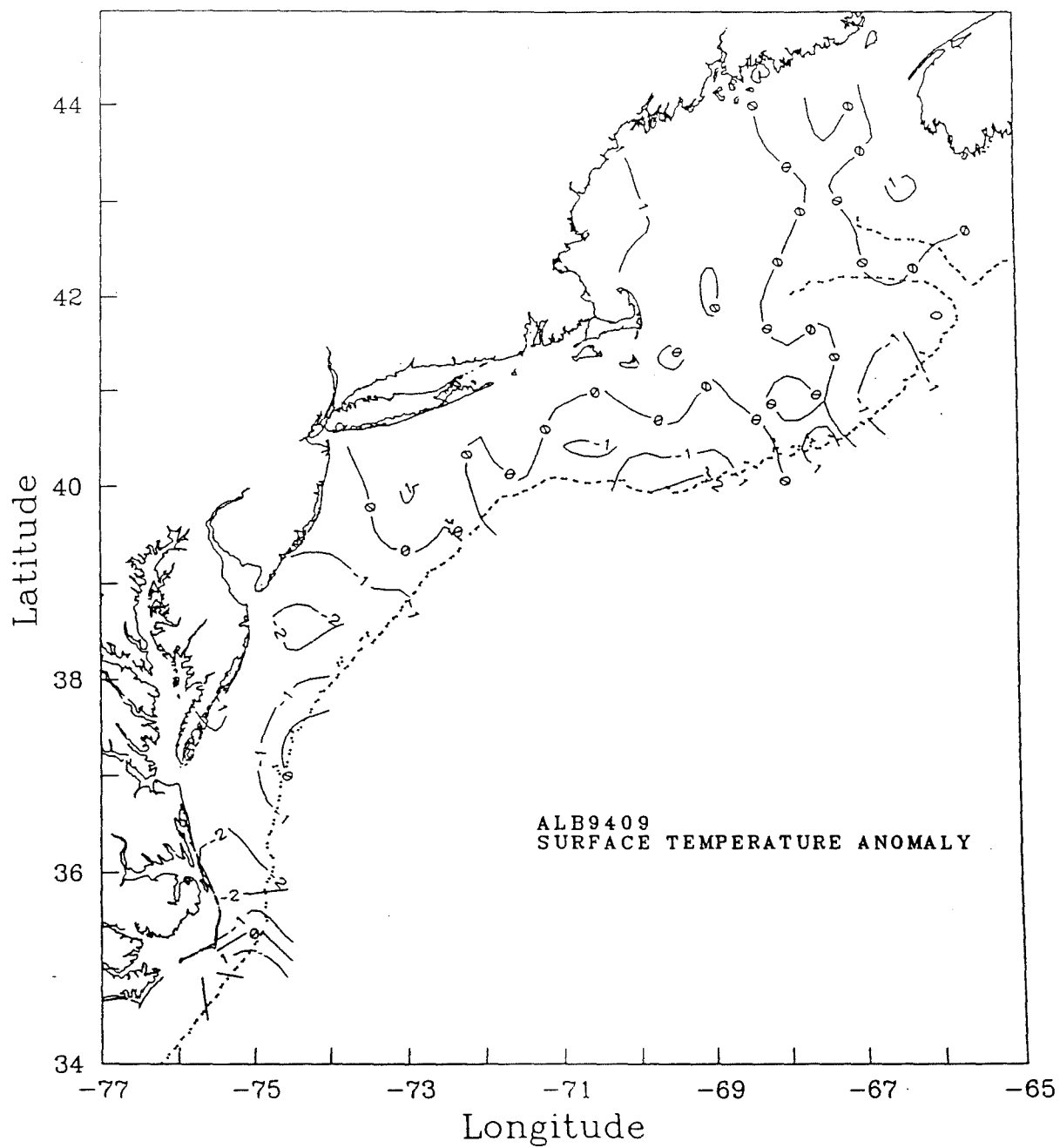


Figure 76. The surface temperature anomaly distribution during the fall bottom trawl survey ALB9409.

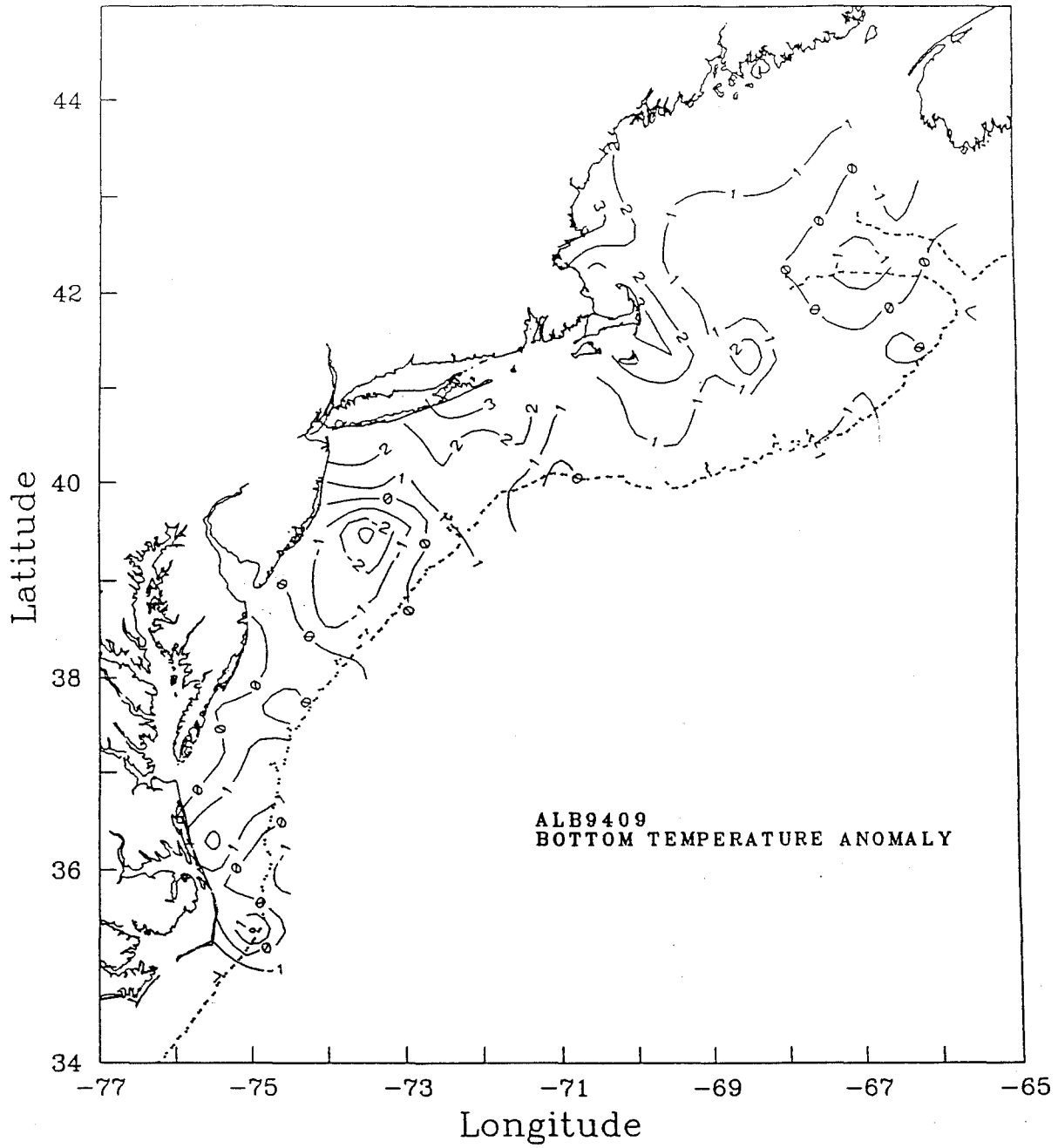


Figure 77. The bottom temperature anomaly distribution during the fall bottom trawl survey ALB9409.

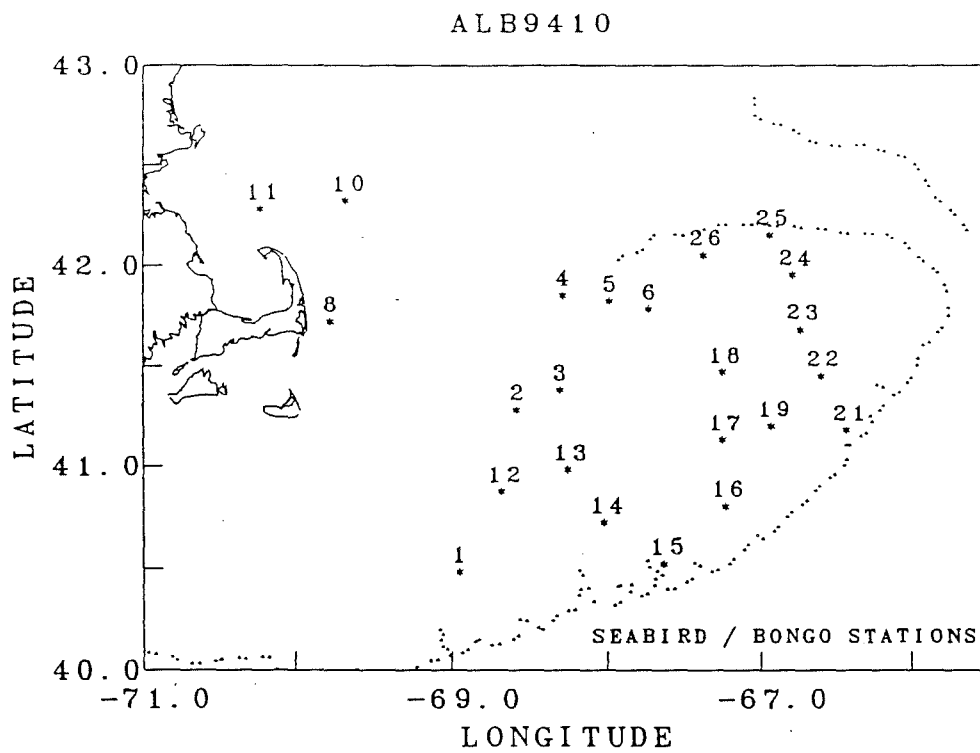


Figure 78. Hydrographic stations occupied during the GLOBEC cruise ALB9410.

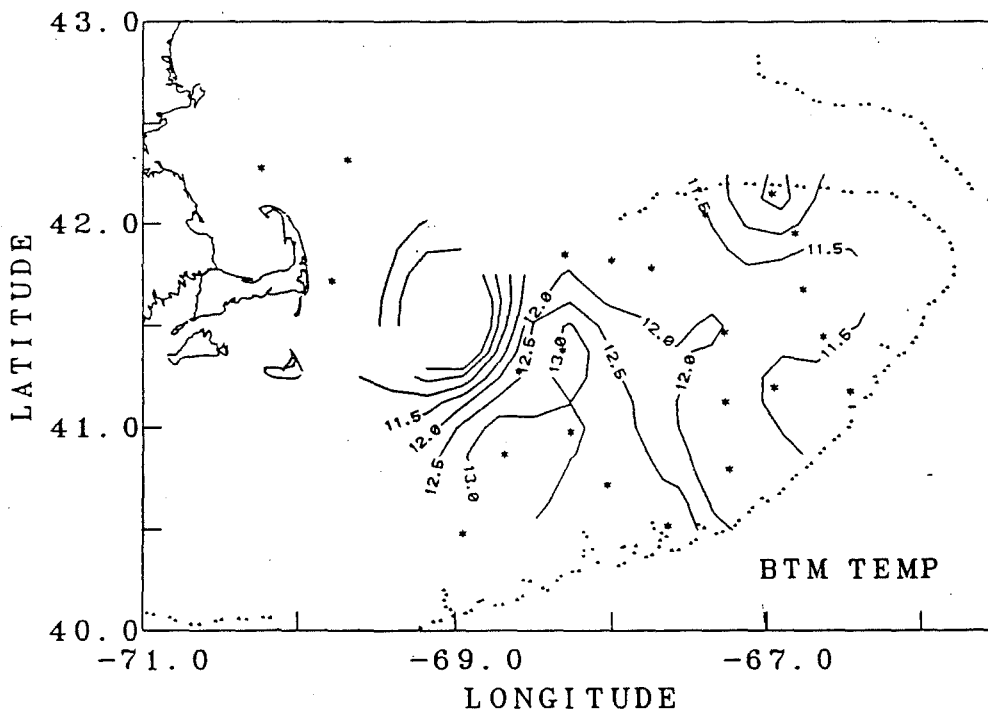
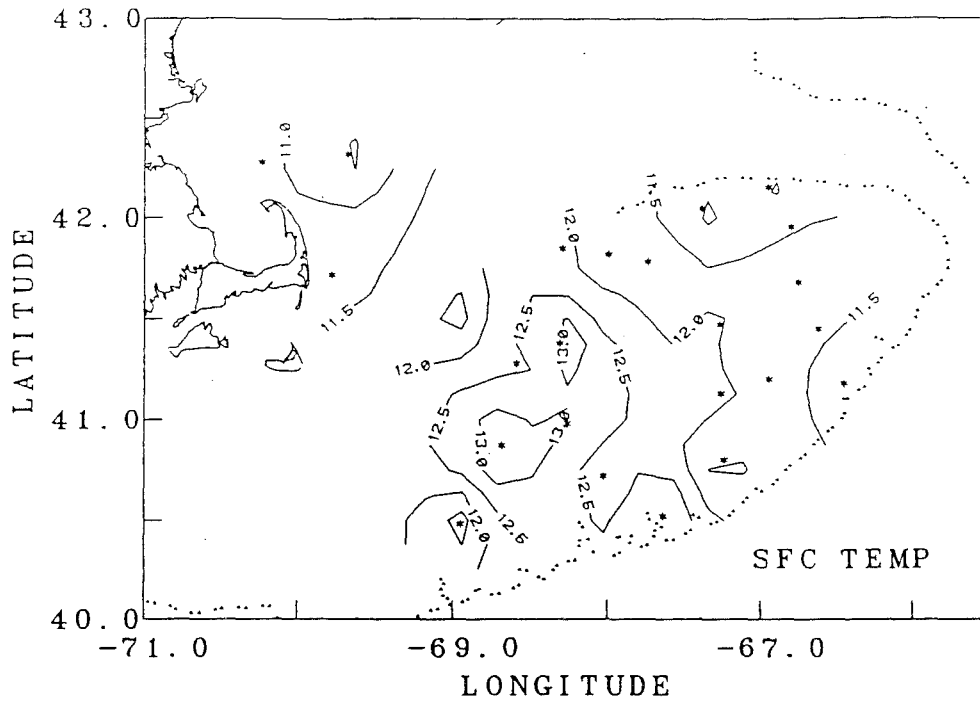


Figure 79. The surface and bottom temperature distribution during the GLOBEC cruise ALB9410.

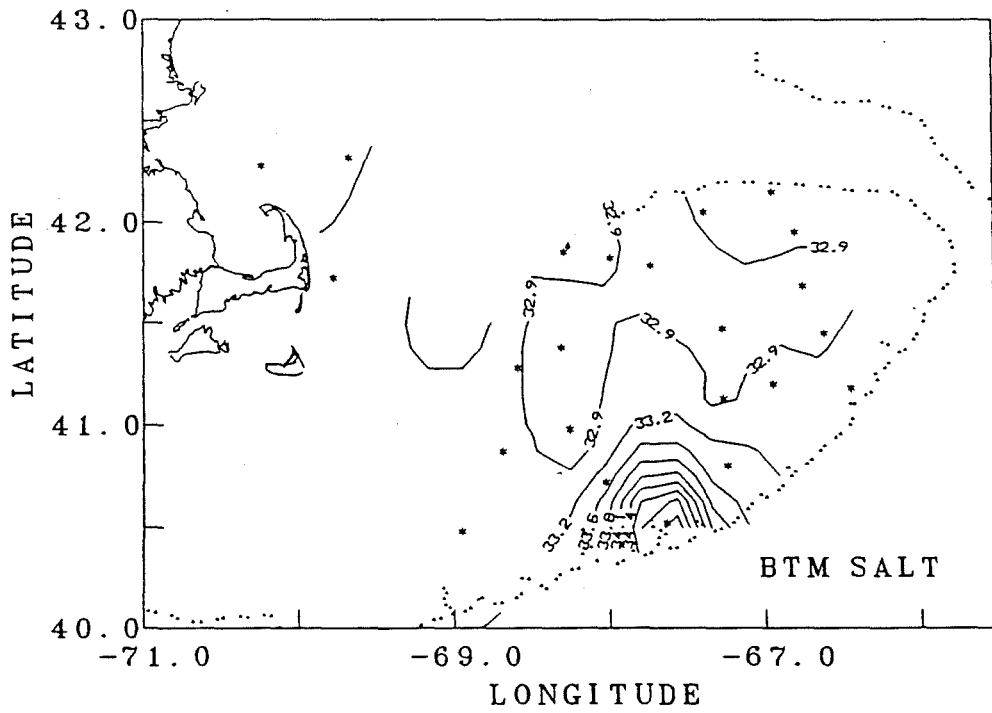
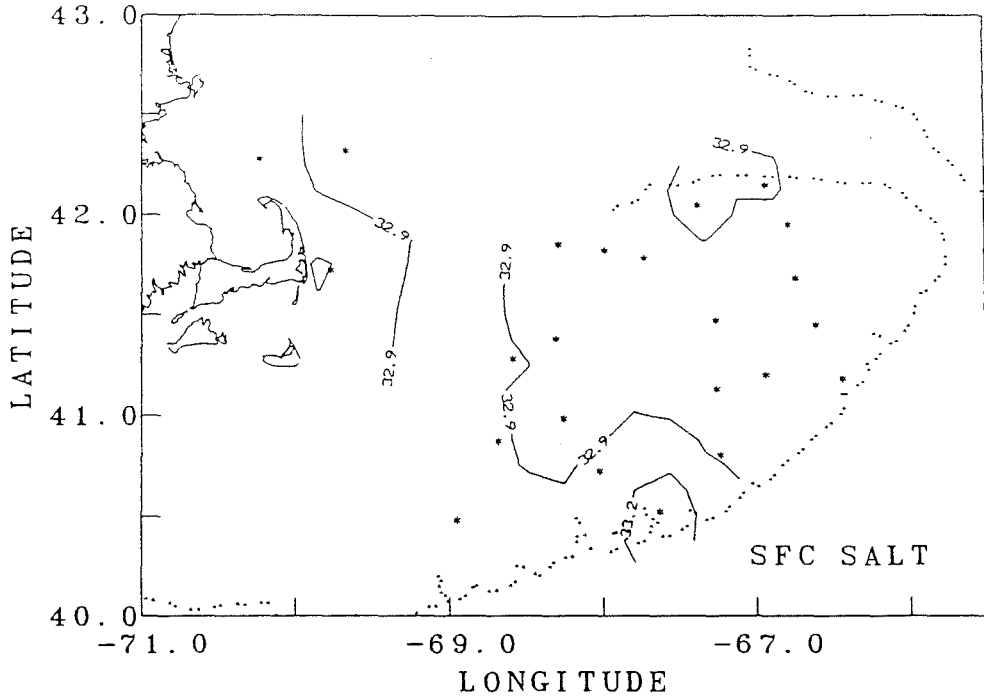


Figure 80. The surface and bottom salinity distribution during the GLOBEC cruise ALB9410.

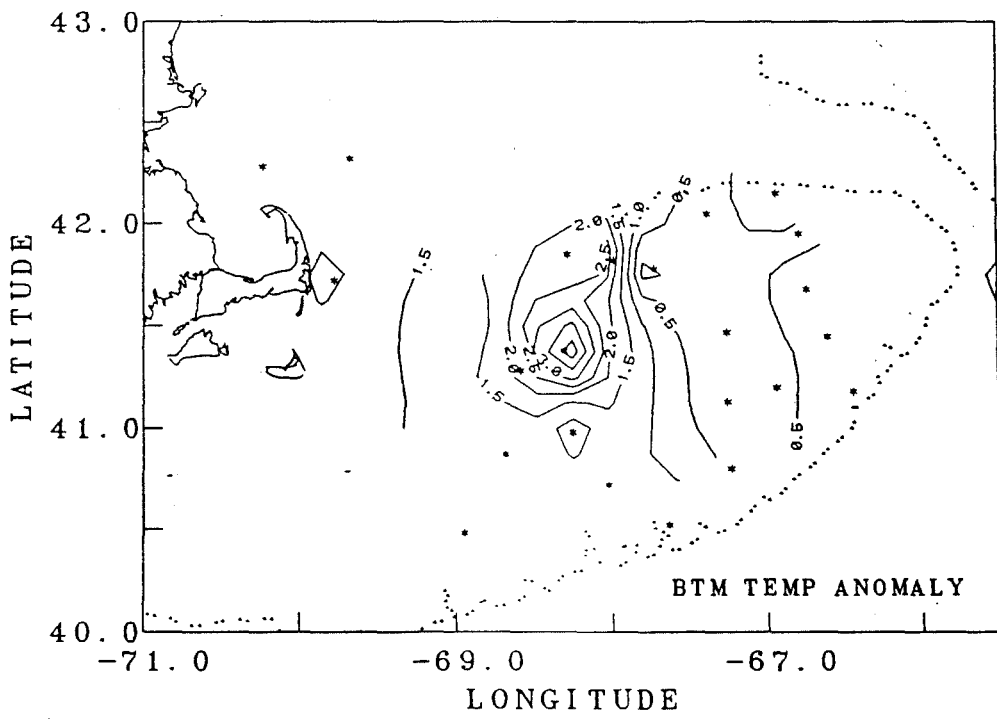
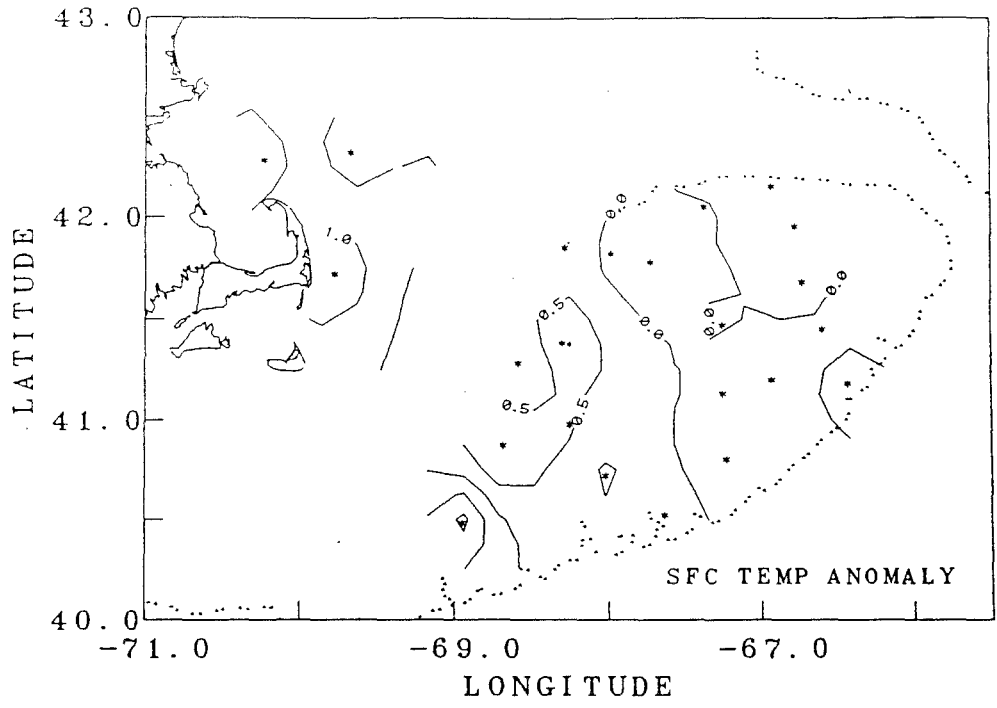


Figure 81. The surface and bottom temperature anomaly distribution during the GLOBEC cruise ALB9410.

APPENDIX A. Summary of cruise information and hydrographic work completed.

Appendix A. Summary of Cruise Information and Hydrographic Work Completed.

Vessel: R/V Delaware II

Cruise: 9401

Program: Larval Herring/Sand Lance Study

Dates: 6 - 18 January

Sea days: 13

Instrument(s): Profiler 1447/Profiler 1468

Cruise Objectives: To (1) determine the distribution, abundance and production of herring and sand lance larvae, (2) index spawning biomass for the target species and (3) provide systematic collections of herring larvae for age and growth estimates through otolith analysis.

Total # of stations: 95

of vertical CTD/Profiler casts: 12

of double oblique profiler casts: 95

XBT drops: 0

salinity samples: 12

salt correction: 0/+0.021

Special Notes: Profiler 1447 malfunctioned during the first half of the cruise. At station 30 it was replaced by profiler 1468, which performed well.

Vessel: R/V Delaware II

Cruise: 9402

Program: Winter Bottom Trawl Survey

Dates: 31 January - 23 February

Sea days: 19

Instrument(s): Profiler 0853

Cruise Objectives: To (1) determine the winter distribution and relative abundance of selected fish and invertebrate species, (2) collect biological samples for studies of age and growth relationships, fecundity, maturity and food habits, (3) collect hydrographic and meteorological data, (4) collect ichthyoplankton and zooplankton samples, and (5) make data and sample collections for cooperative researchers and programs.

Total # of stations: 156

of vertical CTD/Profiler casts: 153
 # of double oblique profiler casts: 22
 # XBT drops: 0
 # salinity samples: 22
 salt correction: +0.02

Special Notes: Profiler 0853 performed well despite a few minor problems.

Vessel: R/V Delaware II

Cruise: 9403

Program: Spring Bottom Trawl Survey

Dates: 28 February - 27 April

Sea days: 37

Instrument(s): Profiler 0851/Profiler 0853

Cruise Objectives: To (1) determine the spring distribution and relative abundance of fish and invertebrate species; (2) collect biological samples for studies of age and growth relationships, fecundity, maturity and food habits, (3) collect hydrographic and meteorological data, and (4) make collections of data and samples for cooperative researchers and programs.

Total # of stations: 311

of vertical CTD/Profiler casts: 246

of double oblique profiler casts: 70

XBT drops: 0

salinity samples: 42/8

salt correction: 0/0

Special Notes: Legs II and III of this cruise, originally scheduled to be carried out aboard R/V Albatross IV, were re-scheduled to Delaware II due to mechanical problems aboard Albatross IV. Leg I returned one day early due to adverse weather conditions. Leg III departed two days late due to operational problems and arrived two days early after all scheduled work was completed. Near the end of leg I, the pressure port on profiler 0851 was damaged. Profiler 0853 was used during leg III, but there continued to be frequent problems with data collected in real time mode. The boom wire termination was respliced.

Vessel: R/V Albatross IV

Cruise: 9403

Program: GLOBEC Stratification Study
Dates: 3 - 28 May
Sea days: 25
Instrument(s): Profiler 1496

Cruise Objectives: To (1) determine the distribution and abundance of larval and pelagic juvenile cod and haddock within a specific sampling grid on the southern portion of Georges Bank, (2) locate well-mixed and stratified stations based on hydrography and the presence of fish larvae, (3) sample to determine the abundance and vertical and temporal distribution of fish larvae, copepods and invertebrate predators, (4) examine gut contents and determine digestion rates of selected predators, (5) test immunological methods for the detection and identification of copepod prey, (6) survey hydrographic conditions between the areas of study and, (7) collect and process fish larvae for biochemical studies of metabolism.

Total # of stations: 87
of vertical CTD/Profiler casts: 13
of double oblique profiler casts: 67
XBT drops: 0
salinity samples: 13
salt correction: +0.023

Special Notes: Leg I was delayed one day due to mechanical problems. Leg II departed on schedule but returned the same day due to rough seas. Leg II departed again on 18 May. This cruise was done in conjunction with Delaware II cruise DEL9404.

Vessel: R/V Delaware II	Cruise: 9404
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Program: Predator-Prey Study
Dates: 2 - 27 May
Sea days: 24
Instrument(s): Profiler 0853

Cruise Objectives: To (1) examine the impact of predation by pelagic fish on the survival of age-zero fish and (2) collect biological samples for use in the development of DNA probes for identification of well-digested fish larvae in stomach contents.

Total # of stations: 198
of vertical CTD/Profiler casts: 20
of double oblique profiler casts: 197
XBT drops: 0

salinity samples: 13
salt correction: 0

Special Notes: During the last several stations of leg II, there was severe spiking in the data due to termination problems. Also, there were not enough salinity calibration samples taken during the cruise to calculate an accurate salt correction.

Vessel: R/V Delaware II

Cruise: 9406

Program: Predator-Prey Study
Dates: 20 - 30 June
Sea days: 11
Instrument(s): Profiler 0851

Cruise Objectives: To (1) examine the effect of predation by pelagic and demersal fish on the survival of age-zero fish and (2) collect biological samples for use in the development of DNA probes for the identification of well-digested fish larvae in stomach contents.

Total # of stations: 106
of vertical CTD/Profiler casts: 10
of double oblique profiler casts: 106
XBT drops: 0
salinity samples: 10
salt correction: 0

Special Notes: A number of salt samples were taken in a salinity gradient and as a result, were not good for quality control comparison. The cruise ended one day early after all scheduled work was completed.

Vessel: R/V Albatross IV

Cruise: 9405

Program: Sea Scallop Survey
Dates: 22 June - 18 July
Sea days: 20
Instrument(s): Profiler 0360

Cruise Objectives: To (1) determine the distribution and relative abundance of the sea scallop Placopecten magellanicus and Iceland scallop Chlamys islandica, (2) collect biological samples and data relative to assessment needs, (3) monitor hydrographic and meteorological conditions and (4) make collections for interested scientists at other institutions and laboratories.

Total # of stations: 153
 # of vertical CTD/Profiler casts: 156
 # of double oblique profiler casts: 0
 # XBT drops: 0
 # salinity samples: 36
 salt correction: 0

Special Notes: The cruise departed two days late due to mechanical problems and returned two days early after all work was completed.

Vessel: R/V Delaware II

Cruise: 9407

Program: Shellfish Resource Assessment Survey
Dates: 18 July - 24 August
Sea days: 33
Instrument(s): Profiler 0851

Cruise Objectives: To (1) investigate the distribution and relative abundance of the surf clam Spisula solidissima, ocean quahog Arctica islandica and other mollusks, (2) collect biological samples and data relative to assessment needs, (3) monitor hydrographic and meteorological conditions, (4) make collections for interested scientists from other institutions and NMFS laboratories and (5) determine the abundance and range of the ocean quahog fishery along the eastern Maine coast.

Total # of stations: 136
 # of vertical CTD/Profiler casts: 141
 # of double oblique profiler casts: 0
 # XBT drops: 0
 # salinity samples: 34
 salt correction: +0.01

Vessel: R/V Gloria Michelle

Cruise: 9412

Program: Gulf of Maine Northern Shrimp Survey
Dates: 2 - 11 August
Sea days: 10
Instrument(s): N/A

Cruise Objectives: To investigate the population of northern shrimp in the Gulf of Maine.

Total # of stations: 49
 # of vertical CTD/Profiler casts: 0
 # of double oblique profiler casts: 0
 # XBT drops: 71
 # salinity samples: 0
 salt correction: 0

Vessel: R/V Albatross IV

Cruise: 9406

Program: Gulf of Maine Bottom Trawl
Dates: 26 July - 5 August
Sea days: 11
Instrument(s): Profiler 0360

Cruise Objectives: To (1) determine the seasonal distribution and relative abundance of fish and invertebrate species, (2) collect biological samples for studies of age and growth relationships, fecundity, maturity and food habits, (3) collect hydrographic and meteorological samples and data, (4) make sample collections for cooperative researchers and programs, (5) sample groundfish nursery areas in order to develop pre-recruit indices.

Total # of stations: 71
 # of vertical CTD/Profiler casts: 72
 # of double oblique profiler casts: 0
 # XBT drops: 0
 # salinity samples: 16
 salt correction: 0

Special Notes: This cruise departed one day late due to mechanical problems.

Vessel: Albatross IV

Cruise: 9407

Program: Predator - Prey Study
Dates: 22 August - 2 September
Sea days: 10
Instrument(s): Profiler 1447

Cruise Objectives: To (1) investigate the impact of predation on the survival of age-zero cod and haddock during their early-

demersal phase of life-history and (2) collect biological samples for the development of DNA and polyclonal immunoassay probes to identify well digested age-zero cod and haddock stomach contents.

Total # of stations: 105
 # of vertical CTD/Profiler casts: 56
 # of double oblique profiler casts: 36
 # XBT drops: 0
 # salinity samples: 13
 salt correction: 0

Vessel: Delaware II

Cruise: 9408

Program: Lobster Trawl Comparison Study
 Dates: 6 - 12 September
 Sea days: 7
 Instrument(s): Profiler 0851

Cruise Objectives: To (1) determine the seasonal distribution and relative abundance of American lobsters in Cape Cod Bay, (2) correlate abundance indices with the Massachusetts Division of Marine Fisheries Survey, and (3) collect basic relative abundance and size composition of other species in the region.

Total # of stations: 27
 # of vertical CTD/Profiler casts: 26
 # of double oblique profiler casts: 0
 # XBT drops: 0
 # salinity samples: 5
 salt correction: 0

Vessel: Delaware II

Cruise: 9409

Program: Gear Comparison Study
 Dates: 19 - 29 September
 Sea days: 10
 Instrument(s): Profiler 0851

Cruise Objectives: To measure and collect data on NEFSC standardized otter trawls and ship performance.

Total # of stations: 123
 # of vertical CTD/Profiler casts: 58

of double oblique profiler casts: 0
 # XBT drops: 0
 # salinity samples: 12
 salt correction: +0.01

Vessel: Albatross IV

Cruise: 9409

Program: Fall Bottom Trawl Survey
Dates: 6 September - 27 October
Sea days: 37
Instrument(s): Profiler 0853

Cruise Objectives: To (1) determine the autumn distribution and relative abundance of fish and selected invertebrate species, (2) collect biological samples for studies of age and growth relationships, fecundity, maturing and food habits, (3) collect hydrographic and meteorological data, (4) collect samples of ichthyoplankton and zooplankton, (5) make data and sample collections for cooperative researchers and programs.

Total # of stations: 336
of vertical CTD/Profiler casts: 170
of double oblique profiler casts: 121
 # XBT drops: 0
 # salinity samples: 41
 salt correction: +0.014

Special Notes: Leg I returned one day early due to mechanical problems. Leg IV left one day late because of mechanical problems but returned a day early after the survey was completed.

Vessel: R/V Relentless

Cruise: 9401

Program: Marine Mammal Survey/Warm Core Ring Study
Dates: 22 August - 2 September
Sea days: 9
Instrument(s): Profiler 1496

Cruise Objectives: To (1) investigate fine-scale cetacean distribution in a warm core ring feature, (2) determine if the distribution of cetaceans is continuous through a warm core ring, (3) conduct line-transect population surveys within the study area, (4) collect information on the relationship between cetaceans and

oceanographic features using real time satellite sea surface data, (5) collect CTD and zooplankton data at selected sites, (6) conduct marine mammal photographic and video identification methodology studies using an inflatable boat.

Total # of stations: 10
 # of vertical CTD/Profiler casts: 10
 # of double oblique profiler casts: 0
 # XBT drops: 0
 # salinity samples: 0
 salt correction: 0

Vessel: R/V Albatross IV

Cruise: 9410

Program: GLOBEC Broad Scale Survey
Dates: 8 - 18 November
Sea days: 8
Instrument(s): Profiler 1468

Cruise Objectives: To (1) establish and test sampling protocols for the broad scale survey component of the US Georges Bank study conducted in 1995, (2) train personnel who will conduct the surveys in the operation of the sampling systems and sampling protocols to be used, (3) determine the late fall abundance and age composition of target zooplankton on Georges Bank and in adjacent GOM and slope waters, (4) determine the size of C4 and C5 Calanus and Pseudocalanus on Georges Bank and in adjacent GOM and slope water, (6) collect large quantities of Calanus which are to be frozen for Mackerel feeding experiments funded by a NOAA Coastal Ocean grant.

Total # of stations: 26
 # of vertical CTD/Profiler casts: 5
 # of double oblique profiler casts: 27
 # XBT drops: 0
 # salinity samples: 5
 salt correction: +0.025

Vessel: R/V Delaware II

Cruise: 9412

Program: Atlantic Cod Spawning Study

Dates: 29 November - 12 December
Sea days: 14
Instrument(s): Profiler 0851/1496

Cruise Objectives: To (1) study the reproductive biology of Atlantic Cod in the Georges Bank/Gulf of Maine region, (2) collect blood samples for a stock identification study and (3) collect live zooplankton for a URI-NOAA Coastal Ocean Program mackerel feeding study.

Total # of stations: 94
of vertical CTD/Profiler casts: 4
of double oblique profiler casts: 0
XBT drops: 0
salinity samples: 4
salt correction: 0
