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Description of the 1992 Oceanographic Conditions on the Northeast Continental Shelf

by

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ABSTRACT

A summary of hydrographic observations for 18 surveys on the northeast continental shelf during 1992 is presented. Plots of station positions, as well as surface and bottom distributions of temperature, salinity, and temperature anomaly are portrayed. The average surface and bottom temperatures and temperature anomalies 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).

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. Larval herring, cod, and sand lance surveys cover the Georges Bank area. Other special interest cruises occur throughout the year, such as marine mammal sighting surveys, shellfish surveys, and summer and winter bottom trawl surveys. Station coverage on these cruises varies.

The oceanographic conditions during 1991 are described in Holzwarth-Davis and Taylor (1992).

Temperature and salinity observations from 18 NEFSC surveys conducted during 1992 are summarized and presented in this report. Cruise operation summaries and station plots 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 temperatures and the corresponding temperature anomalies are also presented for the five different regions on the shelf.

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 two times per second. Two different methods were used for deployment of the instrument, 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. In both cases, the *Profiler* was lowered to within 10 m of the bottom or to a maximum depth of 200 m. Twice a day, a salinity sample was taken from the bottom of a vertical profile cast in order to calibrate the conductivity cell. Water samples were analyzed on shore with a Guildline Autosal salinometer.

All data from the R/V *Gloria Michelle* shrimp cruise and from 18 stations of the R/V *Delaware II* autumn bottom trawl survey were collected with an expendable bathythermograph (XBT) probe. These data sets contain temperature only.

All raw data were averaged into 1 m increments. The data were edited, cleaned, and converted to a standard 80-column ASCII formatted cruise file.

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 temperature anomalies were calculated for the five regions of the northeast continental shelf shown in Figure 1: western and eastern Gulf of Maine, Georges Bank, and northern and southern Middle Atlantic Bight. The areal averaging was done using the method described in Holzwarth and Mountain (1990). The areal average temperatures and temperature anomalies were plotted against the mid-date of all observations within a region of 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 Table 2. The summary includes information on the type of cruise, its objectives, dates, specific information on the number of hydrographic stations, type(s) of instruments used, salinity calibration value,

and notes pertaining to instrument performance and data processing.

Table 3 lists the surface and bottom areal average temperatures and temperature anomalies that were calculated for each of the five regions. For most cruises, areal average temperatures 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 temperature 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 3 present the time series of surface and bottom average temperature and temperature anomaly for each region. These values, taken from Table 3, include only the true areal averaged data.

Station positions and distributions of surface and bottom temperature, salinity, and temperature anomaly for the different cruises are presented in Figures 4 through 74. Temperature, salinity, and temperature anomaly distributions were not prepared for the surface and bottom of R/V *Delaware II* 9205 or R/V *Phocoena* 9201, 9202, and 9203 because the distribution of the stations was such that accurate contours could not be produced by the software. No temperature anomaly distributions were produced for R/V *Delaware* 9207, because the distance to standard MARMAP stations was too great for a reliable comparison to be made. Bottom distributions are not presented for R/V *Abel J* 9201, because on many stations the *Profiler* did not sample to within 10 m of the bottom (the criteria for a value to be considered a "bottom" sample). No salinity samples were taken on the R/V *Gloria Michelle* 9219; no salinity plots were generated.

DISCUSSION

The most notable event of 1992 was the presence of Scotian Shelf Water (less than 32.0 Practical Salinity Units) on the southern flank of Georges Bank during much of the winter and spring months. These anomalous conditions were first observed in January during the DEL9202 survey and persisted through the following months. Low salinity and cold temperatures were most evident during the April 27 to May 8 cruise aboard the R/V *Albatross IV*. Satellite imagery at that time also supports these observations (Jim Bisagni, personal communication).

Figure 3 shows that Georges Bank temperatures were colder than normal throughout most of the year at both the surface and the bottom. None of the other regions showed a strong trend towards either colder or warmer conditions.

REFERENCES

Holzwarth, T.J. and D. Mountain. 1990. Surface and bottom temperature distributions from the Northeast Fisheries Center spring and fall bottom trawl survey program, 1963-1987. Woods Hole, MA: NOAA/NMFS/Northeast Fisheries Center. *NEFSC Ref. Doc. 90-03.*

Holzwarth-Davis, T.J. and M. H. Taylor. 1992. Description of the 1991 oceanographic conditions on the northeast continental shelf. Woods Hole, MA: NOAA/NMFS Northeast Fisheries Science Center. *NEFSC Ref. Doc.* 92-08.

Table 1. Summary of 1992 cruises

Cruise	Program	Dates	Region[1]
DEL9201	Larval Herring Study	6-20 January	MABN,GB,GOMW
DEL9202	Larval Herring Study	28 January - 12 February	MABN,GB,GOMW
ALB9202-DEL9203II	Winter Btm. Trawl Survey	11 February - 6 March	MAB,GB
ALB9203	Spring Btm. Trawl Survey	2 March - 16 April	NE Shelf
DEL9205	Marine Mammal Survey	16 March - 2 April	MAB slope
EG9201	Harbor Porpoise Study	9-14 April	GOM
ALB9204	Marine Ecosystem Response	27 April - 8 May	GB
ALB9205	Marine Ecosystem Response	18-29 May	GB
EG9202	Harbor Porpoise Study	20-25 May	GOM
DEL9206	Shellfish (Clam) Survey	8 June - 13 July	NE Shelf
EG9203	Harbor Porpoise Study	23-28 June	GOM
DEL9207	Summer Btm. Trawl Survey	27 July - 10 August	GOM
AJ9201	Harbor Porpoise Survey	29 July - 6 September	GOM
ORE9204	Sea Scallop Survey	1-22 August	MAB,GB
GM9219	Shrimp Survey	3-15 August	GOM
ALB9211	Autumn Btm. Trawl Survey	8 September - 28 October	NE Shelf
DEL9212	Larval Herring Study	26 October - 4 November	MABN,GB,GOMW
DEL9214	Larval Herring Study	1-18 December	MABN,GB,GOMW

[1] Regional abbreviations
GB=Georges Bank
GOM=Gulf of Maine
MAB=Middle Atlantic Bight
MABN=Northern MAB
NE Shelf=Northeast Continental Shelf
GOMW=Western GOM

Table 2. Summary of cruise information and hydrographic work completed

CRUISE SUMMARY

Vessel: R/V *Delaware II* **Cruise:** DEL9201

Program: Larval herring/Sand lance Study
Dates: January 6 - 20, 1992
Sea days: 11
Instrument(s): *Profiler* 851

Cruise objectives: To monitor the changing status of Atlantic herring in the Georges Bank area and the recruitment of sand lance larvae. Principally (1) determine larval distribution, abundance, and production, (2) index spawning biomass, and (3) provide systematic collections of herring larvae for age and growth estimates.

Total # of stations: 85
 # Vertical CTD/*Profiler* casts: 11
 # Double Oblique *Profiler* casts: 85
 # XBT drops: 0
 # salinity samples: 11
Salt correction: No correction was needed.

Special Notes: Instrument performed well, data were recorded in 'real-time' mode, recording and simultaneously downloading data to a computer via a conducting core cable.

CRUISE SUMMARY

Vessel: R/V *Delaware II* **Cruise:** DEL9202

Program: Larval herring/Sand lance Study
Dates: January 28 - February 12, 1992
Sea days: 15
Instrument(s): *Profiler* 851

Cruise objectives: To monitor the changing status of Atlantic herring in the Georges Bank area and the recruitment of sand lance larvae. Principally (1) determine larval distribution, abundance and production, (2) index spawning biomass, (3) provide systematic collections of herring larvae for age and growth estimates.

Total # of stations: 123
 # Vertical CTD/*Profiler* casts: 14
 # Double Oblique *Profiler* casts: 123
 # XBT drops: 0
 # salinity samples: 14
Salt correction: +0.011 PSU

Special Notes: Instrument performed well, used in real-time mode.

Table 2. Continued.

CRUISE SUMMARY

Vessels: R/V *Albatross IV* **Cruises:** ALB9202
R/V *Delaware II* DEL9203

Program: Winter Bottom Trawl Survey
Dates: February 11 - March 6, 1992
Sea days: 19
Instrument(s): *Profiler* 456

Cruise objectives: To (1) determine the winter distribution and relative abundance of fish 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: 138
 # Vertical CTD/*Profiler* casts: 104
 # Double Oblique *Profiler* casts: 16
 # XBT drops: 5
 # salinity samples: 26
Salt correction: +0.021 PSU

Special Notes: Part II of the survey took place aboard the *R/V Delaware* because of mechanical problems with the *R/V Albatross*. *Profiler* 456 performed well in the real-time mode.

CRUISE SUMMARY

Vessel: R/V *Albatross IV* **Cruise:** ALB9203

Program: Spring Bottom Trawl Survey
Dates: March 2 - April 16, 1992
Sea days: 42

Instrument(s): *Profiler* 853/*Profiler* 851

Cruise objectives: To (1) determine the spring distribution and relative abundance of fish 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: 326
 # Vertical CTD/*Profiler* casts: 216
 # Double Oblique *Profiler* casts: 99
 # XBT drops: 5
 # salinity samples: 43 (for #853)/ 21 (for #851)
Salt correction: +0.037 PSU/none needed

Special Notes: Both instruments used in real-time mode. *Profiler* 853 was damaged near the end of the second leg and replaced with *Profiler* 851. On several occasions *Profiler* 853 stopped working during the upcast and twice would not work at all. These problems may have been related to the damage to the bulkhead or to a bad connection. One bad weather port call was made on the second leg and the third leg ended one day early.

Table 2. Continued.

CRUISE SUMMARY

Vessel: R/V *Delaware* **Cruise:** DEL9205

Program: Marine Mammal Sighting Survey
Dates: March 16 - April 2, 1992
Sea days: 17
Instrument(s): *Profiler* 456/*Profiler* 360

Cruise objectives: To (1) investigate and determine the fine scale distribution and habitat utilization within warm core rings, canyons and the shelf edge break, (2) to conduct line-transect population surveys along the shelf edge break and out to the Gulf Stream wall, and (3) determine how the composition of marine mammal species varies spatially.

Total # of stations: 29
 # Vertical CTD/*Profiler* casts: 29
 # Double Oblique *Profiler* casts: 0
 # XBT drops: 0
 # salinity samples: 5/2
Salt correction: +0.023 PSU/not enough samples

Special Notes: Instrument used in #456 used in real-time mode until it failed at station 19. *Profiler* #360 was used to complete the cruise. It worked best when data was internally recorded (archived) and then downloaded to the computer. Hand editing was required for some of the raw data. Data from four stations were lost. Several days of work were lost due to adverse sighting conditions. *Profiler* #456 was returned to the manufacturer for repairs.

CRUISE SUMMARY

Vessel: R/V *Phocoena* **Cruise:** EG9201

Program: Harbor Porpoise Migration Study
Dates: April 9 - 14, 1992
Sea days: 5
Instrument(s): *Profiler* 360

Cruise objectives: To investigate the distribution of harbor porpoise and the water characteristics in the Penobscot Bay, Maine area.

Total # of stations: 16
 # Vertical CTD/*Profiler* casts: 16
 # Double Oblique *Profiler* casts: 0
 # XBT drops: 0
 # salinity samples: 4
Salt correction: not enough samples

Special Notes: Instrument used in archived mode and generally performed well. Instrument was hand lowered to the bottom. The R/V *Phocoena* is a 17 ft hard-bottom, inflatable boat.

Table 2. Continued.

CRUISE SUMMARY

Vessel: R/V *Albatross IV* **Cruise:** ALB9204

Program: Marine Ecosystem Response
Dates: April 27 - May 8, 1992
Sea days: 12
Instrument(s): *Profiler* 851/*Profiler* 360

Cruise objectives: To (1) acquire sidescan sonar data, video surveys, and bottom grabs of selected sites on Georges Bank to be used for improved detailed interpretation and digital mapping of the marine environment and fisheries habitats, and (2) to acquire information on the abundance and distribution of cod and haddock eggs and early larvae using MOCNESS and CTD sampling gear.

Total # of stations: 52
 # Vertical CTD/*Profiler* casts: 34
 # Double Oblique *Profiler* casts: 21
 # XBT drops: 0
 # salinity samples: 6/2
Salt correction: None, not enough samples for either instrument.

Special Notes: *Profiler* #360 was used on stations 1 through 43, *Profiler* #851 was used on the remainder of the stations. Both instruments were used in the real-time mode and the conductivity data experienced severe spiking which was caused by hydraulic fluid leaking into the slipring. Scotian Shelf Water was observed on the southern flank of Georges Bank.

CRUISE SUMMARY

Vessel: R/V *Albatross IV* **Cruise:** ALB9205

Program: Marine Ecosystem Response
Dates: May 18 - 29, 1992
Sea days: 12
Instrument(s): *Profiler* 853/*Profiler* 456

Cruise objectives: To (1) acquire information on the abundance and distribution of ichthyoplankton and zooplankton on the southern flank of Georges Bank in relation to water column conditions, (2) deploy and recover two moorings for measuring physical and biological parameters at a fixed site, (3) make repeated observations of the plankton at the fixed site and within a drifting patch of water tagged by transmitting buoys, and (4) make these observations in close cooperation with the *R/V Endeavor*.

Total # of stations: 35*
 # Vertical CTD/*Profiler* casts: 5
 # Double Oblique *Profiler* casts: 35
 # XBT drops: 0
 # salinity samples: 1/4
Salt correction: None, not enough samples for either instrument.

Special Notes: *There were approximately 450 stations at which many other instruments were deployed. Instrument #853 was used at the first station only. Both instruments were used in real-time mode. Scotian Shelf Water was still evident at some stations.

Table 2. Continued.

CRUISE SUMMARY

Vessel: R/V *Phocoena* **Cruise:** EG9202

Program: Harbor Porpoise Migration Study
Dates: May 20 - 25, 1992
Sea days: 5
Instrument(s): *Profiler* 851

Cruise objectives: To investigate the distribution of harbor porpoise and the water characteristics in the Penobscot Bay, Maine area.

Total # of stations: 14
 # Vertical CTD/*Profiler* casts: 14
 # Double Oblique *Profiler* casts: 0
 # XBT drops: 0
 # salinity samples: 4
Salt correction: not enough samples

Special Notes: Instrument used in archived mode and generally performed well. Instrument was hand lowered to the bottom.

CRUISE SUMMARY

Vessel: R/V *Delaware II* **Cruise:** DEL9206

Program: Shellfish Resource Assessment Survey
Dates: June 8 - July 13, 1992
Sea days: 29
Instrument(s): *Profiler* 853

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 other institutions and NMFS laboratories, and (5) on part III, determine the abundance and range of the quahog fishery along the eastern Maine coast.

Total # of stations: 493
 # Vertical CTD/*Profiler* casts: 108
 # Double Oblique *Profiler* casts: 0
 # XBT drops: 0
 # salinity samples: 43
Salt correction: +0.026 PSU

Special Notes: The instrument performed well in the real-time mode.

Table 2. Continued.

CRUISE SUMMARY

Vessel: R/V *Phocoena* **Cruise:** EG9203

Program: Harbor Porpoise Migration Study
Dates: June 23- 28, 1992
Sea days: 5
Instrument(s): *Profiler* 851

Cruise objectives: To investigate the distribution of harbor porpoise and the water characteristics in the Penobscot Bay, Maine area.

Total # of stations: 16
 # Vertical CTD/*Profiler* casts: 16
 # Double Oblique *Profiler* casts: 0
 # XBT drops: 0
 # salinity samples: 6
Salt correction: not enough samples

Special Notes: Instrument used in archived mode and generally performed well. Instrument was hand lowered to the bottom.

CRUISE SUMMARY

Vessel: R/V *Delaware II* **Cruise:** DEL9207

Program: Gulf of Maine Bottom Trawl Survey
Dates: July 27 - August 10, 1992
Sea days: 15
Instrument(s): *Profiler* 851

Cruise objectives: To (1) determine the seasonal distribution and relative abundance of fish species in the Gulf of Maine, (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.

Total # of stations: 120
 # Vertical CTD/*Profiler* casts: 112
#Double Oblique *Profiler* casts: 0
 # XBT drops: 0
 # salinity samples: 26
Salt correction: no correction necessary

Special Notes: *Profiler* performed well, used in real-time mode.

Table 2. Continued.

CRUISE SUMMARY

Vessel: R/V *Abel J* **Cruise:** AJ9201

Program: Harbor Porpoise Sighting Survey
Dates: July 29 - September 6, 1992
Sea days: 39
Instrument(s): *Profiler* 853

Cruise objectives: To perform sighting survey in Gulf of Maine, Lower Bay of Fundy, and southern Scotian Shelf and to estimate abundance of marine mammals, in particular, harbor porpoise.

Total # of stations: 56
 # Vertical CTD/*Profiler* casts: 56
 # Double Oblique *Profiler* casts: 0
 # XBT drops: 0
 # salinity samples: 15
Salt correction: none applied

Special Notes: Salinity samples were taken at the surface and were not reliable for calibration purposes. The instrument was used in archived mode and performed well.

CRUISE SUMMARY

Vessel: R/V *Oregon II* **Cruise:** ORE9204

Program: Sea Scallop Survey
Dates: August 1 - 22, 1992
Sea days: 21
Instrument(s): CTD 1510

Cruise objectives: To (1) determine the distribution and relative abundance of the sea scallop Placoppecten magellanicus and Iceland scallop Chlamys islandica, (2) collect biological samples and assessment data, (3) monitor hydrographic and meteorological conditions, and (4) make collections for other scientists .

Total # of stations: 420
 # Vertical CTD/*Profiler* casts: 113
 # Double Oblique *Profiler* casts: 0
 # XBT drops: 9
 # salinity samples: 33
Salt correction: none applied

Special Notes: Salinity samples may have been mixed up in the case, many samples were taken in shallow (less than 30 meters) water and did not give consistent comparisons to the CTD. The instrument was used in archived mode. Faulty equipment caused a few problems while downloading data, but for most of the stations the CTD performed well.

Table 2. Continued.

CRUISE SUMMARY

Vessel: R/V *Gloria Michelle* **Cruise:** GM9219

Program: Summer Gulf of Maine Shrimp Survey
Dates: August 3 - 15, 1992
Sea days: 13
Instrument(s):

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

Total # of stations: 57
 # Vertical CTD/*Profiler* casts: 0
 # Double Oblique *Profiler* casts: 0
 # XBT drops: 57
 # salinity samples: 0
Salt correction: N/A

Special Notes: No CTD or *Profiler* was used on this trip. Six bad XBT drops were deleted. This vessel was using the SEAS III data acquisition software for the first time.

CRUISE SUMMARY

Vessel: R/V *Albatross IV* **Cruise:** ALB9211

Program: Autumn Bottom Trawl Survey
Dates: September 8 - October 28, 1992
Sea days: 45
Instrument(s): *Profiler* 851/ *Profiler* 360

Cruise objectives: To (1) determine the autumn distribution and relative abundance of fish 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: 353
 # Vertical CTD/*Profiler* casts: 186
 # Double Oblique *Profiler* casts: 120
 # XBT drops: 18
 # salinity samples: 6/43
Salt correction: +0.022 PSU/ +0.041 PSU

Special Notes: During the first 98 stations of this cruise both instruments were used in archived and real-time made in an attempt to eliminate problems with the equipment. Starting with station 99, *Profiler* #360 was used for the remainder of the cruise in the real-time mode. At the end of the cruise, #360 was found to be missing part of the pressure port, data were not noticeably affected. The pressure port has been replaced.

Table 2. Continued.

CRUISE SUMMARY

Vessel: R/V *Delaware II* **Cruise:** DEL9212

Program: Larval herring/Sand lance Study
Dates: October 26 - November 4, 1992
Sea days: 10
Instrument(s): *Profiler* 853

Cruise objectives: To monitor the changing status of Atlantic herring in the Georges Bank area and the recruitment of sand lance larvae. Principally (1) determine larval distribution, abundance, and production, (2) index spawning biomass, and (3) provide systematic collections of herring larvae for age and growth estimates.

Total # of stations: 128
 # Vertical CTD/*Profiler* casts: 16
 # Double Oblique *Profiler* casts: 128
 # XBT drops: 0
 # salinity samples: 16
Salt correction: +0.019 PSU

Special Notes: *Profiler* 853 was used in real-time mode. Instrument performed well. The trip was completed five days earlier than scheduled.

CRUISE SUMMARY

Vessel: R/V *Delaware II* **Cruise:** DEL9214

Program: Larval herring/Sand lance Study
Dates: December 1 - 18, 1992
Sea days: 15
Instrument(s): *Profiler* 456/*Profiler* 853

Cruise objectives: To monitor the changing status of Atlantic herring in the Georges Bank area and the recruitment of sand lance larvae. Principally (1) determine larval distribution, abundance, and production, (2) index spawning biomass, and (3) provide systematic collections of herring larvae for age and growth estimates.

Total # of stations: 117
 # Vertical CTD/Profiler casts: 132
 # Double Oblique *Profiler* casts: 117
 # XBT drops: 0
 # salinity samples: 9/5
Salt correction: +0.025 PSU/none applied

Special Notes: Salinity samples taken for *Profiler* #853 were from shallow stations and did not compare well. This instrument has needed little or no correction in the past. *Profiler* #456 was removed after failing at station 78. Both instruments performed well in the real-time mode.

Table 3. Areal average surface and bottom temperature and temperature anomaly for the NEFSC 1992 cruises in the five regions of the northeast continental shelf shown in Figure 1[1]

Cruise	CD	Surface #Obs	Surface Temp (°C)	Surface Anomaly	Surface SDV1	Surface SDV2	Bottom #Obs	Bottom Temp (°C)	Bottom Anomaly	Bottom SDV1	Bottom SDV2
Gulf of Maine West											
DEL9201	11	8[2]	6.00	-0.10	0.50	0.48	8[2]	6.35	0.46	0.36	0.64
DEL9202	38	8[2]	4.35	-0.11	0.50	0.58	8[2]	4.71	0.41	0.36	0.63
ALB9203	101	37	3.76	-0.71	0.18	0.73	37	5.53	0.49	0.14	0.90
DEL9206	191	6[2]	12.48	-1.06	0.54	1.05	6[2]	6.03	-0.58	0.39	0.67
DEL9207	215	34[2]	13.64	-0.95	0.21	1.21	34[2]	5.57	-1.00	0.20	0.52
GM9219	221	39[2]	17.30	-0.08	0.19	1.49	392	5.94	0.16	0.14	1.18
AJ9201	230	4[2]	13.03	0.19	0.52	2.71	4[2]	8.32	0.24	0.42	0.72
ALB9211	294	38	11.36	-0.57	0.19	0.80	36	6.97	-0.25	0.15	1.46
DEL9212	303	10[2]	10.74	-0.09	0.45	0.27	10[2]	7.45	-0.72	0.41	1.14
DEL9214	344	8[2]	6.90	-1.08	0.49	0.50	8[2]	7.06	-0.51	0.35	0.95
Gulf of Maine East											
ALB9203	100	27[2]	3.09	-1.56	0.20	0.67	26[2]	6.76	0.16	0.19	0.69
DEL9206	182	4[2]	12.03	1.67	0.43	1.48	4[2]	6.98	-2.59	0.40	1.77
AJ9201	238	11[2]	12.60	-0.14	0.34	1.99	10[2]	9.19	-0.20	0.41	2.31
ALB9211	292	35	11.16	-1.05	0.20	0.80	27	8.75	0.07	0.21	1.27
DEL9212	304	11[2]	11.07	-1.19	0.27	0.33	10[2]	9.35	-1.49	0.27	1.49
DEL9214	351	5[2]	7.10	-1.37	0.39	0.34	5[2]	7.08	-1.64	0.40	0.35
Georges Bank											
DEL9201	12	31[2]	6.87	0.11	0.21	0.68	30[2]	7.02	0.09	0.20	0.93
DEL9202	33	65	5.08	-0.56	0.18	0.63	62	5.15	-0.93	0.22	1.00
AD0203	63	26	4.30	-0.14	0.25	0.51	23	4.46	-0.43	0.27	1.06
ALB9203	92	46	3.87	-0.85	0.20	0.99	41	4.23	-0.62	0.22	0.84
ALB9204	124	35[2]	3.68	-3.06	0.28	1.97	26[2]	4.28	-1.54	0.25	0.96
ALB9205	140	28[2]	5.59	-2.60	0.23	1.00	27[2]	4.38	-2.43	0.32	0.85
DEL9206	180	19[2]	11.95	0.02	0.23	1.56	19[2]	9.12	-0.97	0.24	1.92
OR9204	230	24[2]	16.02	0.22	0.23	2.42	23[2]	10.90	-0.72	0.26	1.50
ALB9211	283	55	14.50	-0.31	0.19	1.07	48[2]	12.76	-0.13	0.16	1.50
DEL9212	305	68	11.95	-1.16	0.18	0.78	67	11.89	-0.49	0.17	1.20
DEL9214	348	62[2]	7.95	-1.10	0.13	0.54	60[2]	8.10	-1.16	0.13	0.79
Middle Atlantic Bight North											
DEL9201	8	24[2]	6.66	-0.29	0.31	0.95	22[2]	6.58	-0.36	0.34	1.29
DEL9202	42	25[2]	3.55	-0.59	0.28	0.86	25[2]	3.56	-0.49	0.30	1.32
AD0203	57	41	4.77	0.26	0.28	0.86	36	5.23	-0.20	0.34	1.39
ALB9203	80	58	4.41	0.27	0.27	0.67	52	4.77	-0.30	0.34	1.48
DEL9203	82	10[2]	5.84	-0.05	0.66	0.54	5[2]	6.02	-0.2	0.75	0.83
DEL9206	170	19[2]	14.73	-0.81	0.32	1.35	19[2]	6.99	-0.43	0.35	0.90
OR9204	221	13[2]	21.40	0.73	0.37	1.06	13[2]	7.72	-1.17	0.38	1.25
ALB9211	270	59	18.13	0.31	0.27	1.23	52[2]	12.50	0.09	0.34	2.16
DEL9212	300	19[2]	12.64	-0.98	0.34	0.56	18[2]	13.08	-0.12	0.39	0.96
DEL9214	338	21[2]	9.69	-0.50	0.33	0.65	19[2]	10.09	-0.63	0.38	1.04
Middle Atlantic Bight South											
AD0203	47	48	6.57	0.05	0.29	1.66	40	6.85	0.43	0.38	1.40
ALB9203	69	79	6.96	1.00	0.26	1.68	71	7.13	1.51	0.32	1.30
DEL9205	89	5[2]	6.32	0.04	1.00	0.87	4[2]	7.03	-0.66	1.28	2.70
DEL9206	167	54	17.79	-1.40	0.26	1.41	54	9.17	-0.40	0.29	1.91
OR9204	218	43[2]	23.20	-0.89	0.25	0.83	43[2]	7.85	0.10	0.28	1.53
ALB9211	262	56	22.02	0.63	0.36	1.11	51	13.56	-1.00	0.42	2.74

[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.

[2] A true areal average could not be calculated due to poor station coverage and that the average values listed were derived from a simple average of the observations that were within the region.

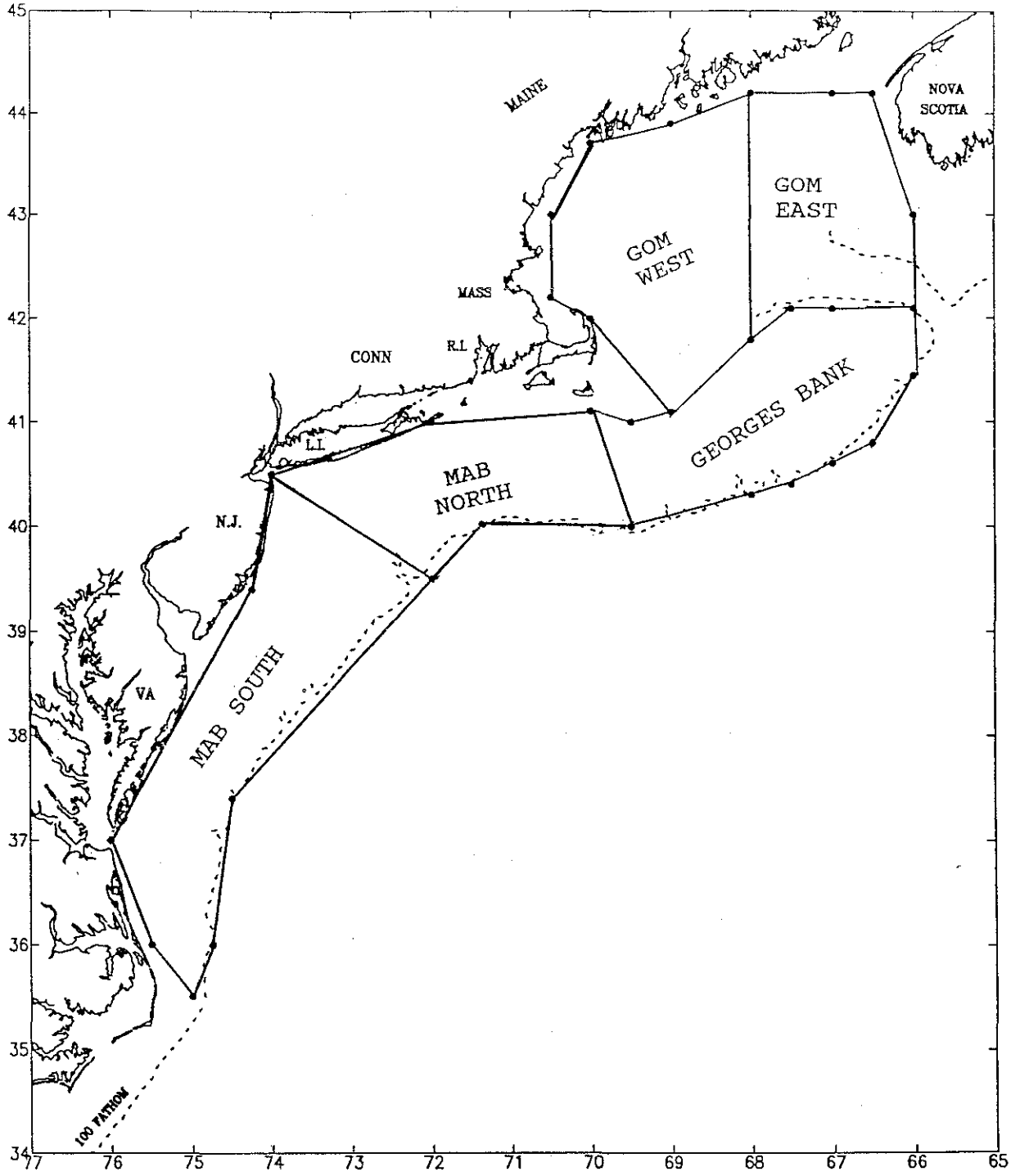


Figure 1. The region of the northeast continental shelf covered by the Northeast Fisheries Science Center cruises during 1992. The boundaries of the five areas of the shelf for which average temperature and anomaly values are calculated are shown: western Gulf of Maine, eastern Gulf of Maine, Georges Bank, northern Middle Atlantic Bight, and southern Middle Atlantic Bight.

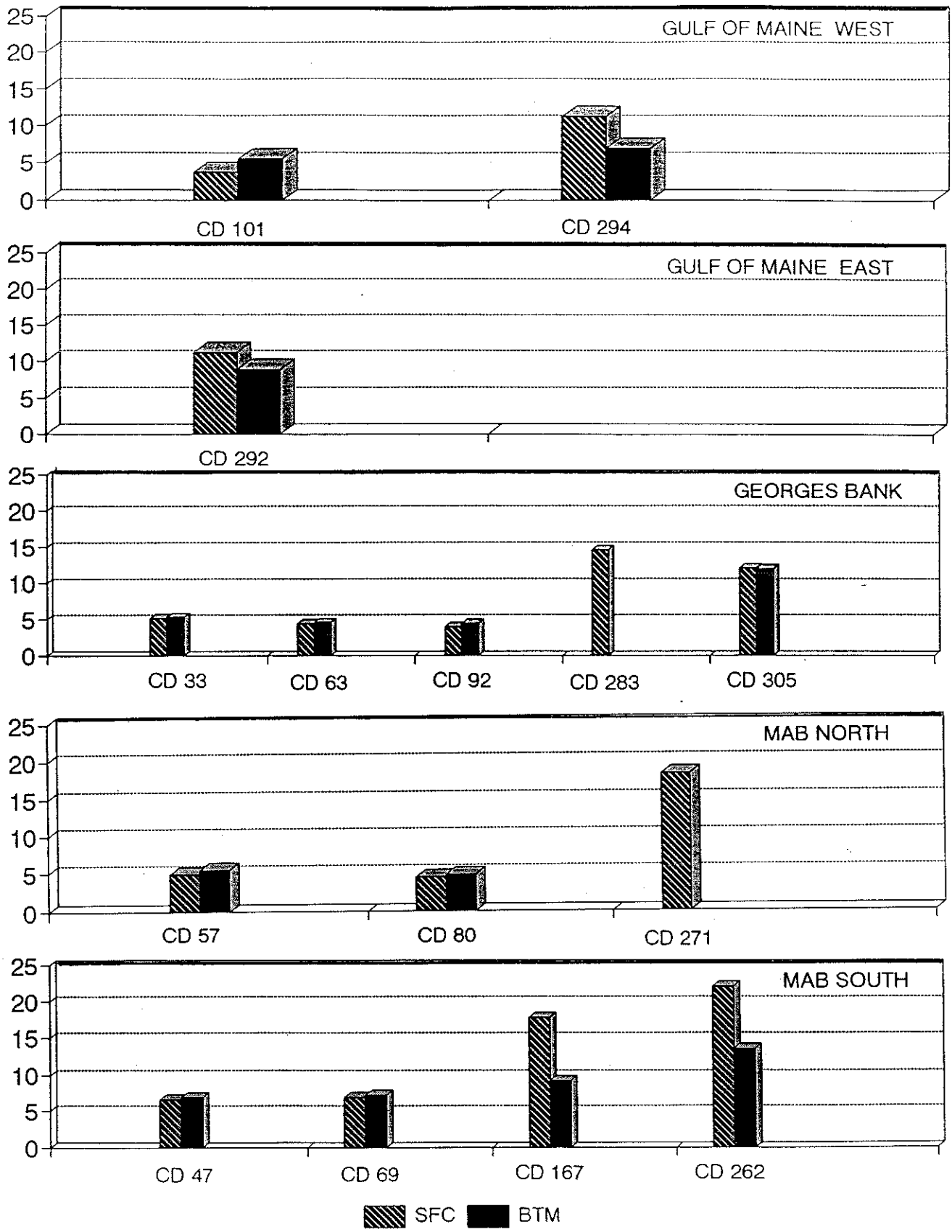


Figure 2. The 1992 areal average surface and bottom temperature values from Table 3. They are presented by the mean calendar day (CD) of the observations within a particular region during a cruise. Averages marked with an asterisk in Table 1 are not included here because they do not represent a "true" areal average and may be biased by the location of stations within a region.

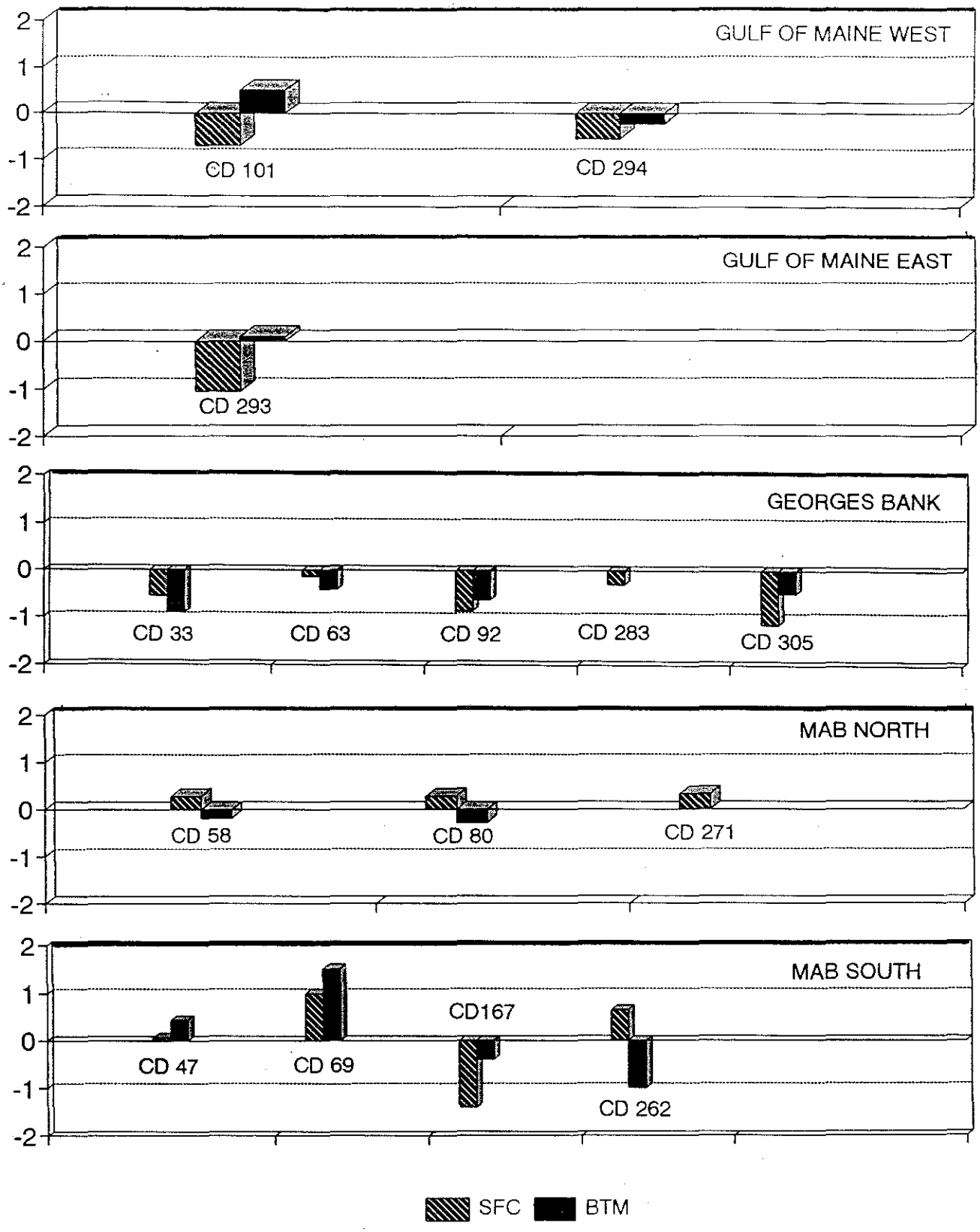


Figure 3. The 1992 areal average surface and bottom temperature anomalies from Table 3. Anomalies are presented by the mean calendar day (CD) of the observations within a particular region during a cruise.

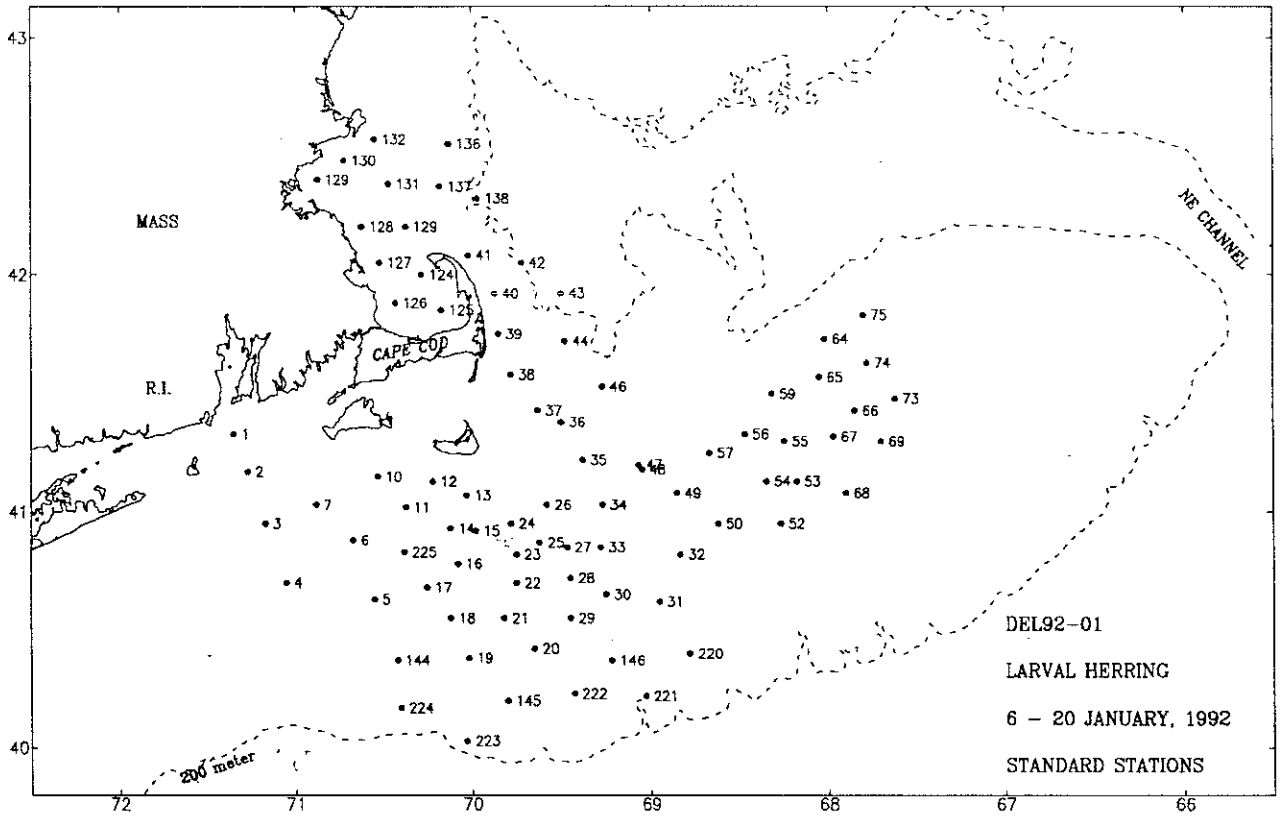


Figure 4. Hydrographic stations occupied during the larval herring/sand lance study DEL9201.

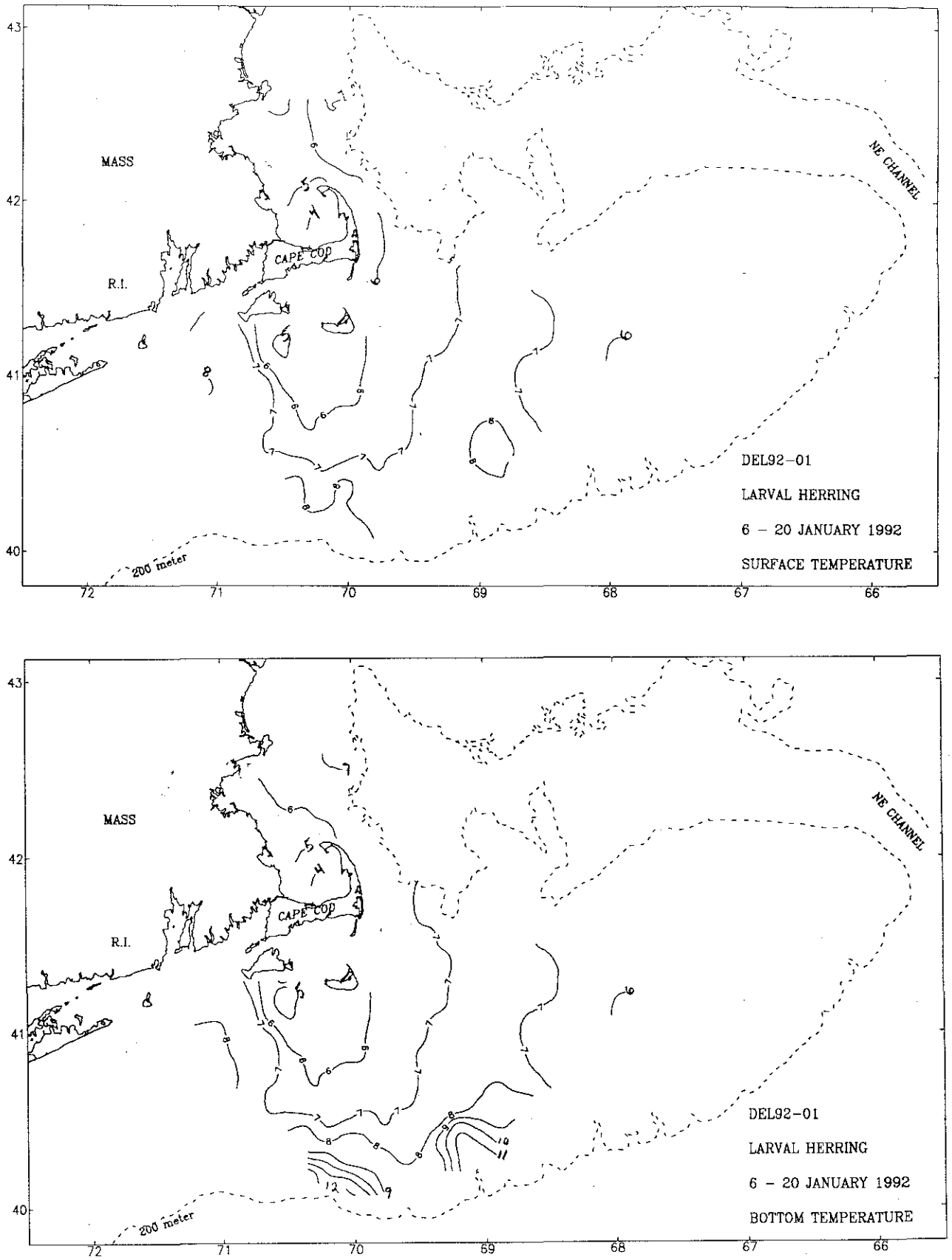


Figure 5. The surface and bottom temperature distribution for the larval herring/sand lance study DEL9201.

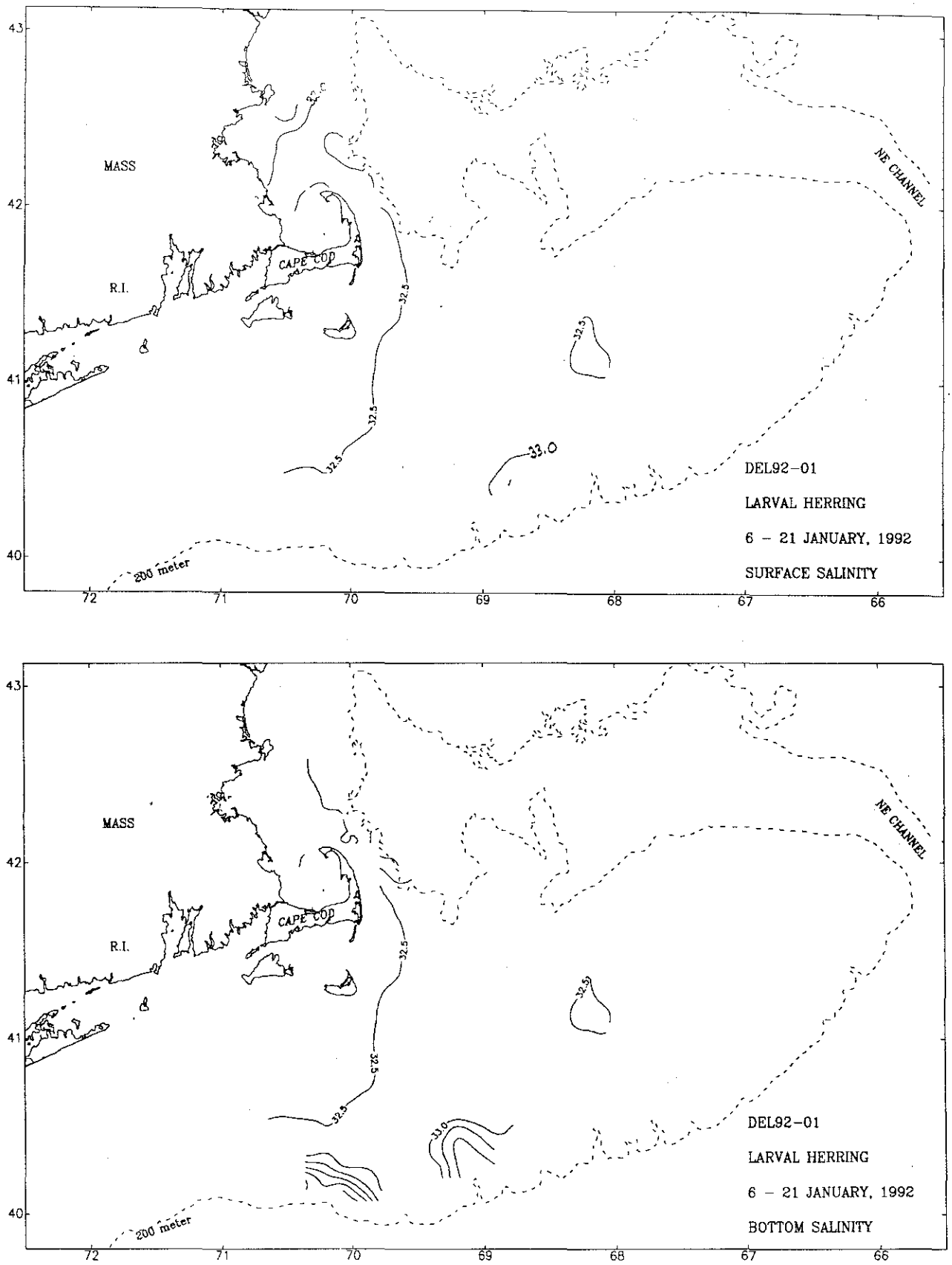


Figure 6. The surface and bottom salinity distribution for the larval herring/sand lance study DEL9201.

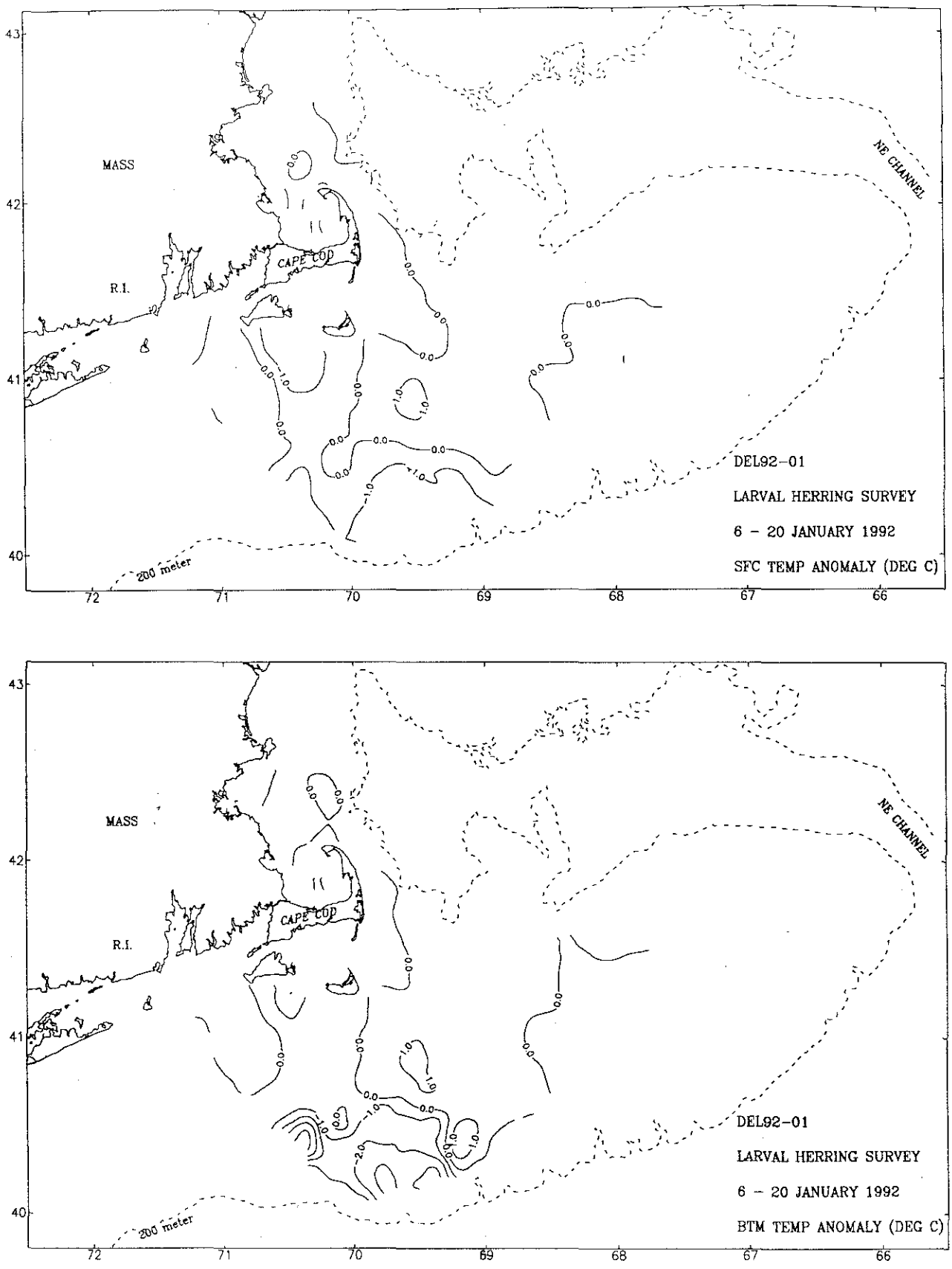


Figure 7. The surface and bottom temperature anomaly distribution for the larval herring/sand lance study DEL9201.

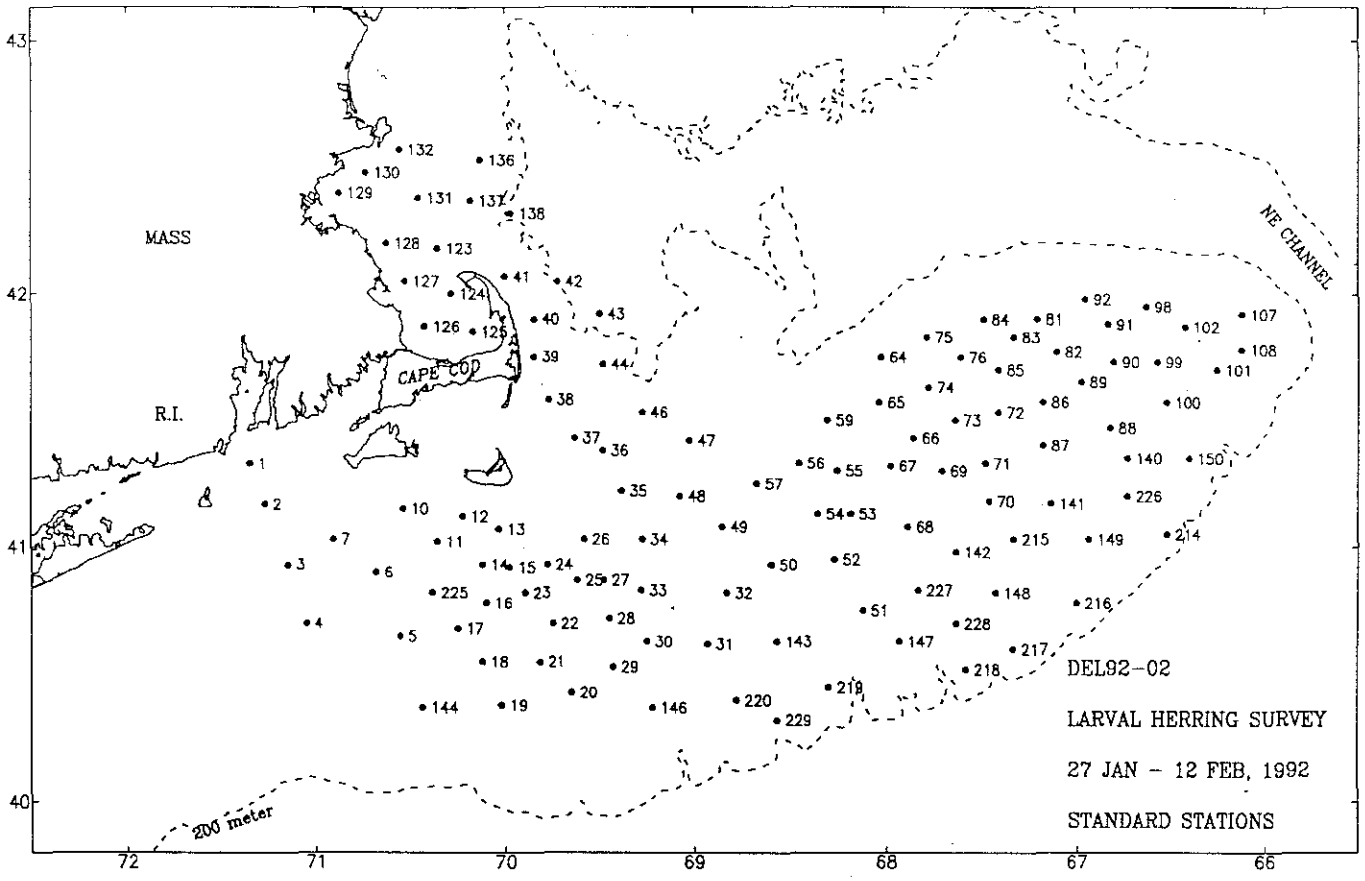


Figure 8. Hydrographic stations occupied during the larval herring/sand lance study DEL9202.

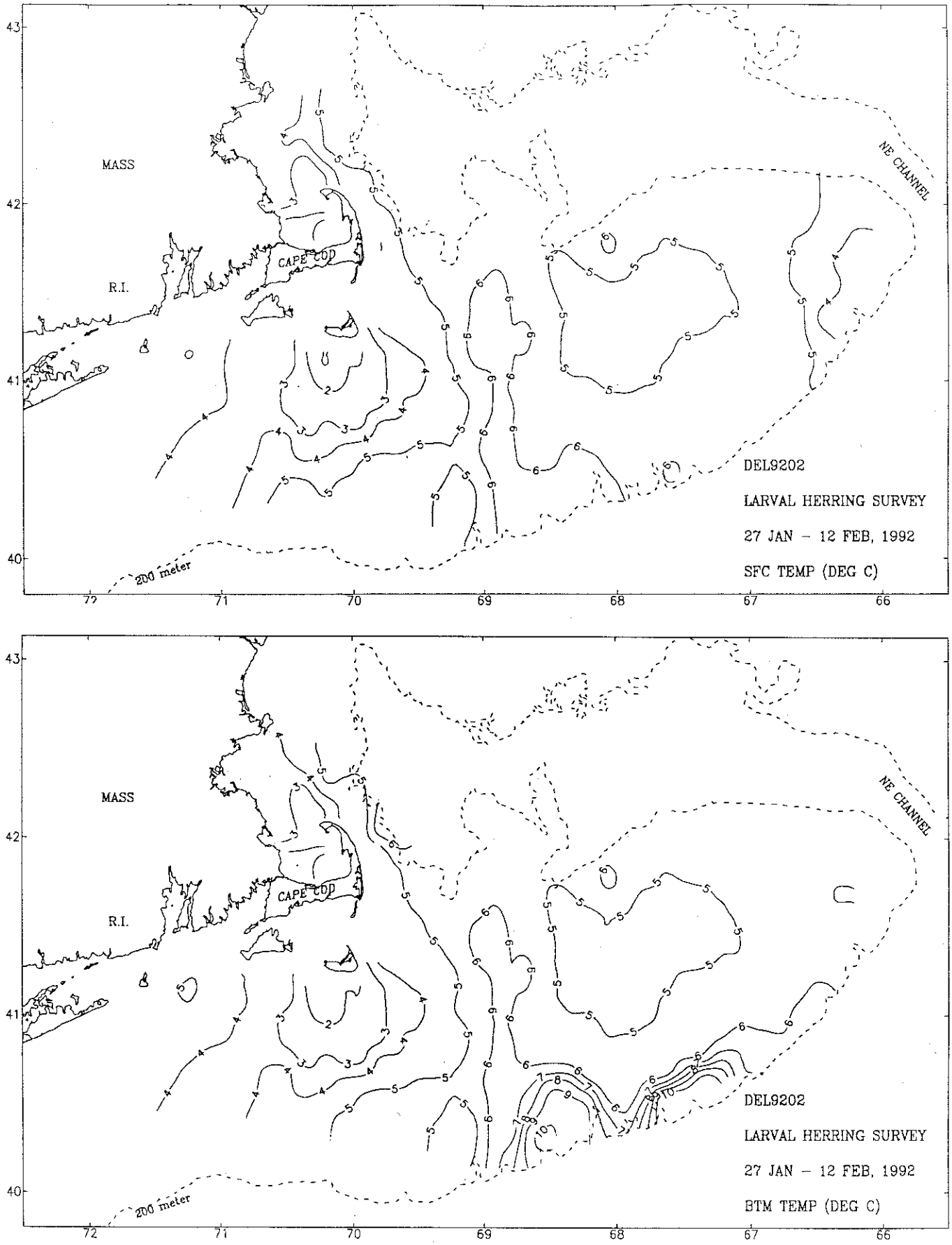


Figure 9. The surface and bottom temperature distribution for the larval herring/sand lance study DEL9202.

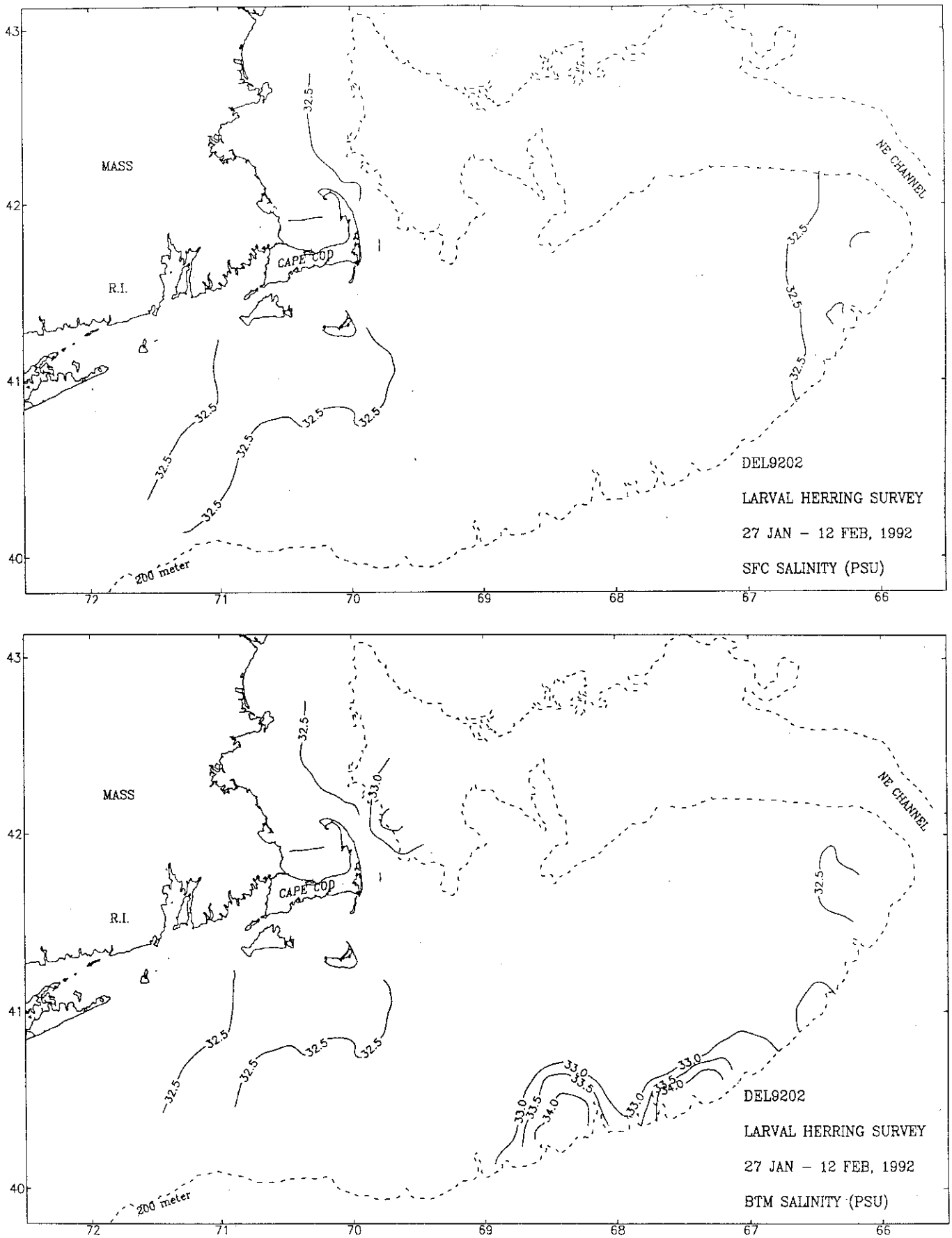


Figure 10. The surface and bottom salinity distribution for the larval herring/sand lance study DEL9202.

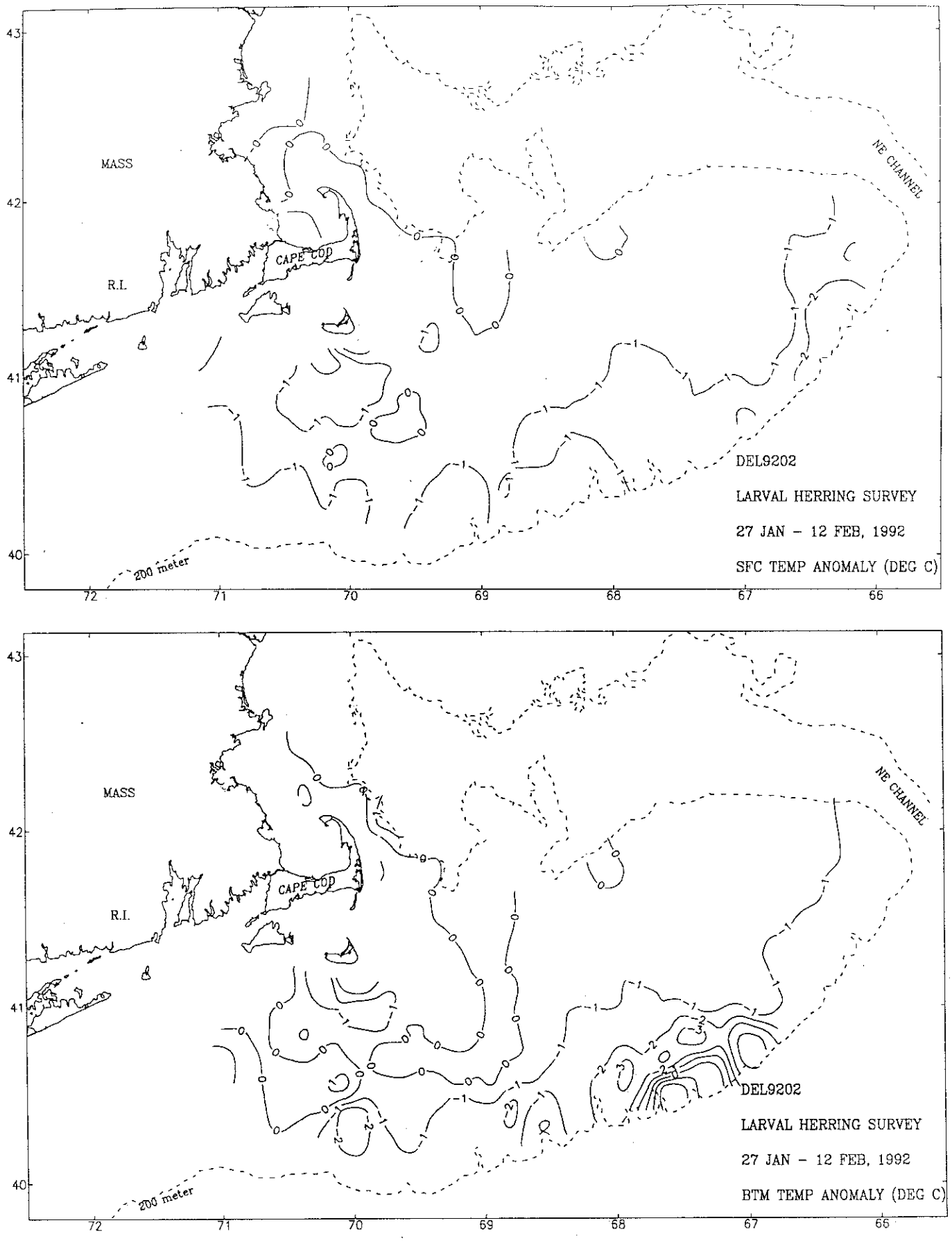


Figure 11. The surface and bottom temperature anomaly distribution for the larval herring/sand lance study DEL9202.

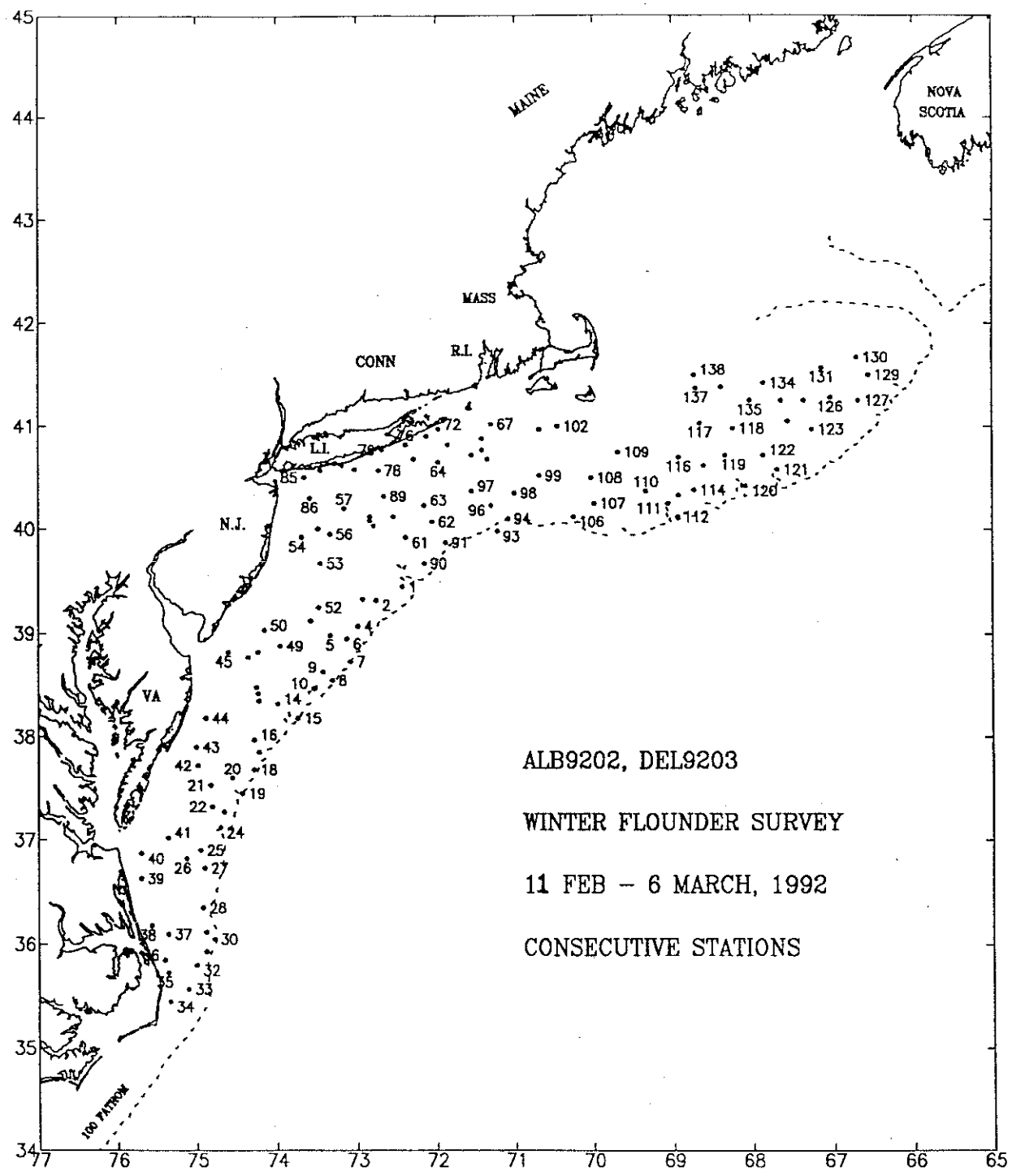


Figure 12. Hydrographic stations occupied during the winter flounder survey ALB9202 / DEL9203.

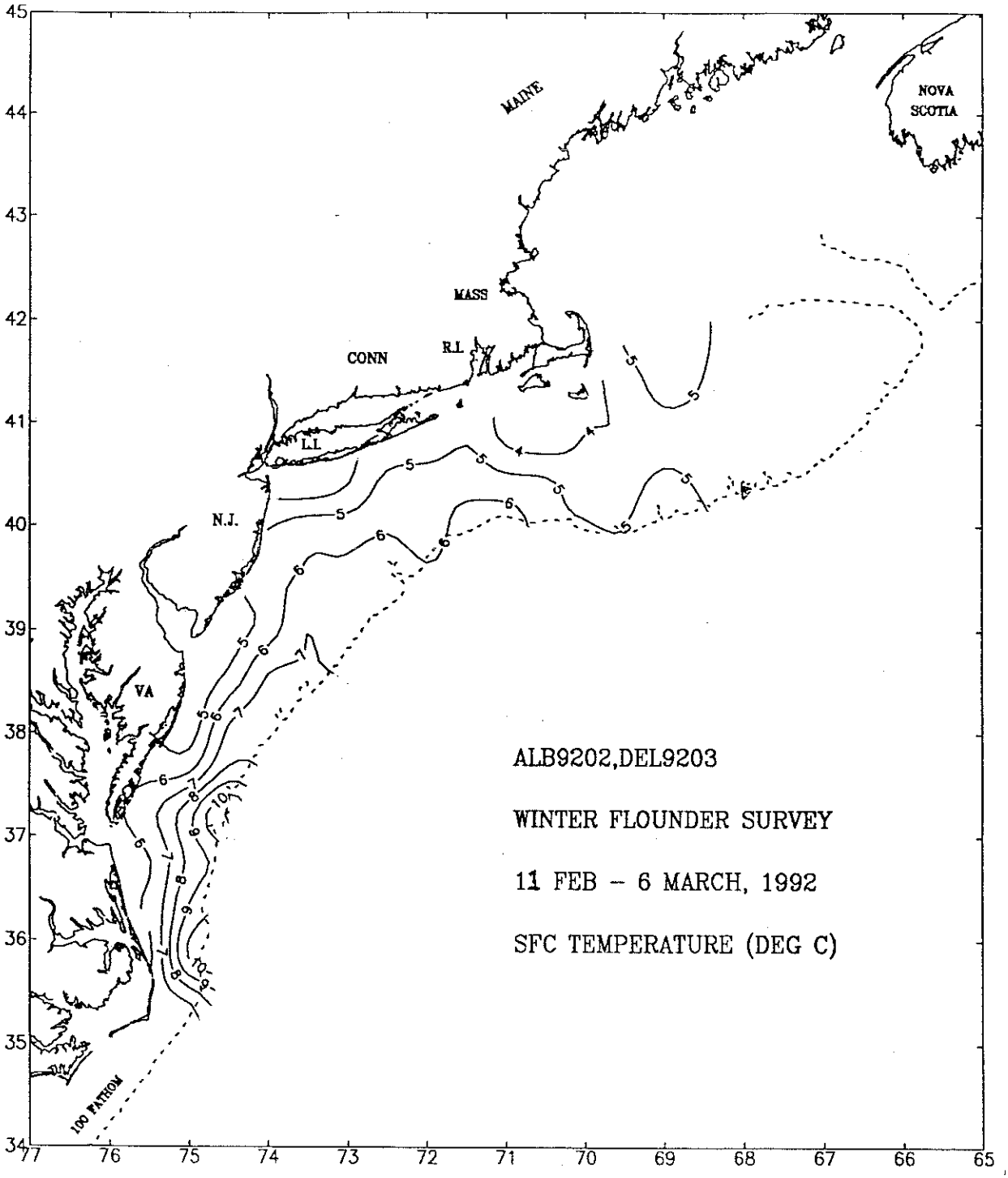


Figure 13. The surface temperature distribution for the winter flounder survey ALB9202 / DEL9203.

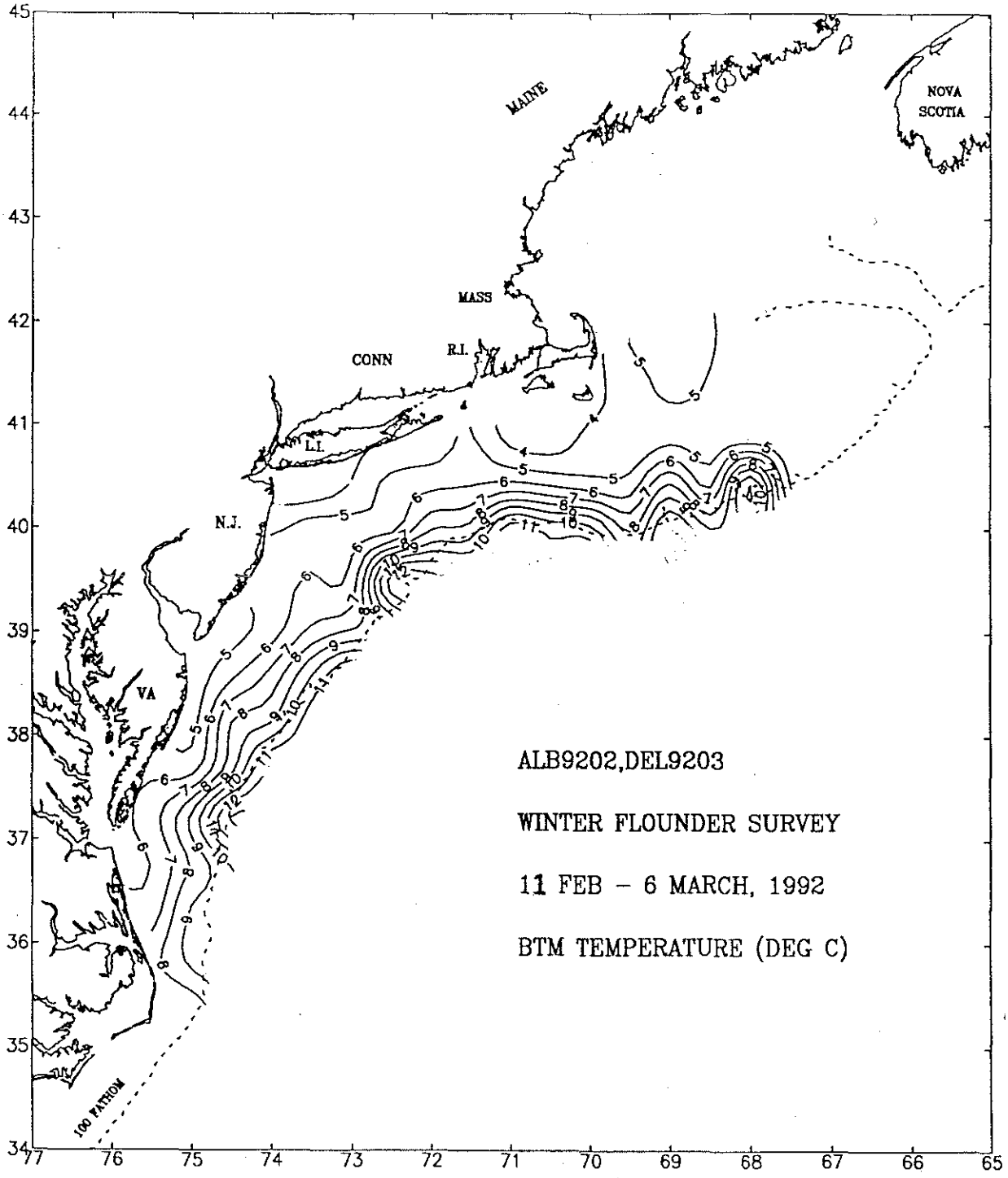


Figure 14. The bottom temperature distribution for the winter flounder survey ALB9202 / DEL9203.

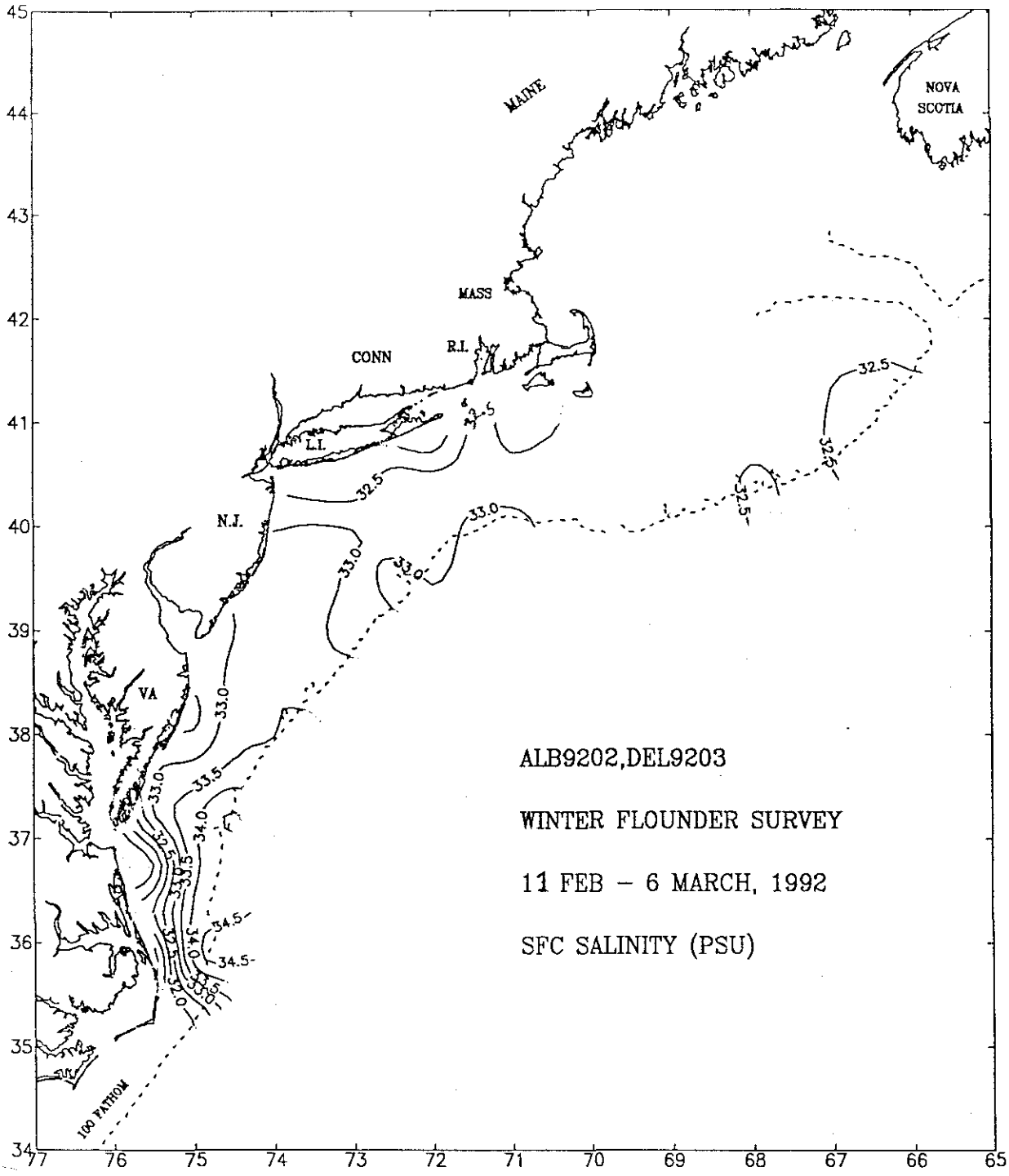


Figure 15. The surface salinity distribution for the winter flounder survey ALB9202 / DEL9203.

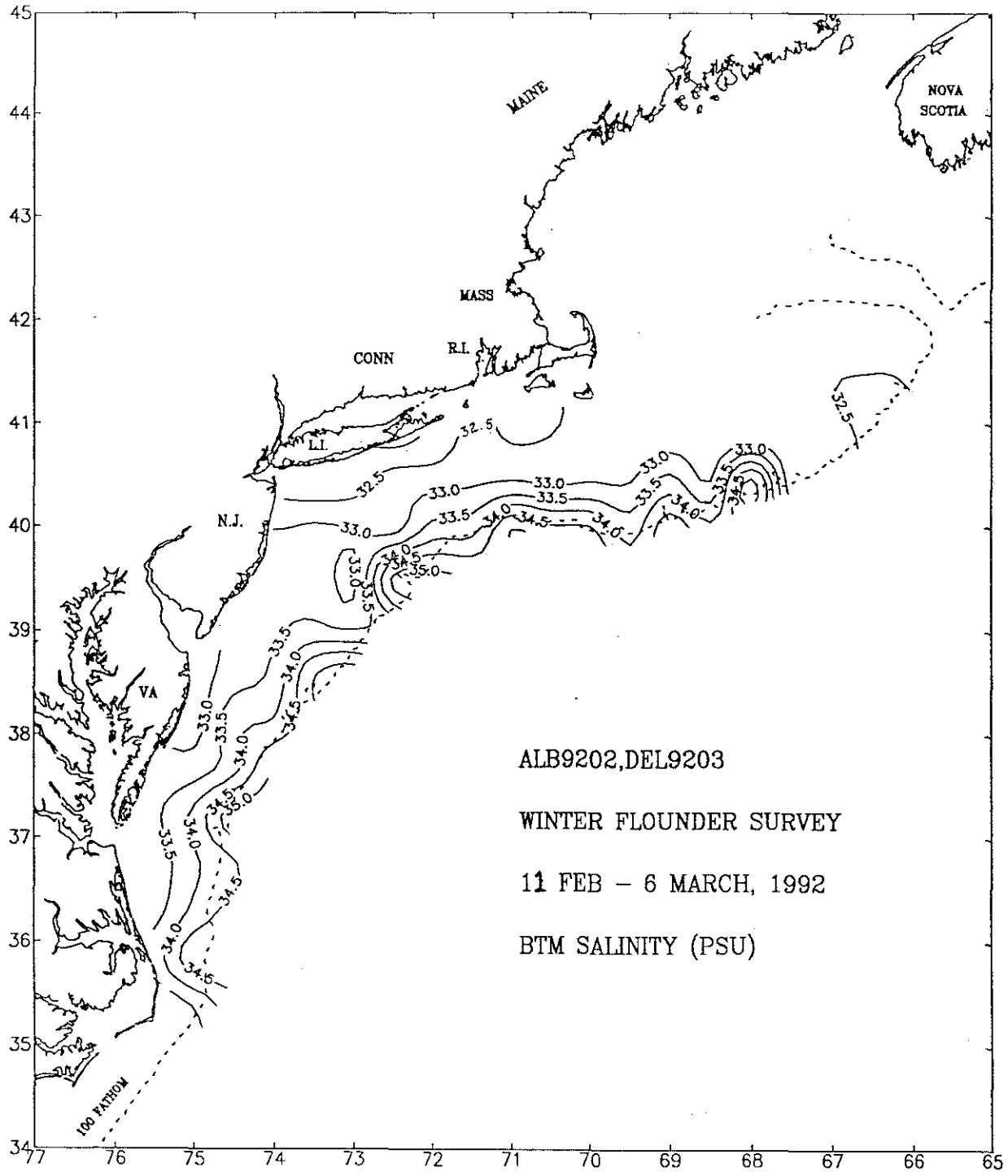


Figure 16. The bottom salinity distribution for the winter flounder survey ALB9202 / DEL9203.

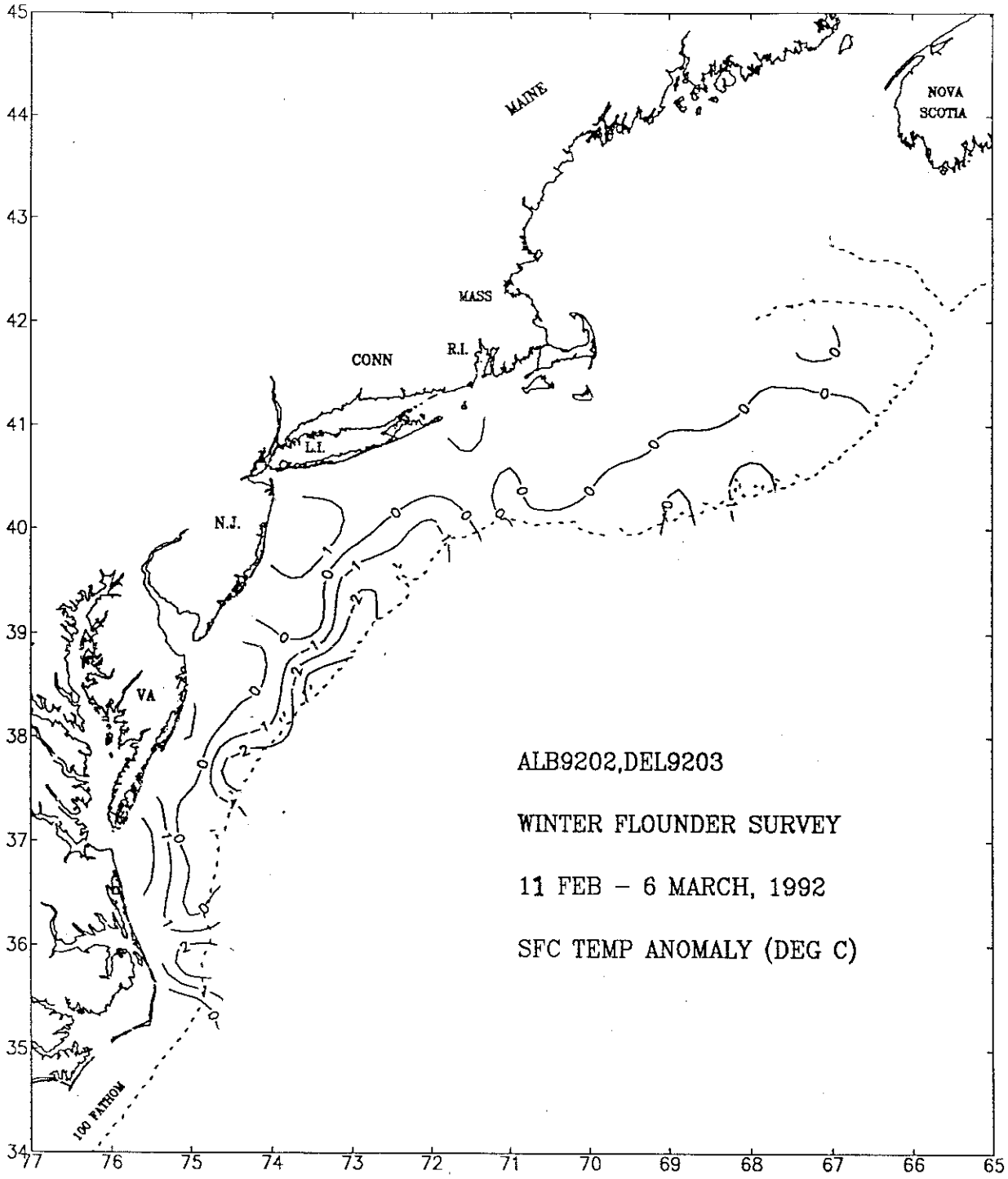


Figure 17. The surface temperature anomaly distribution for the winter flounder survey ALB9202 / DEL9203.

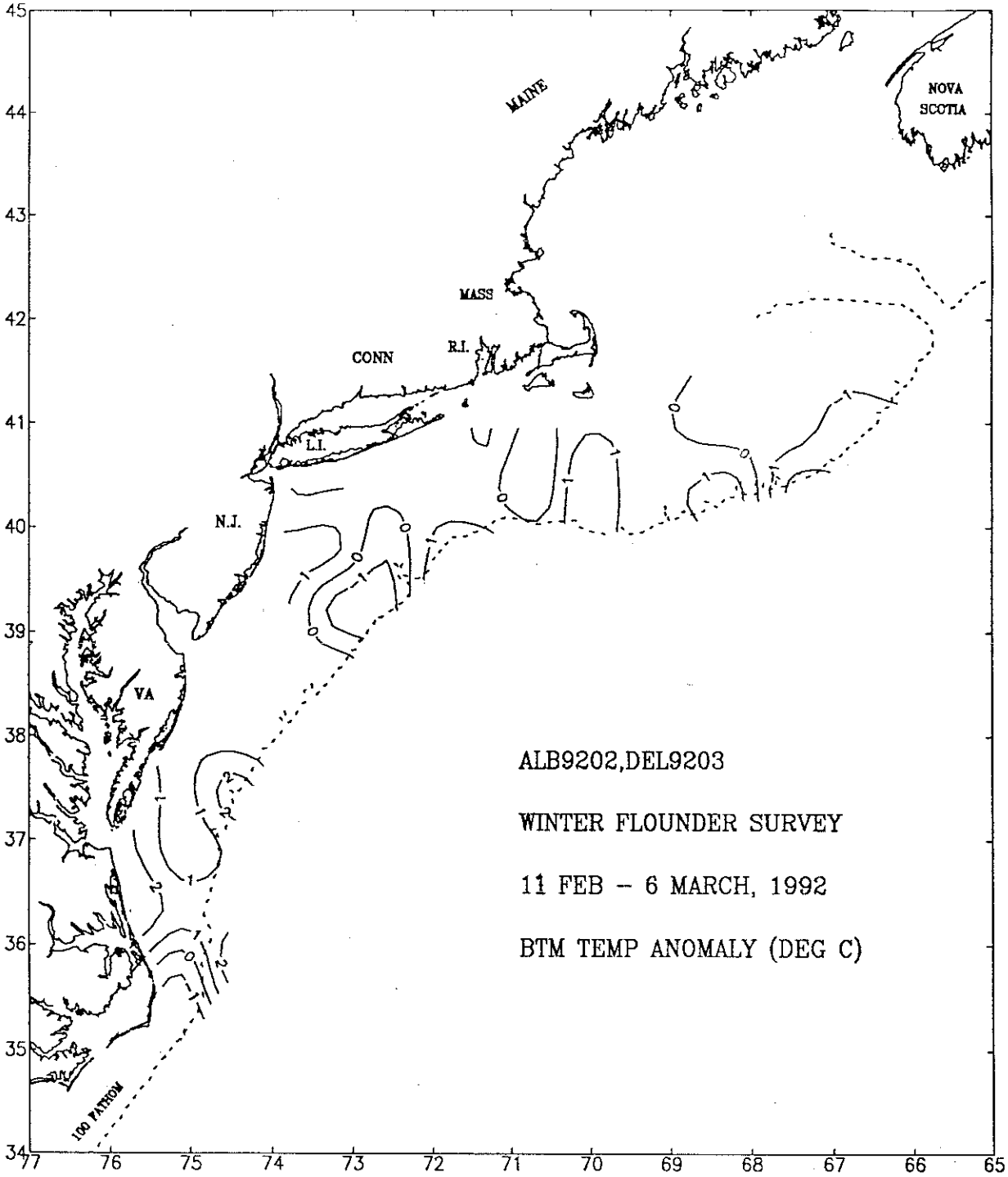


Figure 18. The bottom temperature anomaly distribution for the winter flounder survey ALB9202 / DEL9203.

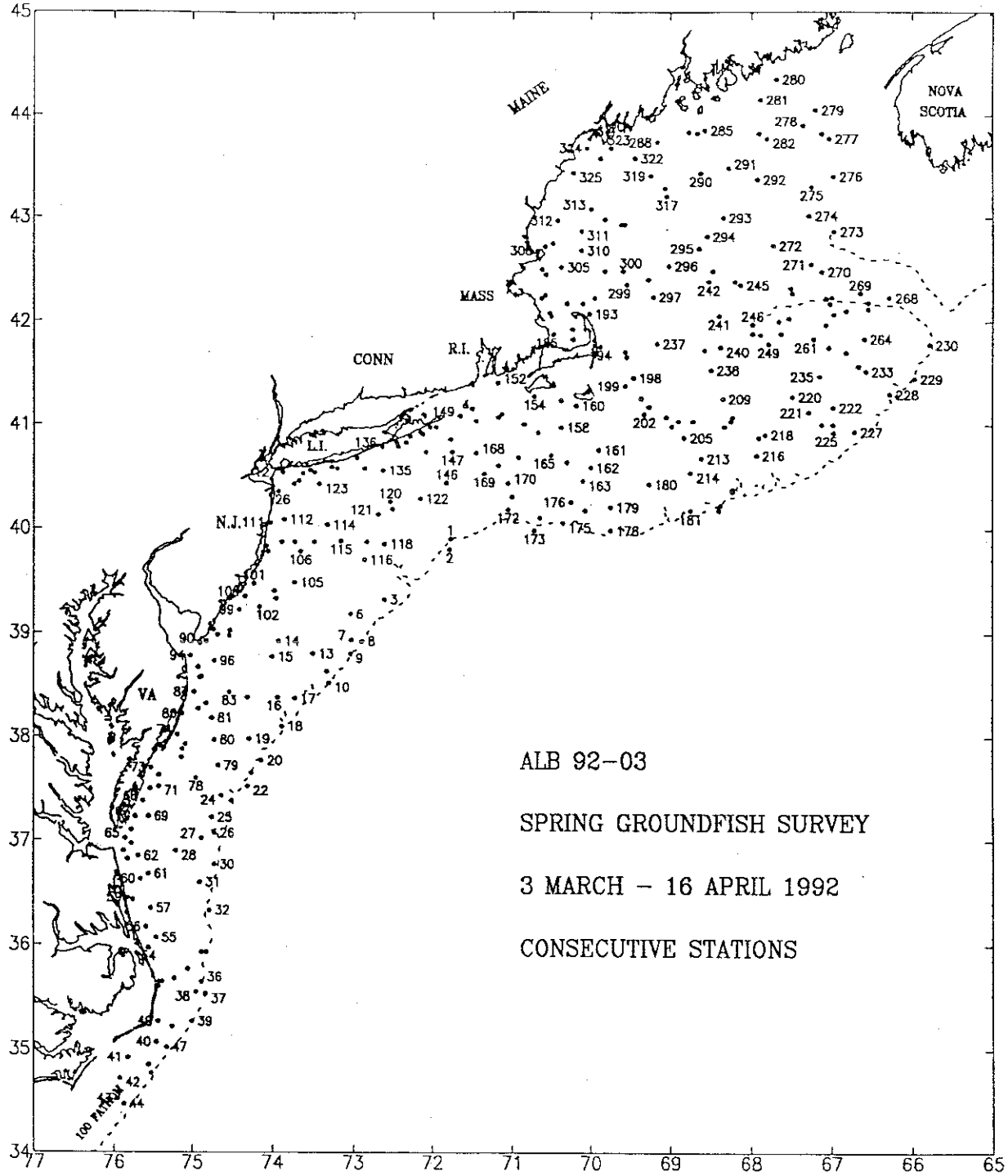


Figure 19. Hydrographic stations occupied during the spring bottom trawl survey ALB9203.

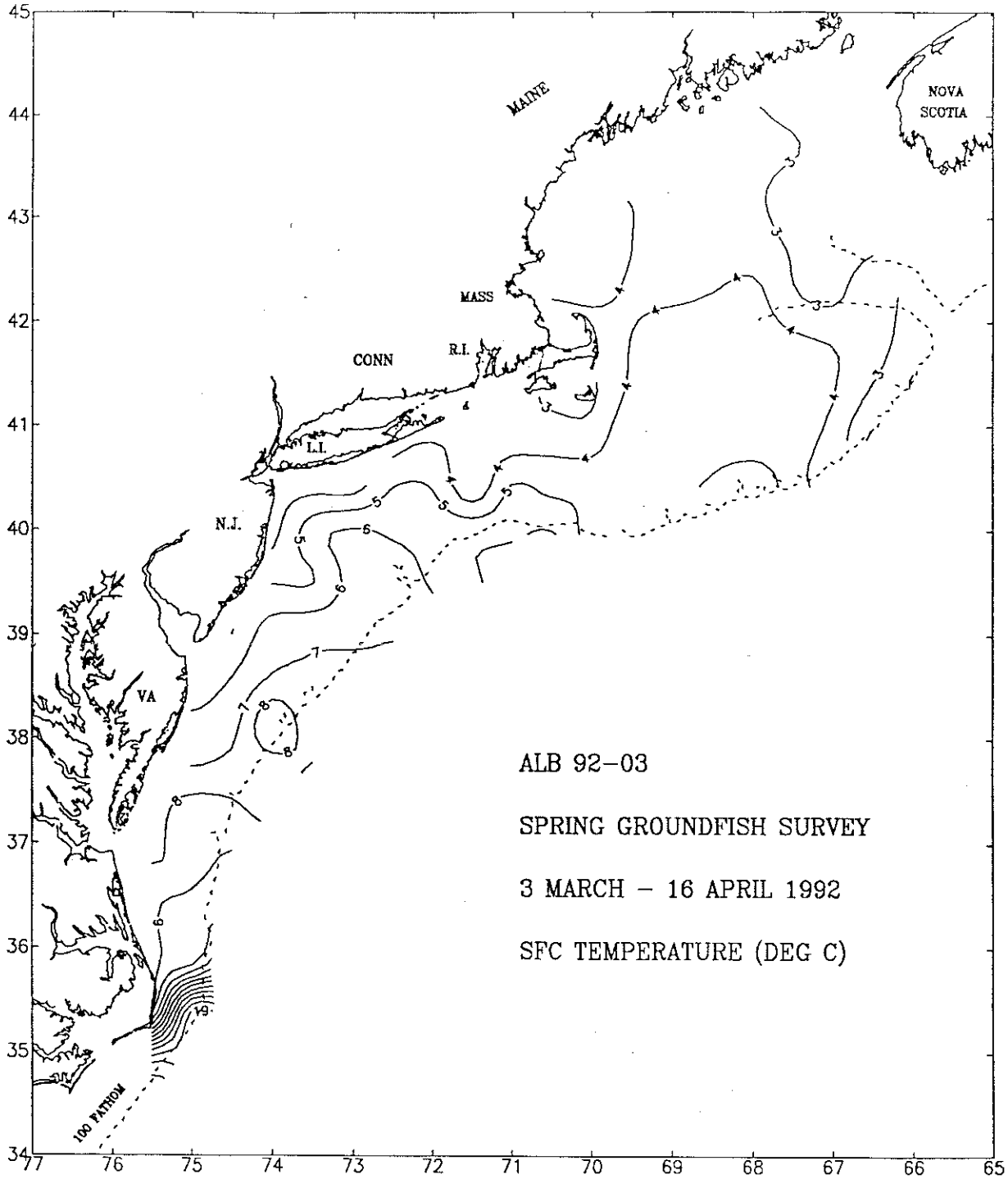


Figure 20. The surface temperature distribution for the spring bottom trawl survey ALB9203.

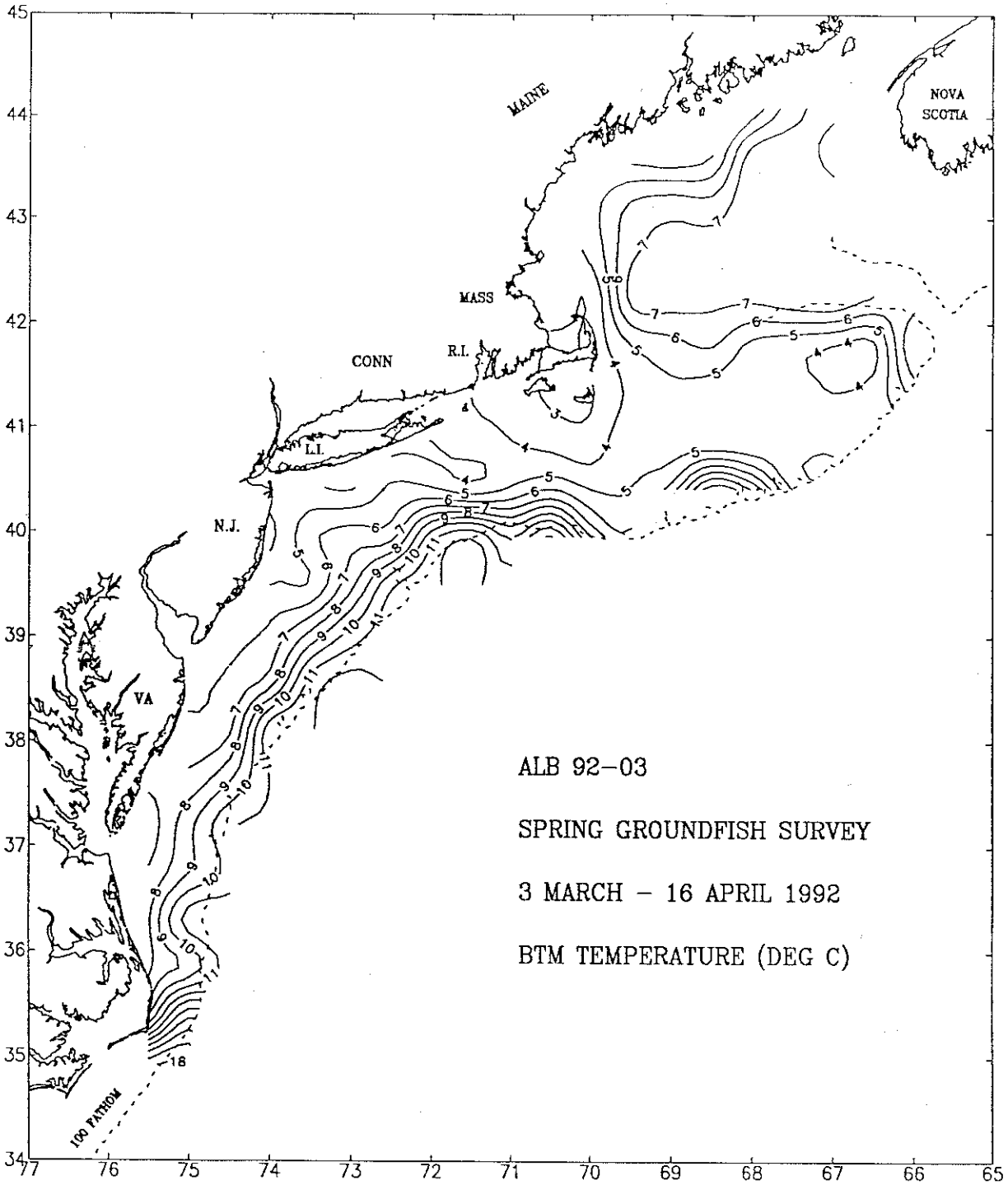


Figure 21. The bottom temperature distribution for the spring bottom trawl survey ALB9203.

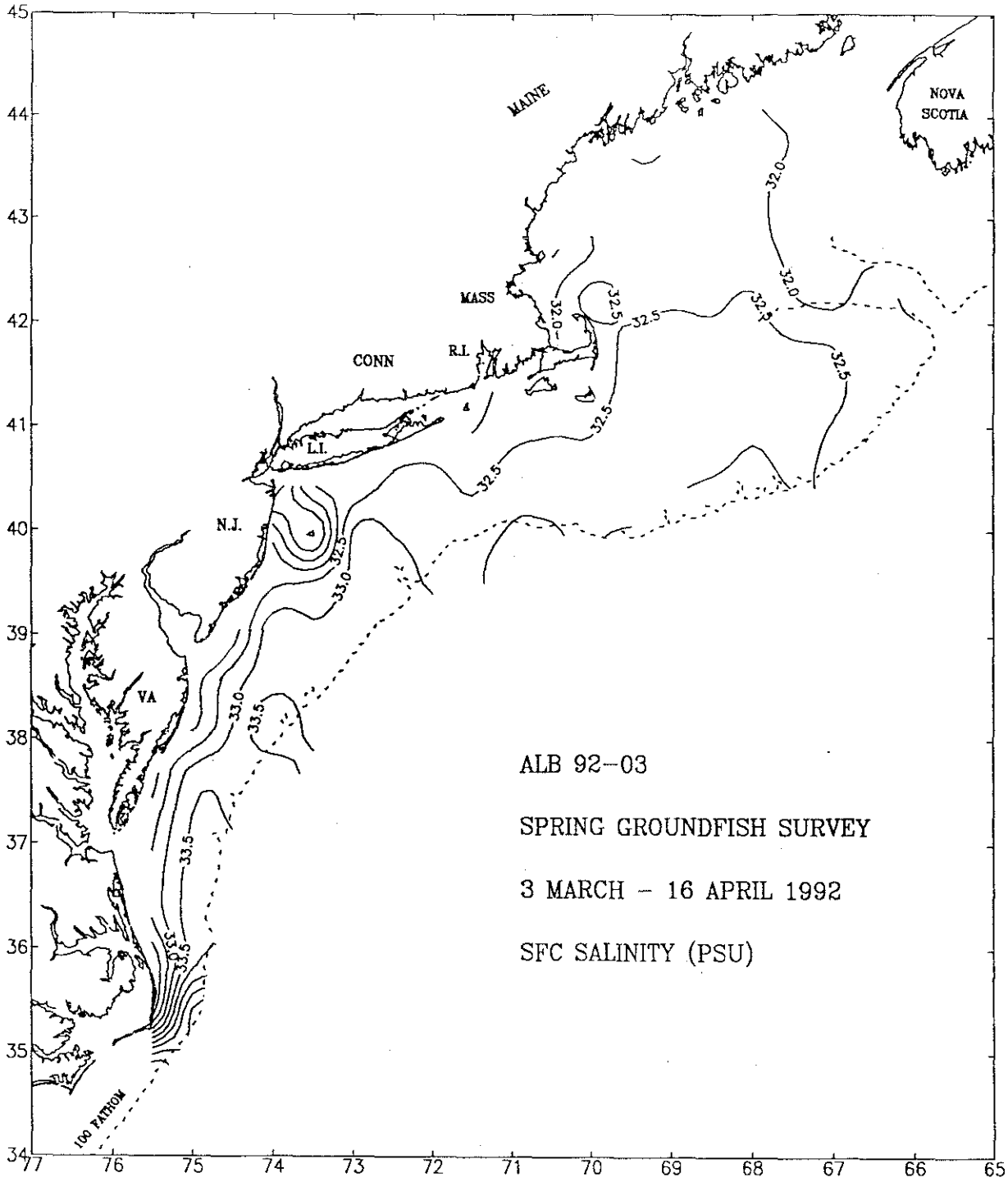


Figure 22. The surface salinity distribution for the spring bottom trawl survey ALB9203.

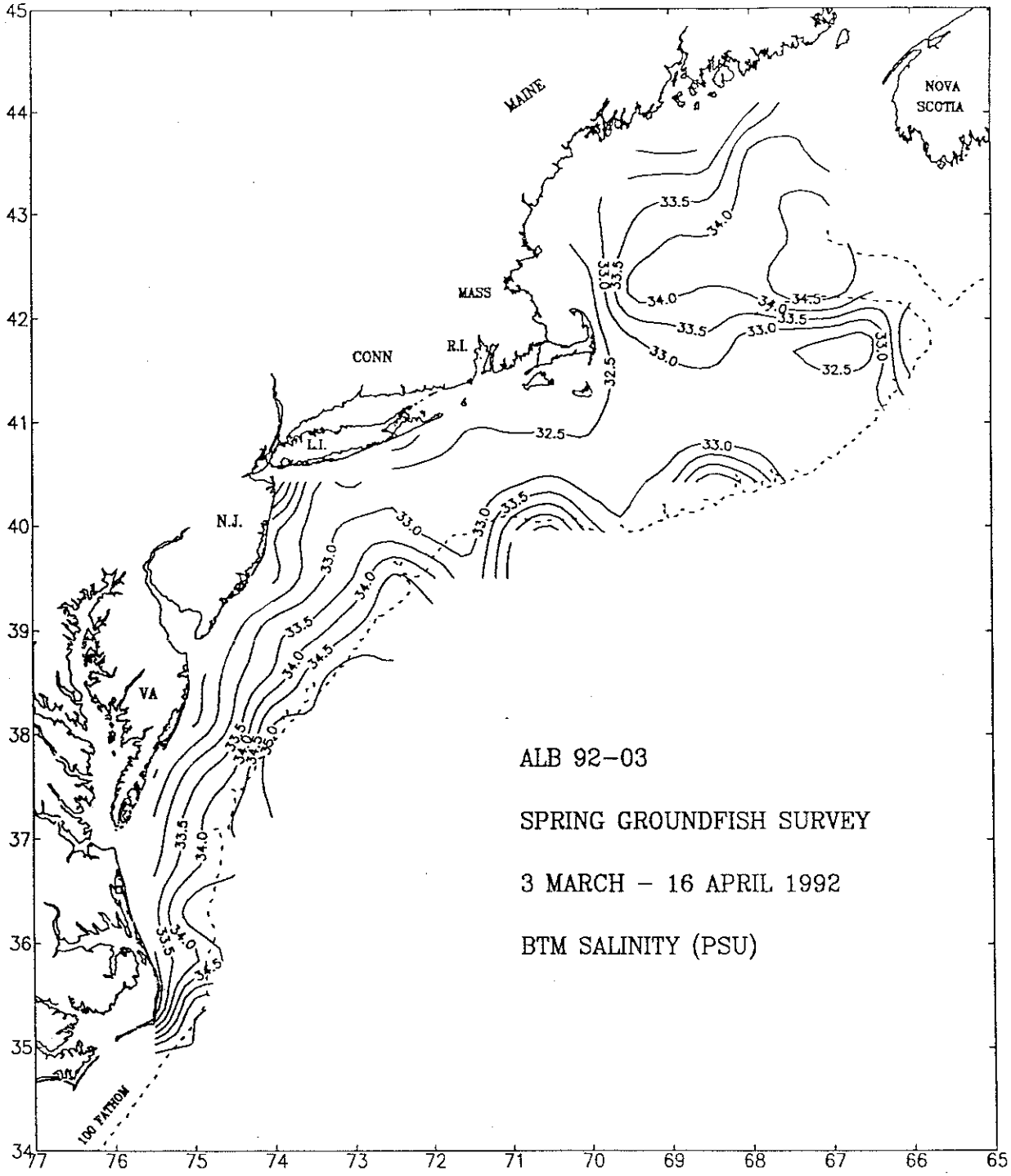


Figure 23. The bottom salinity distribution for the spring bottom trawl survey ALB9203.

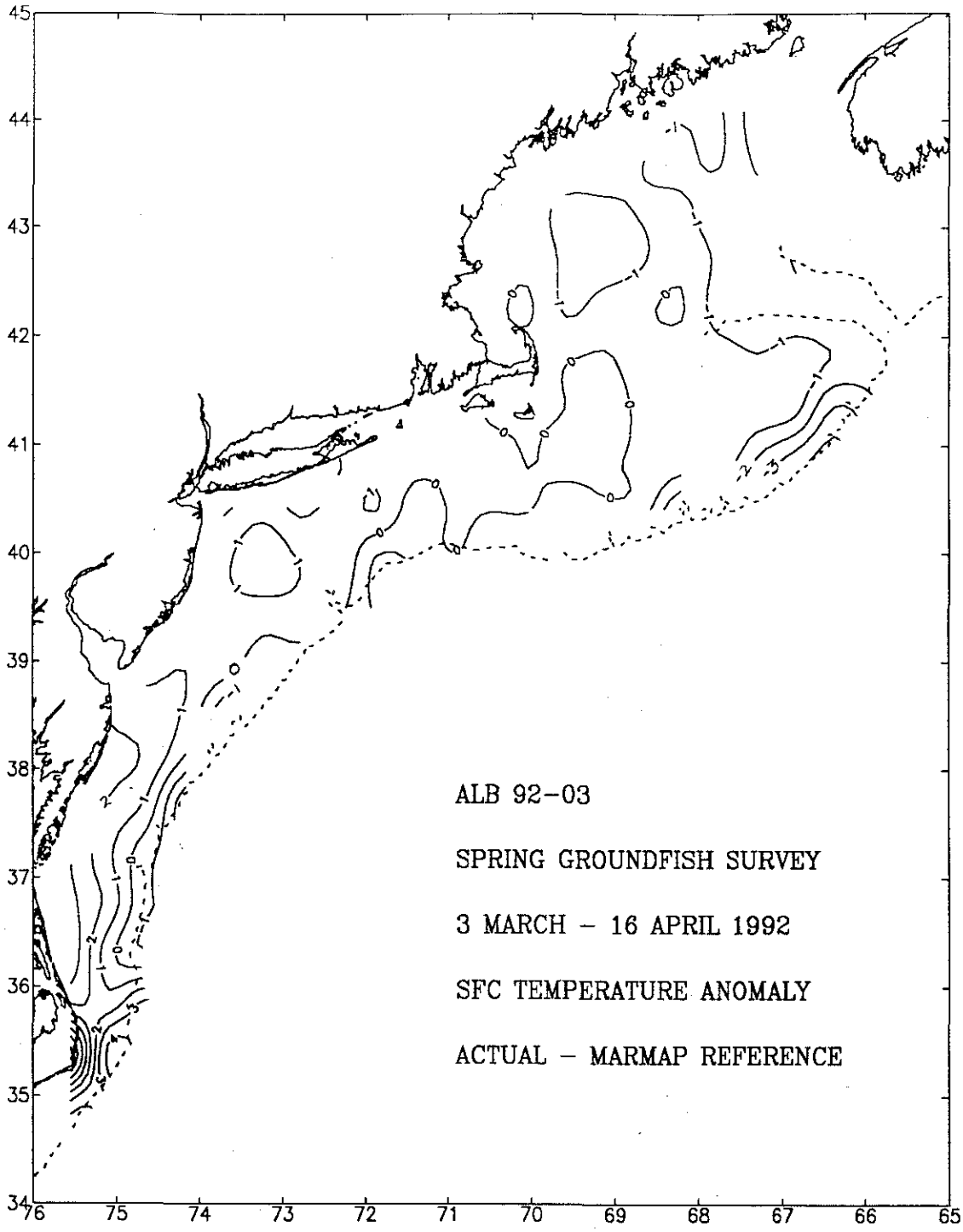


Figure 24. The surface temperature anomaly distribution for the spring bottom trawl survey ALB9203.

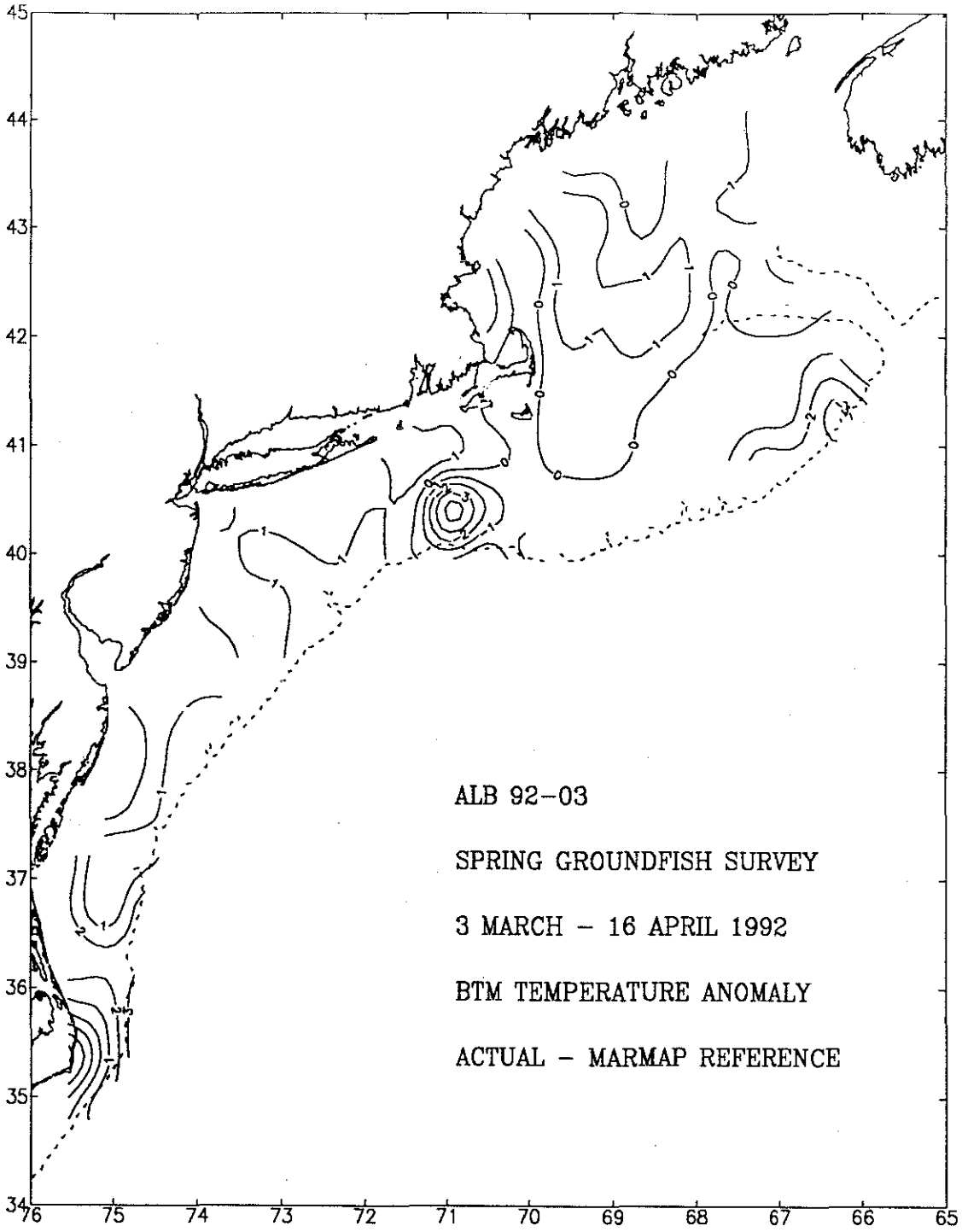


Figure 25. The bottom temperature anomaly distribution for the spring bottom trawl survey ALB9203.

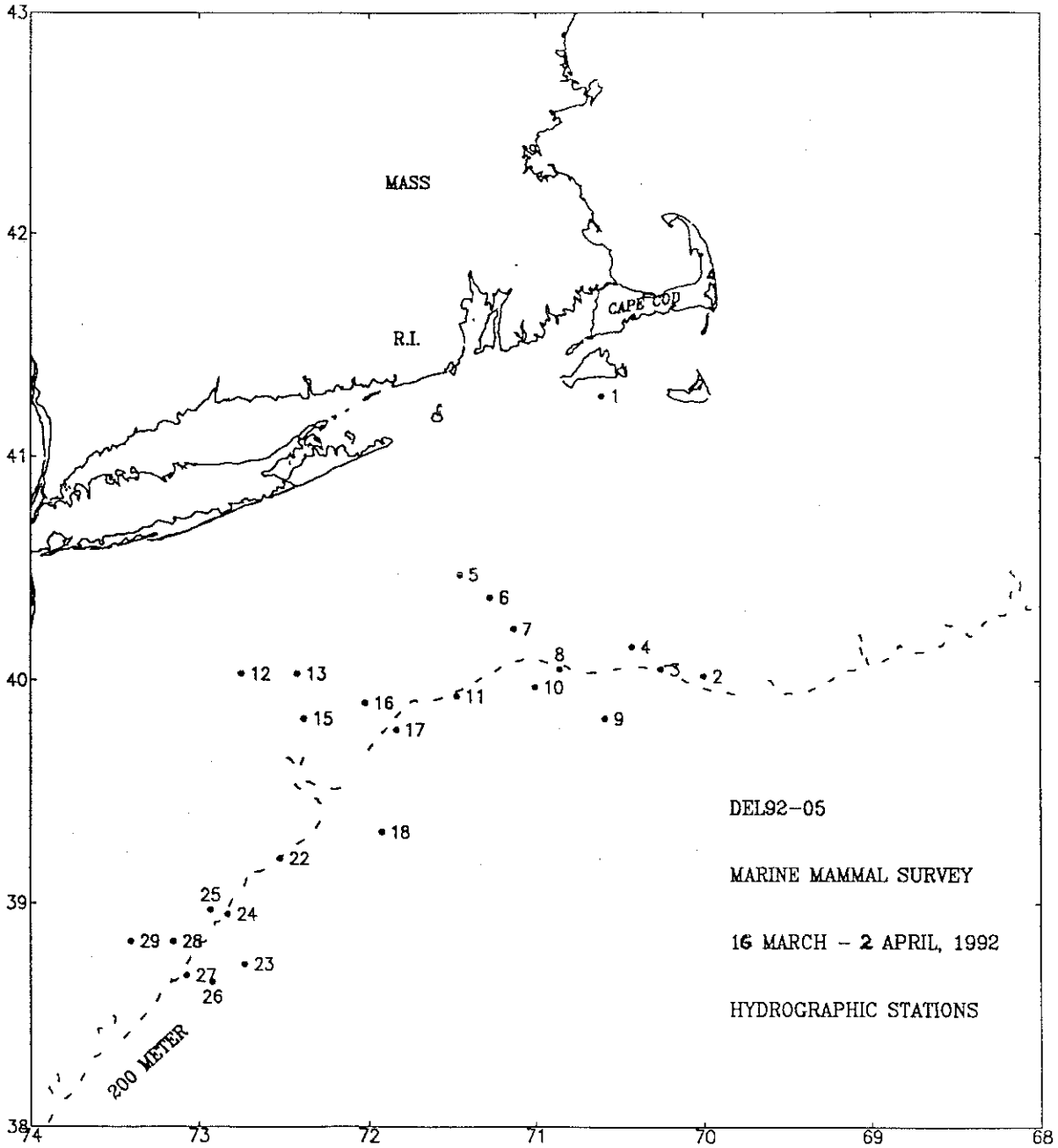


Figure 26. Hydrographic stations occupied during the marine mammal sighting survey DEL9205.

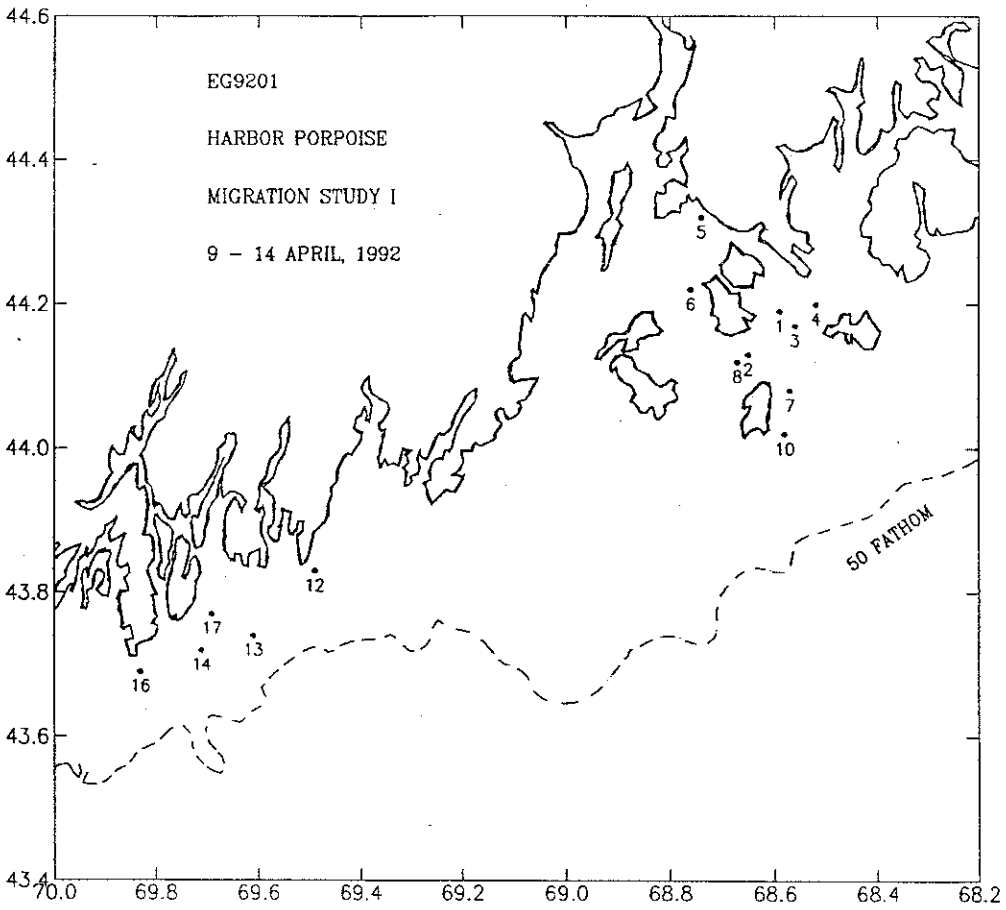


Figure 27. Hydrographic stations occupied during the harbor porpoise migration study EG9201.

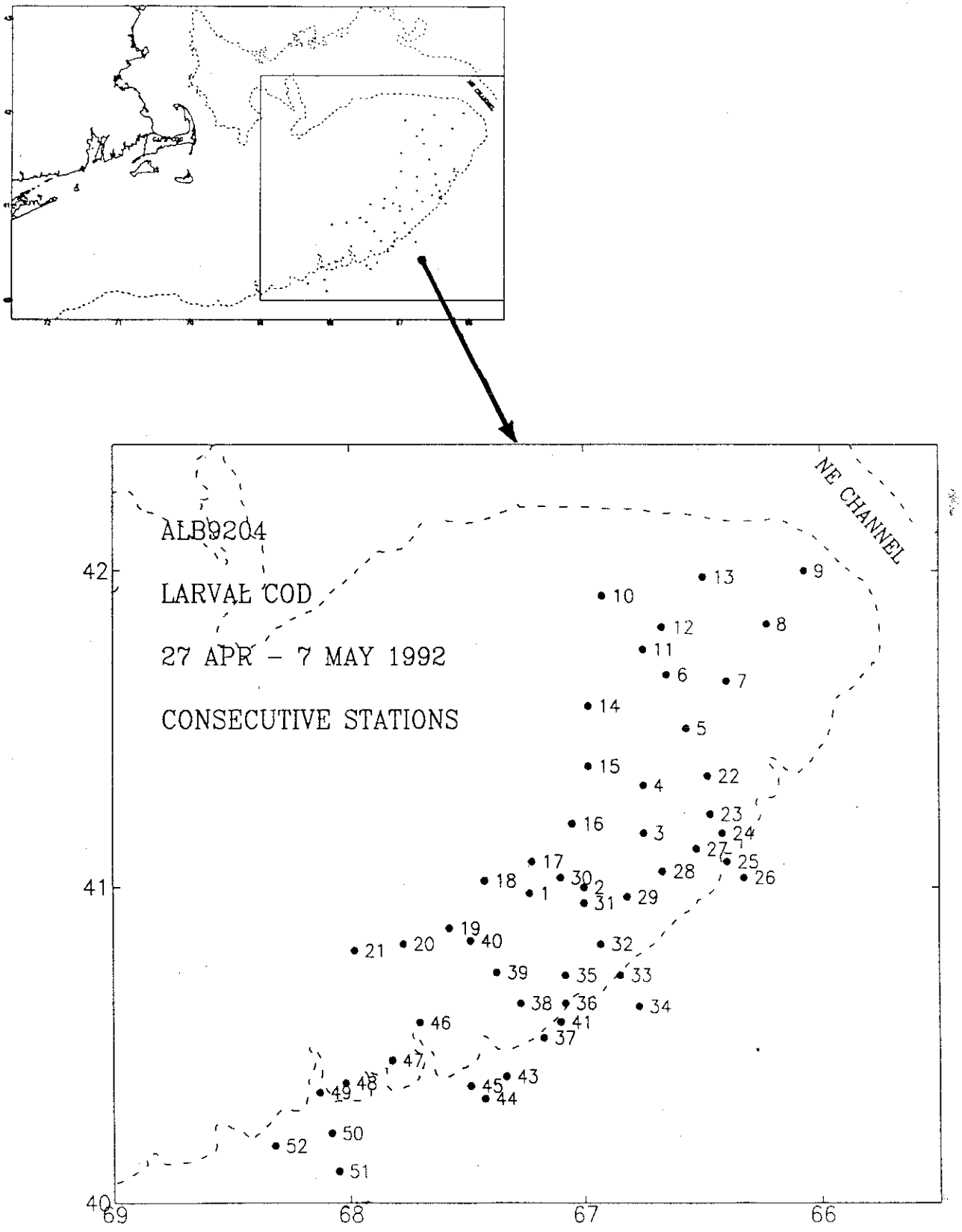


Figure 28. Hydrographic stations occupied during the larval cod survey ALB9204.

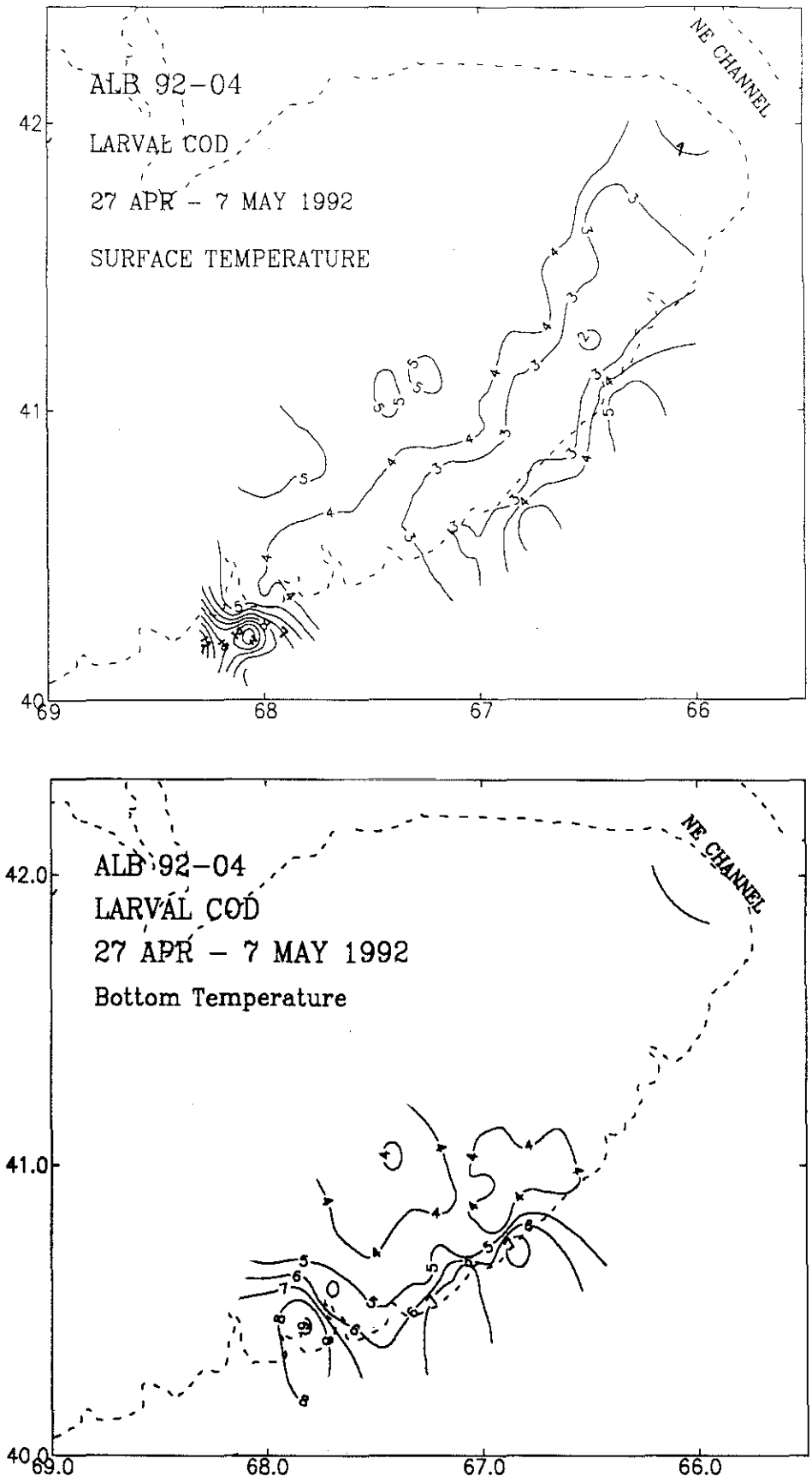


Figure 29. The surface and bottom temperature distribution for the larval cod survey ALB9204.

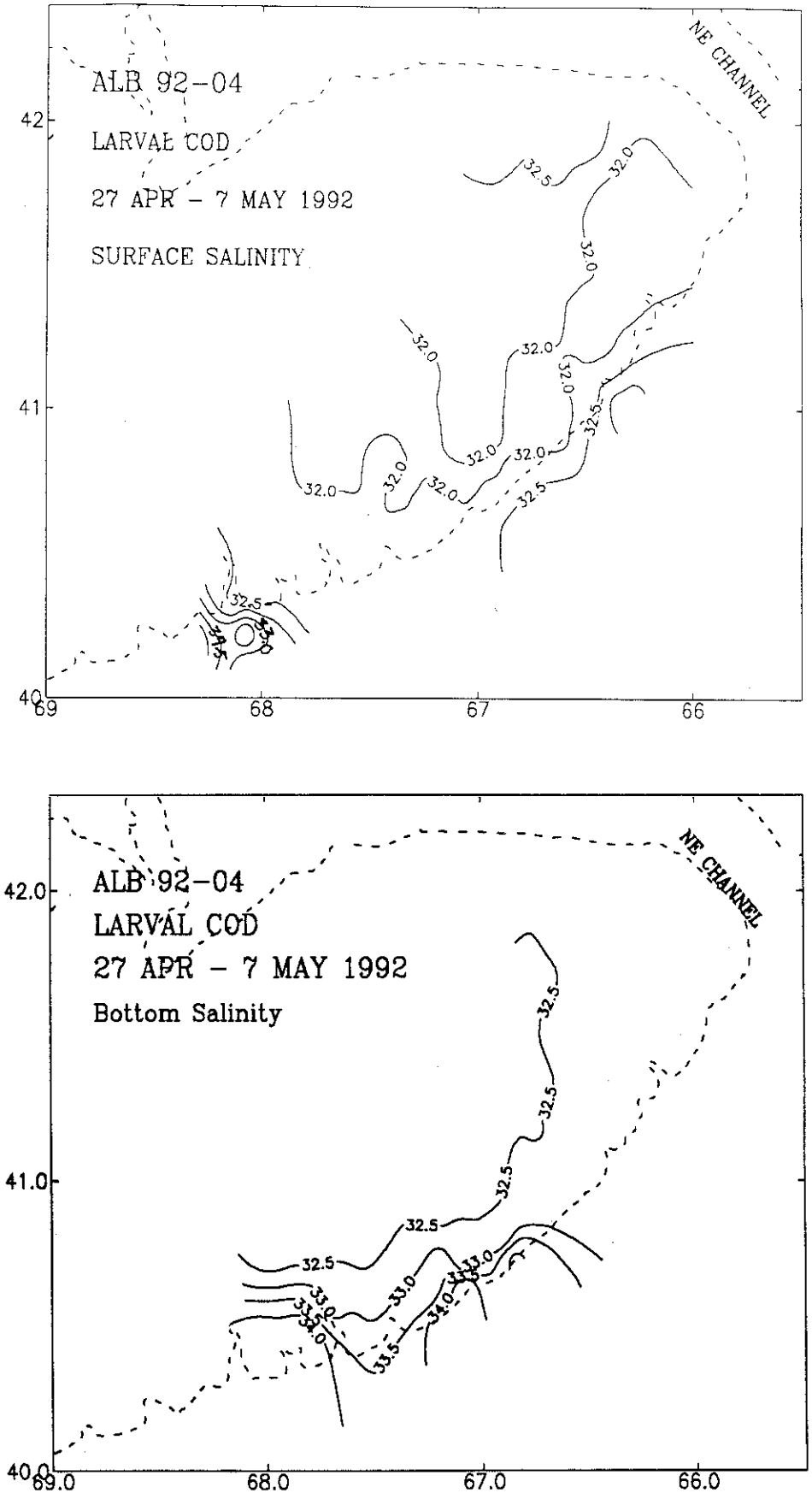


Figure 30. The surface and bottom salinity distribution for the larval cod survey ALB9204.

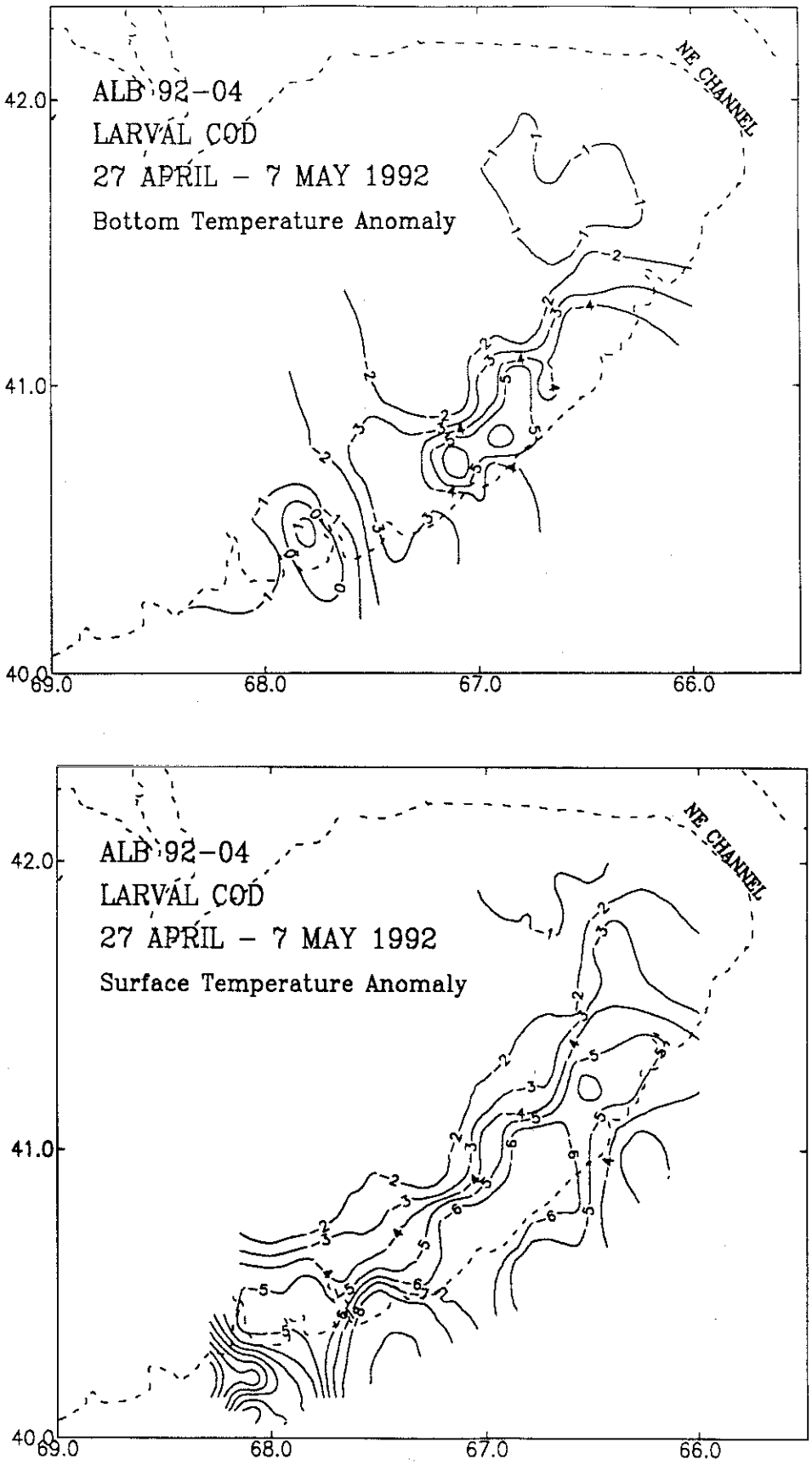


Figure 31. The surface and bottom temperature anomaly distribution for the larval cod survey ALB9204.

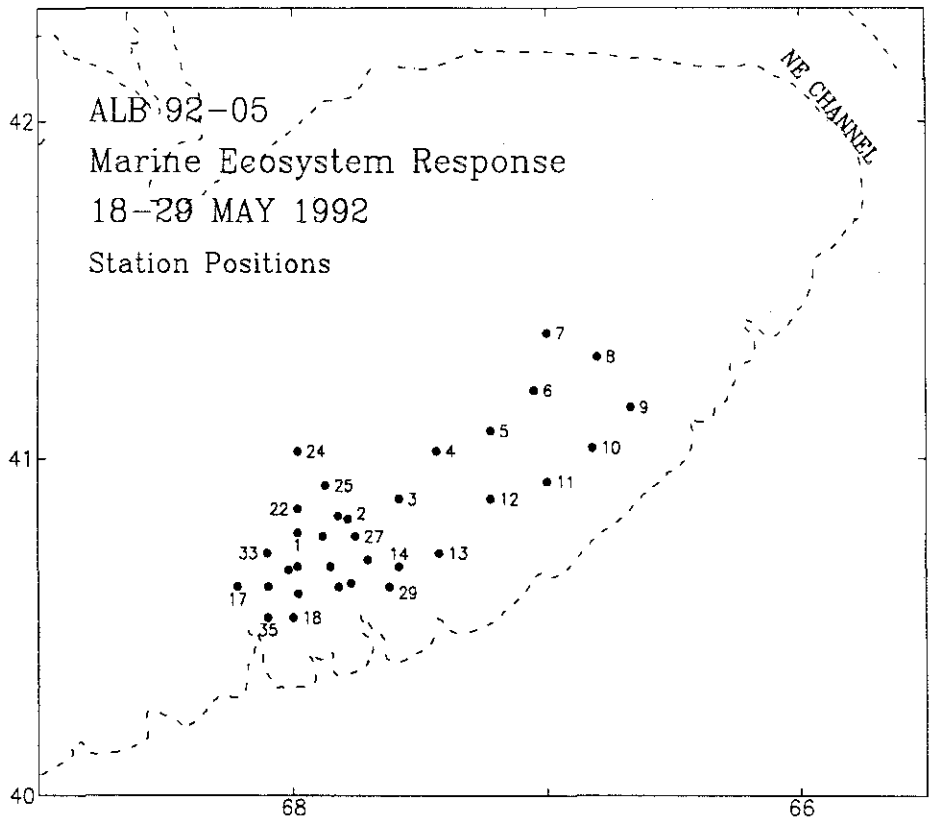


Figure 32. Hydrographic stations occupied during the stratif-ication study ALB9205.

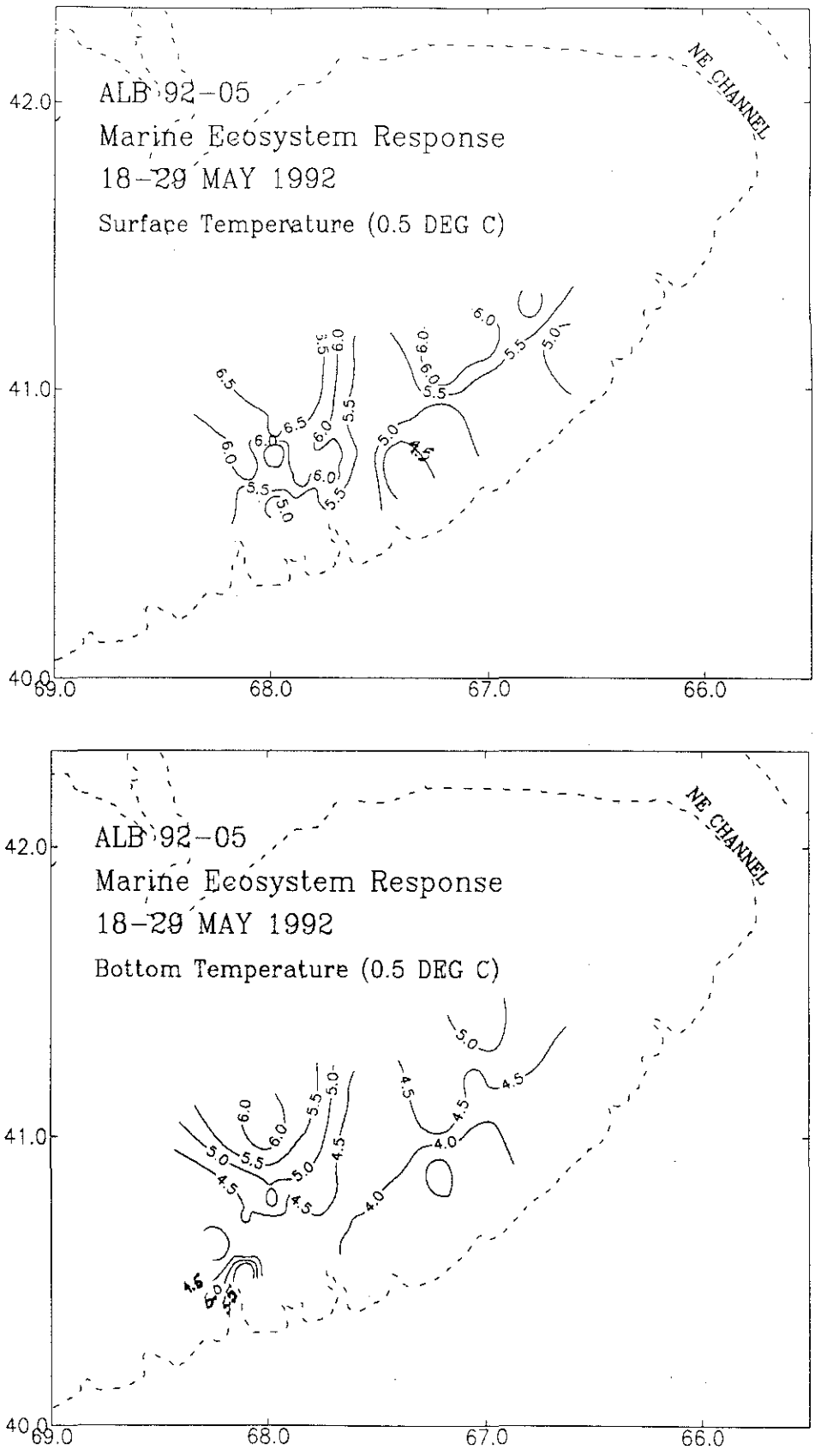


Figure 33. The surface and bottom temperature distribution for the stratification study ALB9205.

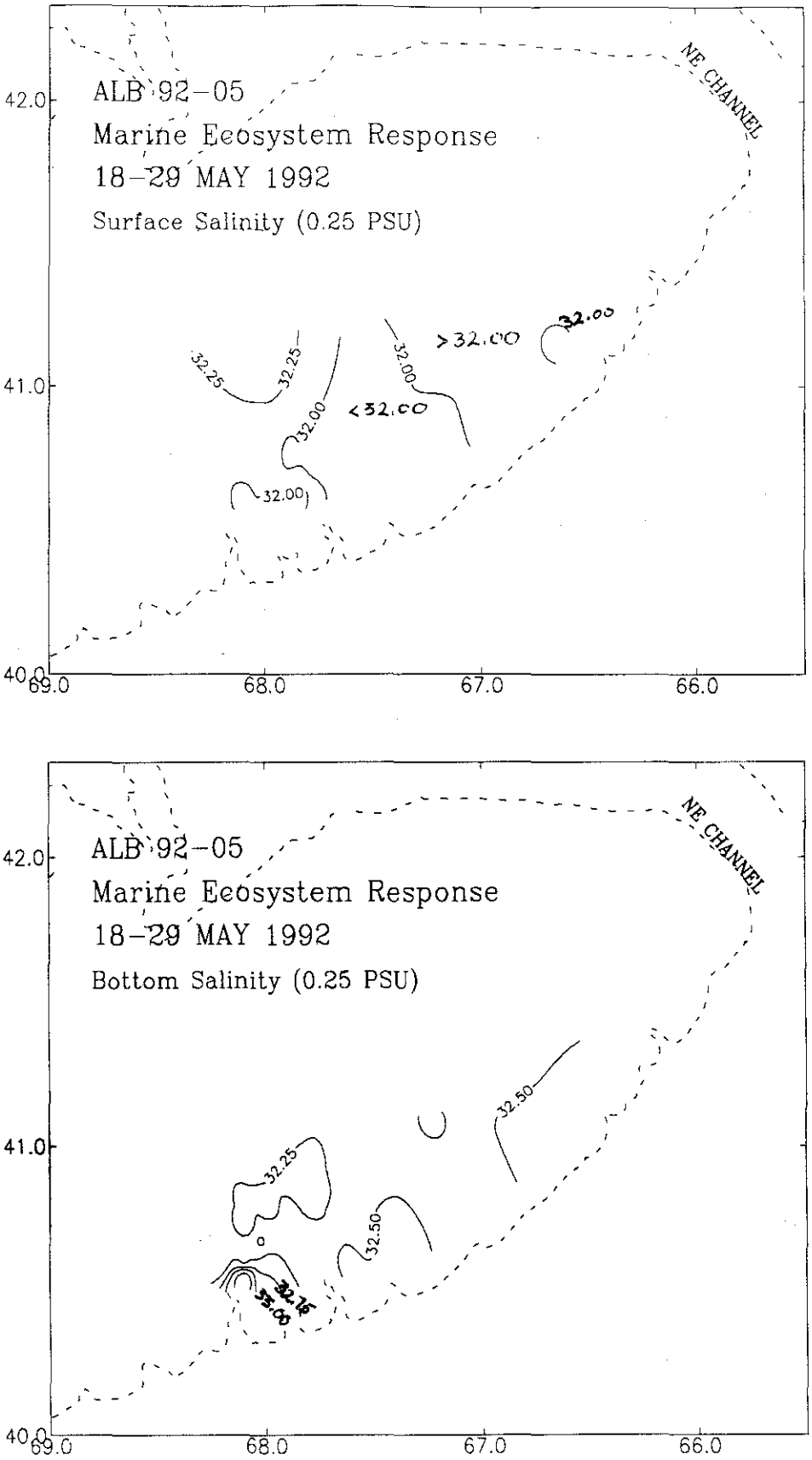


Figure 34. The surface and bottom salinity distribution for the stratification study ALB9205.

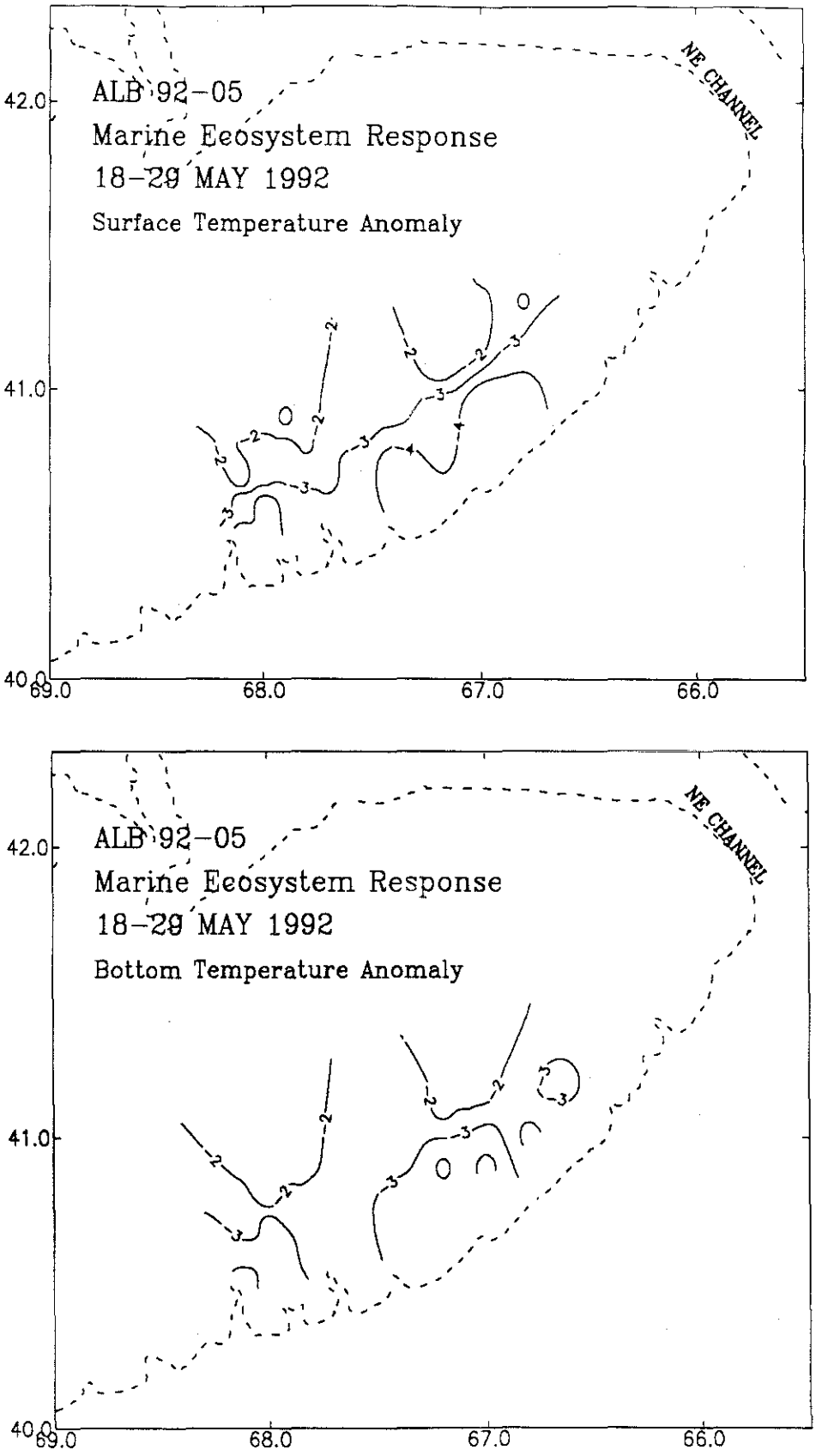


Figure 35. The surface and bottom temperature anomaly distribution for the stratification study ALB9205.

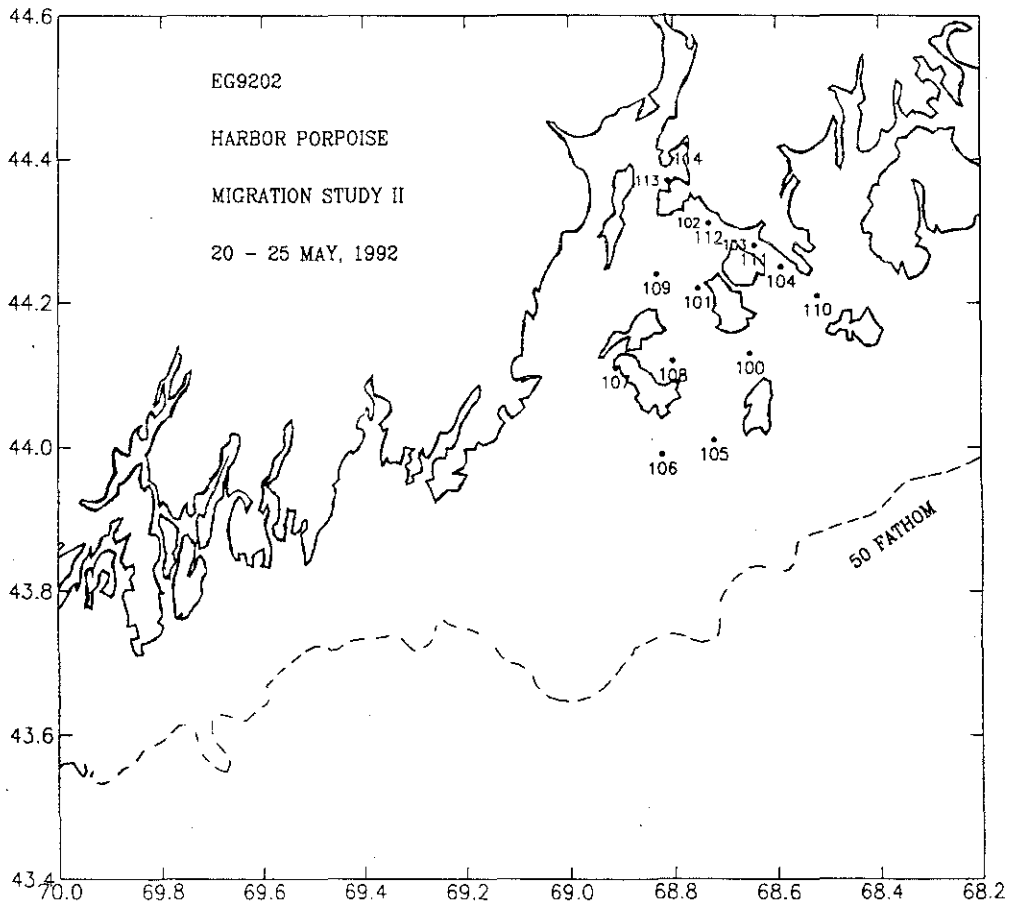


Figure 36. Hydrographic stations occupied during the harbor porpoise migration study EG9202.

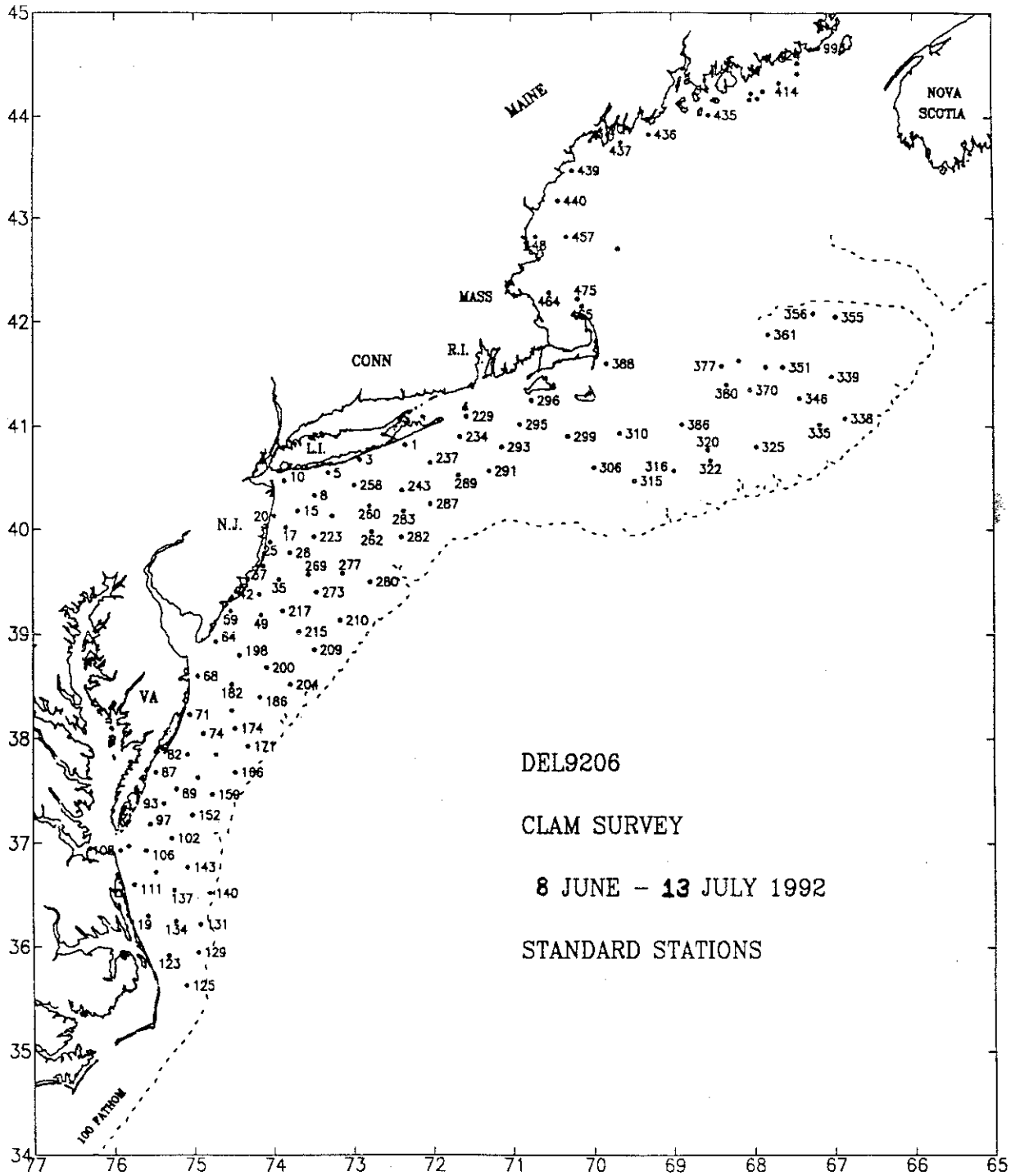


Figure 37. Hydrographic stations occupied during the clam survey DEL9206.

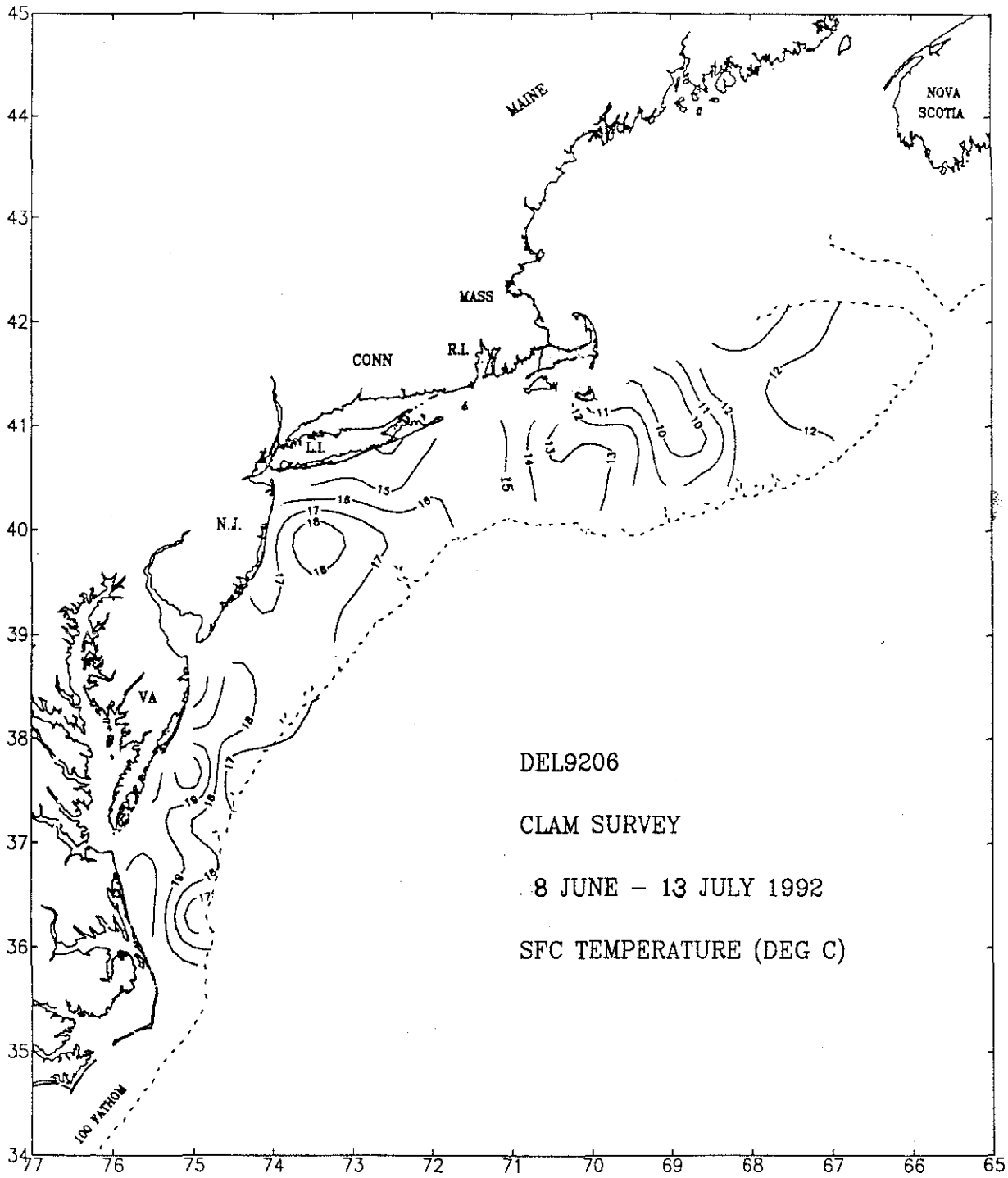


Figure 38. The surface temperature distribution for the clam survey DEL9206.

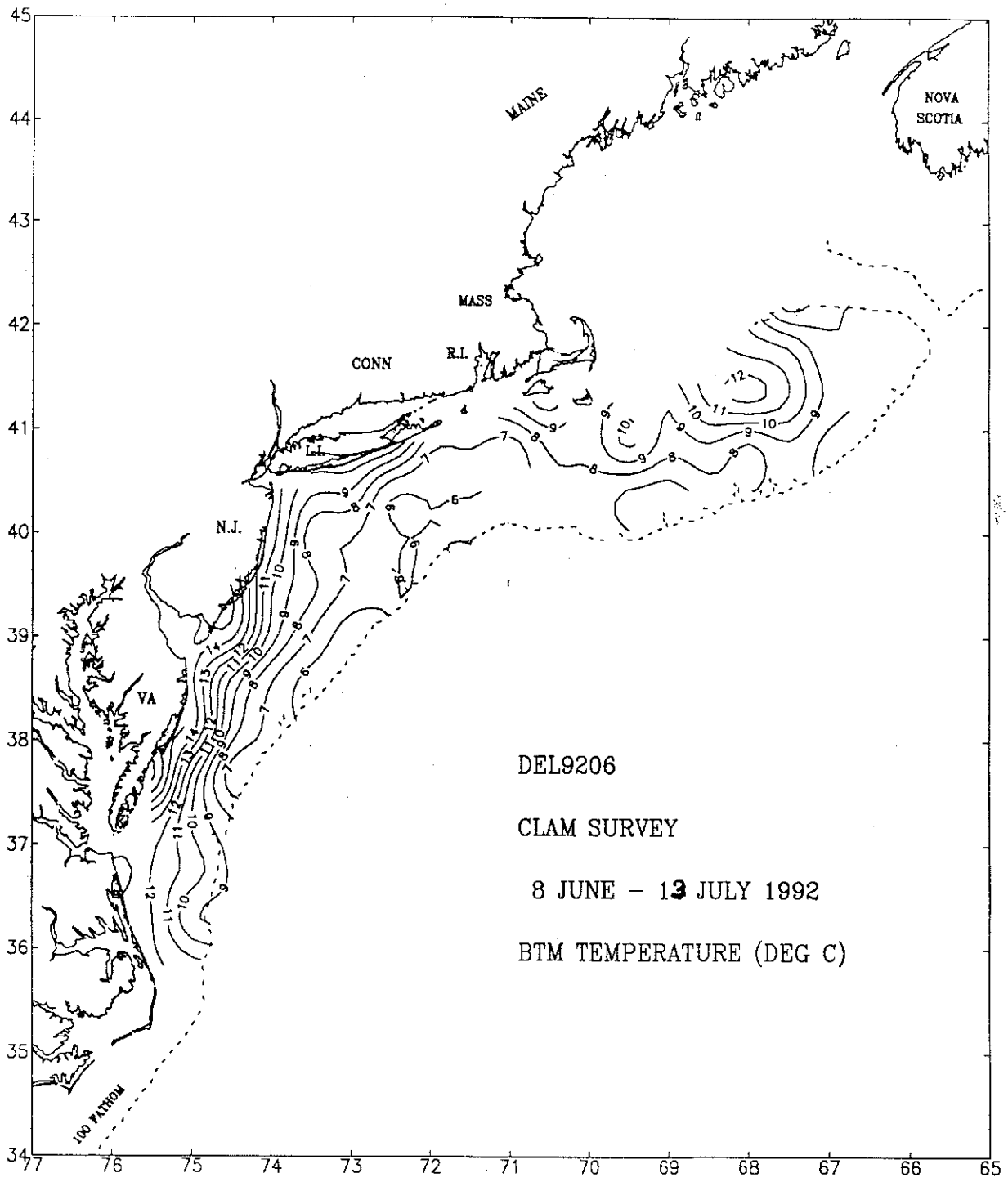


Figure 39. The bottom temperature distribution for the clam survey DEL9206.

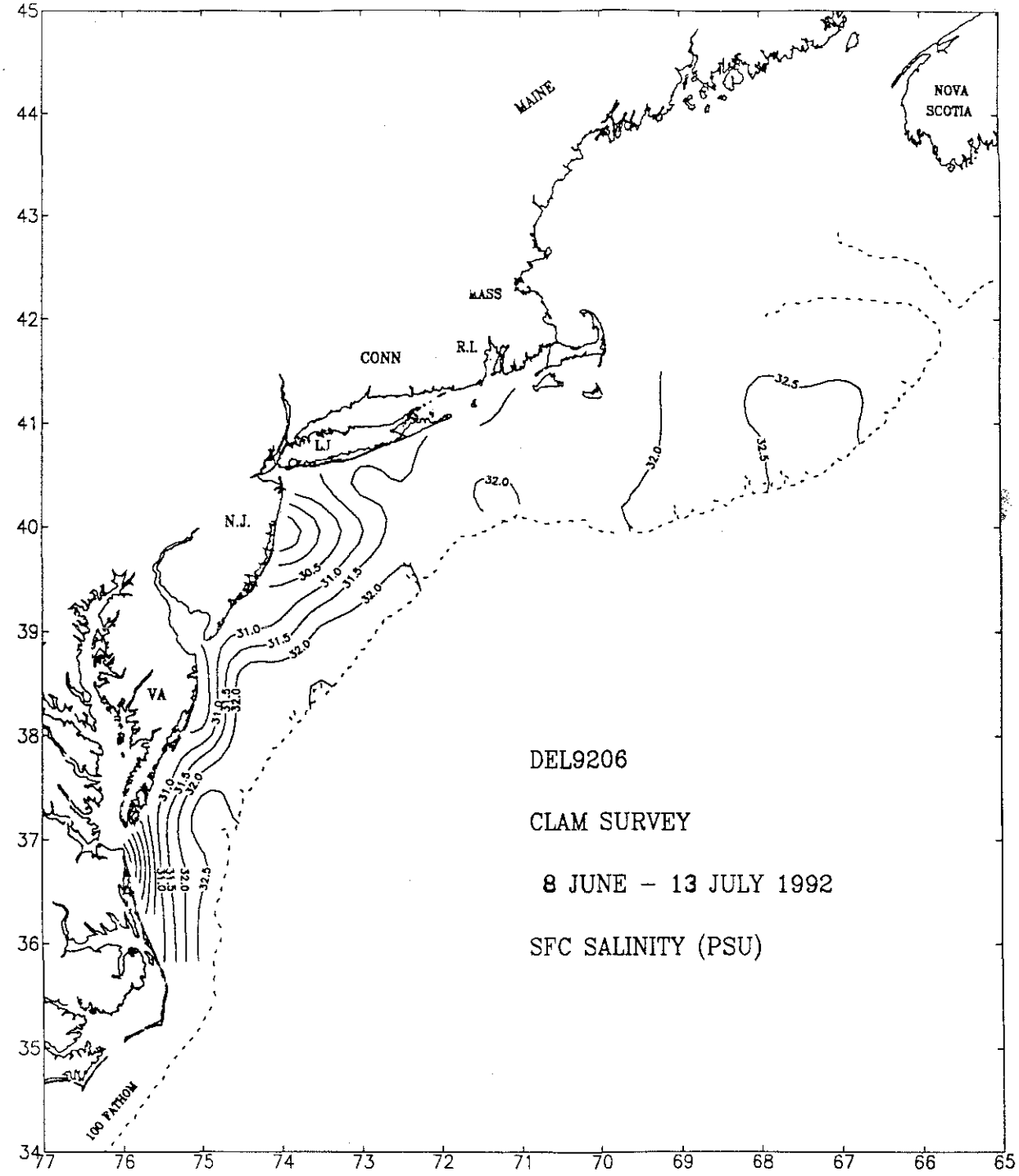


Figure 40. The surface salinity distribution for the clam survey DEL9206.

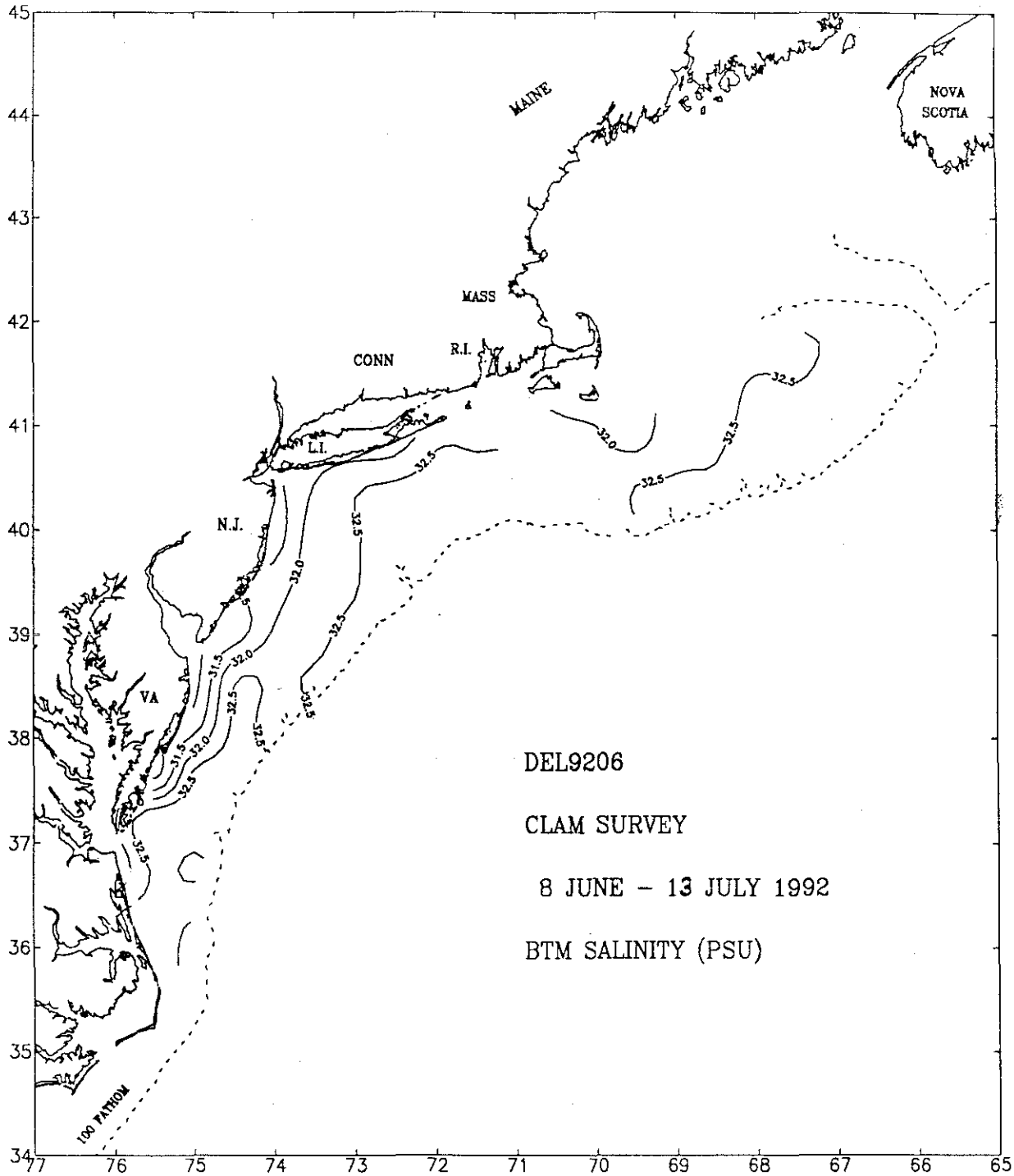


Figure 41. The bottom salinity distribution for the clam survey DEL9206.

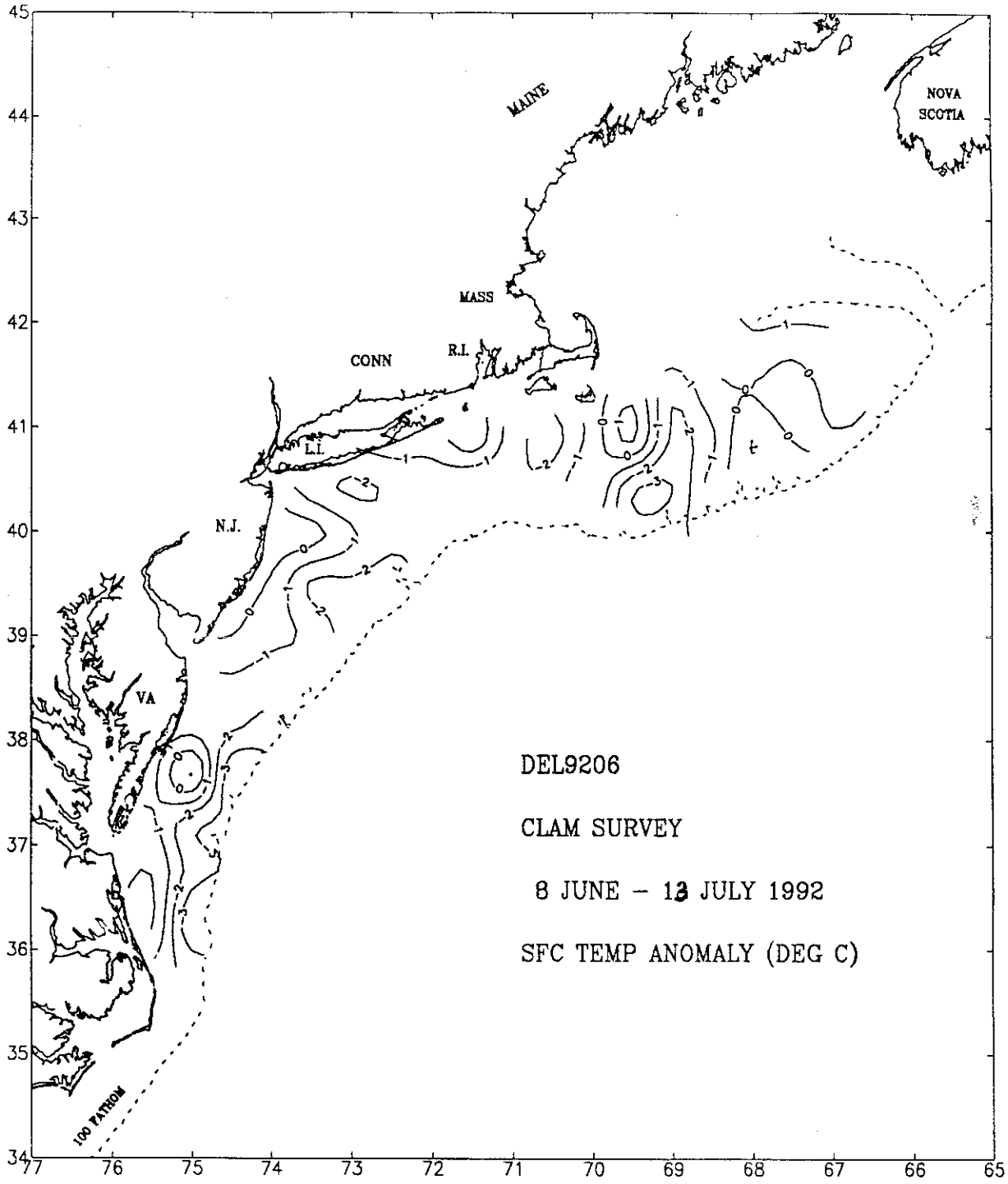


Figure 42. The surface temperature anomaly distribution for the clam survey DEL9206.

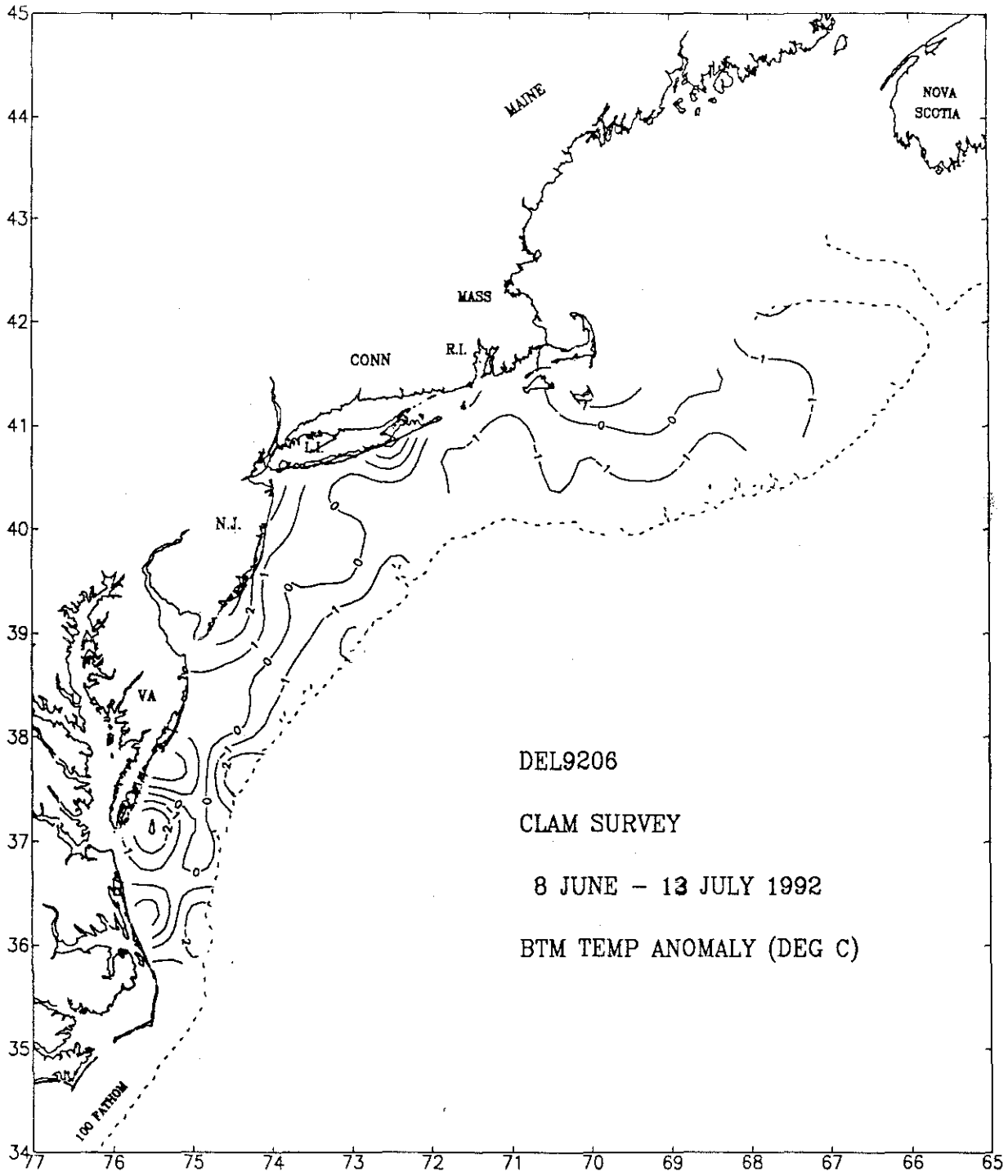


Figure 43. The bottom temperature anomaly distribution for the clam survey DEL9206.

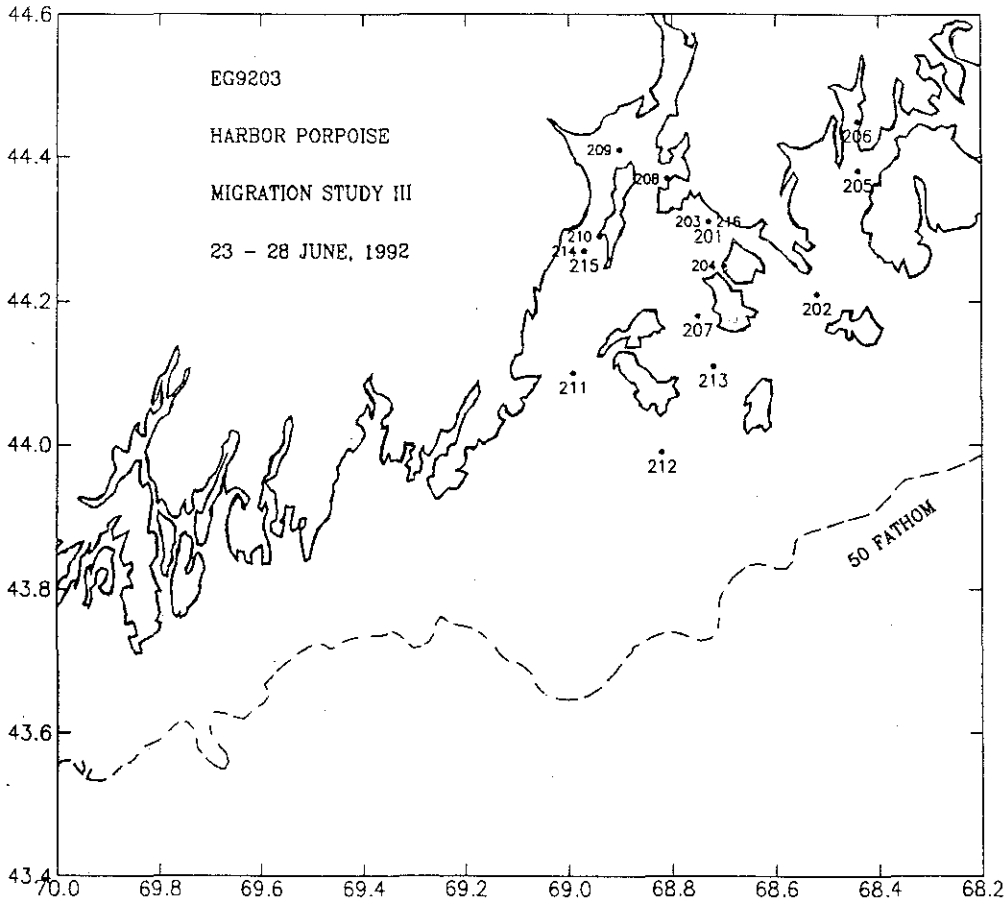


Figure 44. Hydrographic stations occupied during the harbor porpoise migration study EG9203.

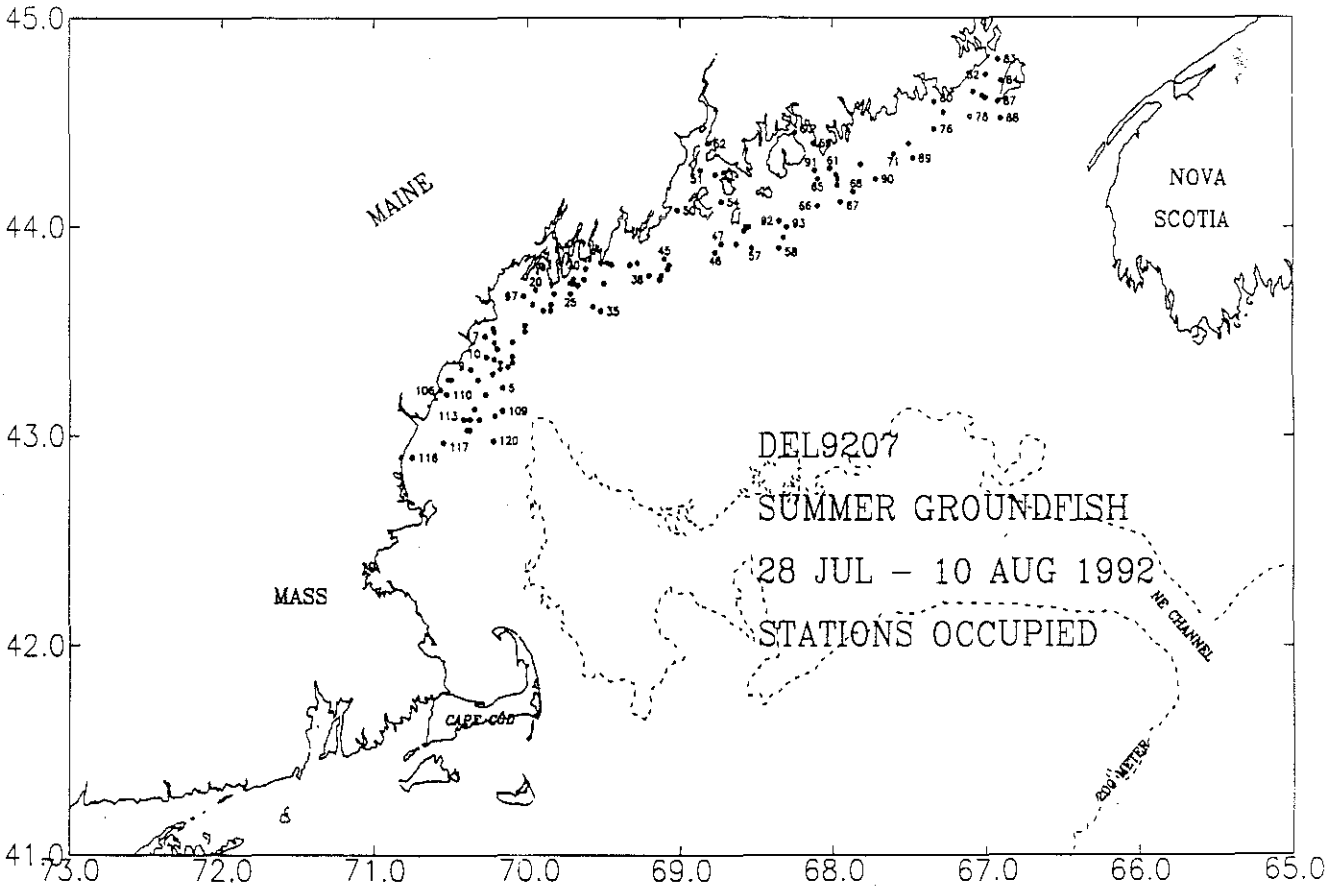


Figure 45. Hydrographic stations occupied during the summer bottom trawl survey DEL9207.

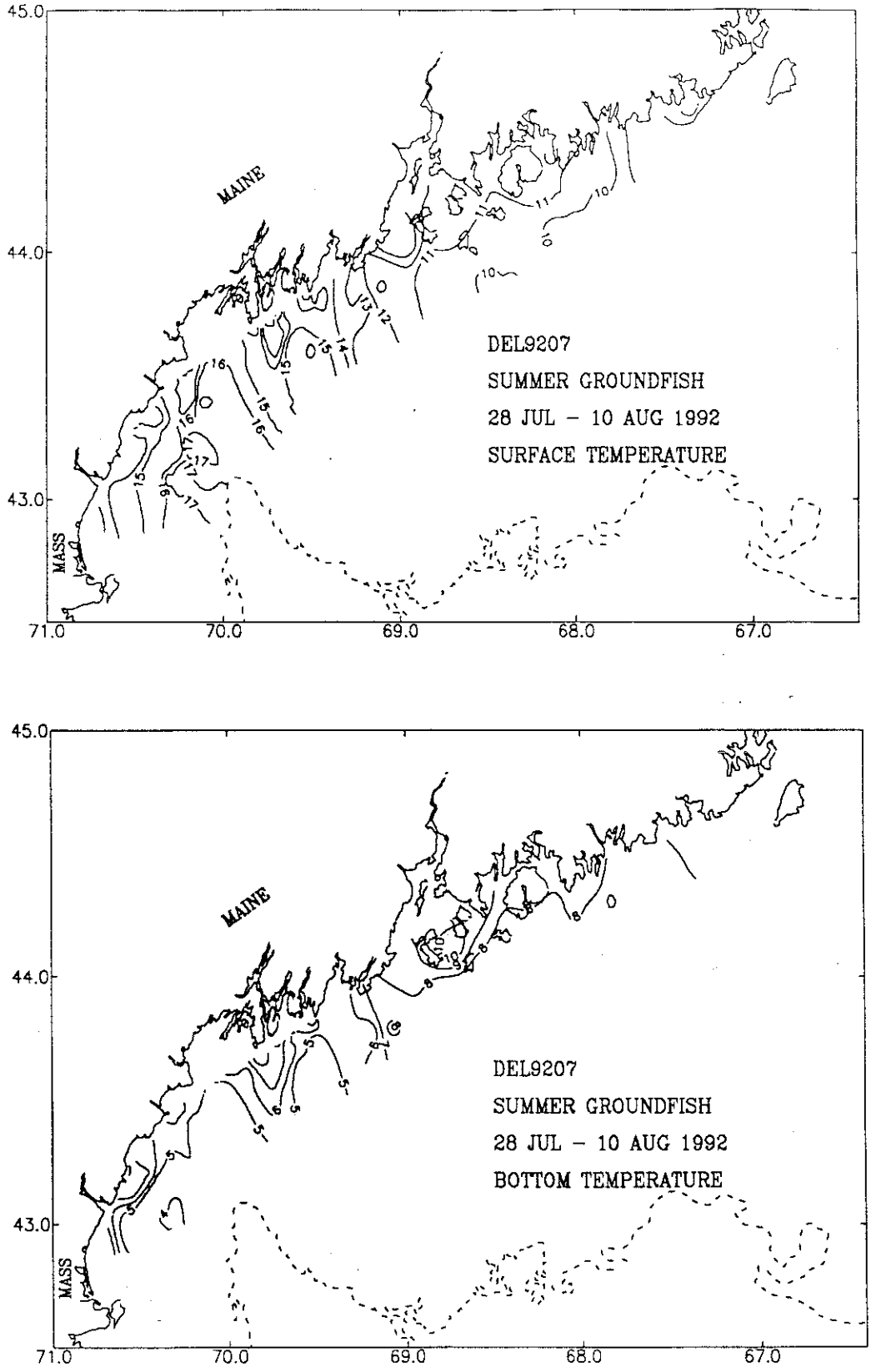


Figure 46. The surface and bottom temperature distribution for the summer bottom trawl survey DEl9207.

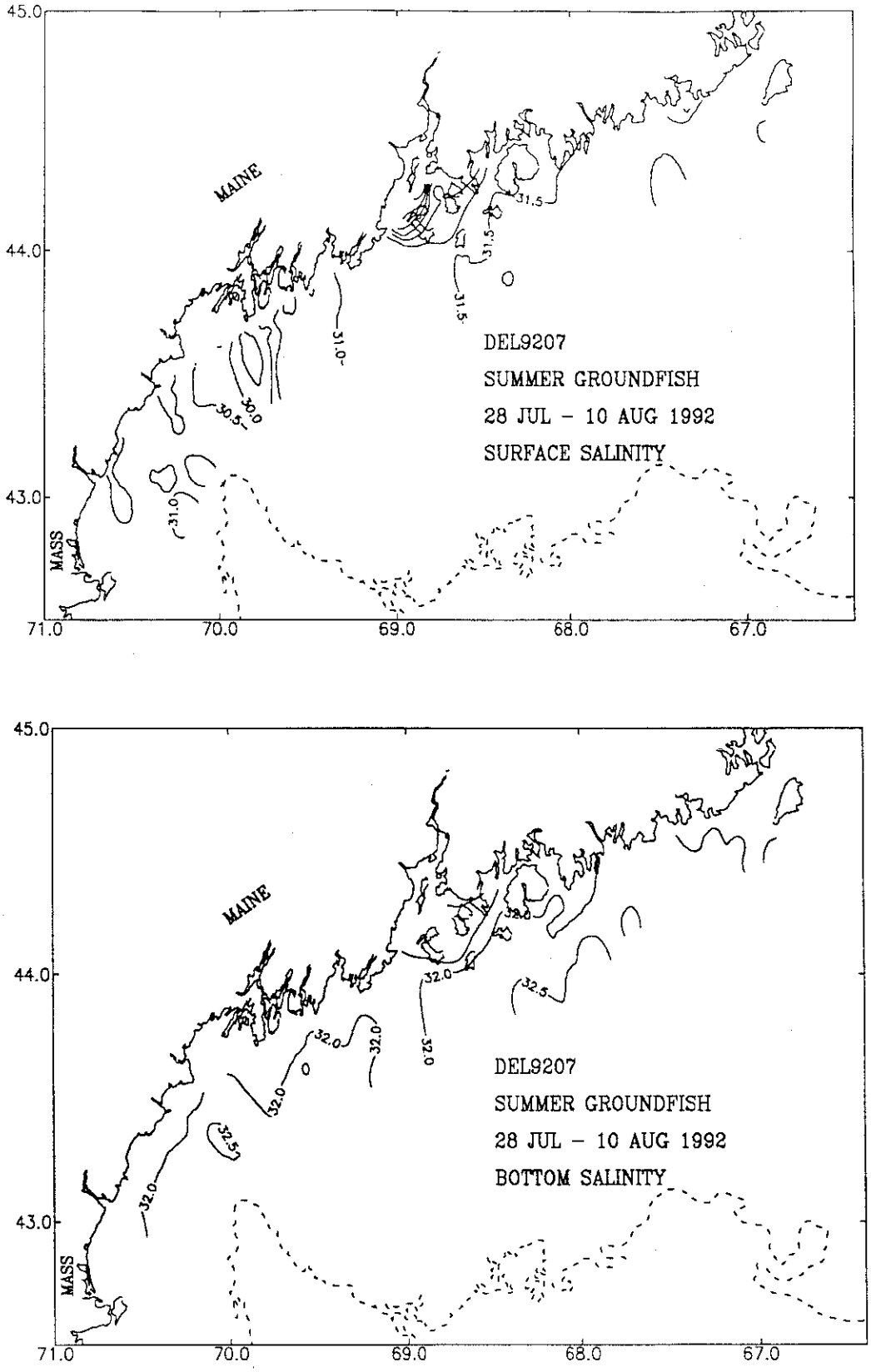


Figure 47. The surface and bottom salinity distribution for the summer bottom trawl survey DEl9207.

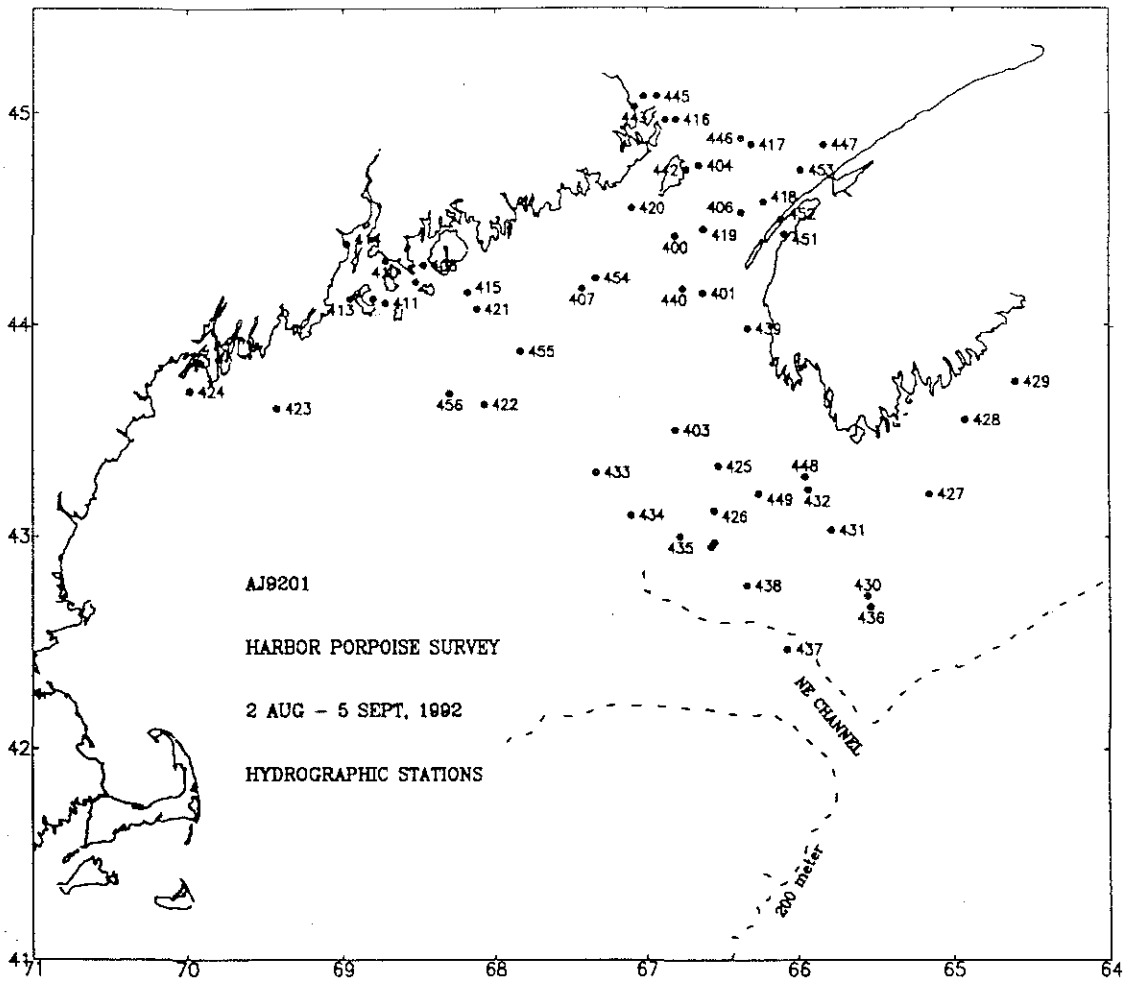


Figure 48. Hydrographic stations occupied during the harbor porpoise sighting survey AJ9201.

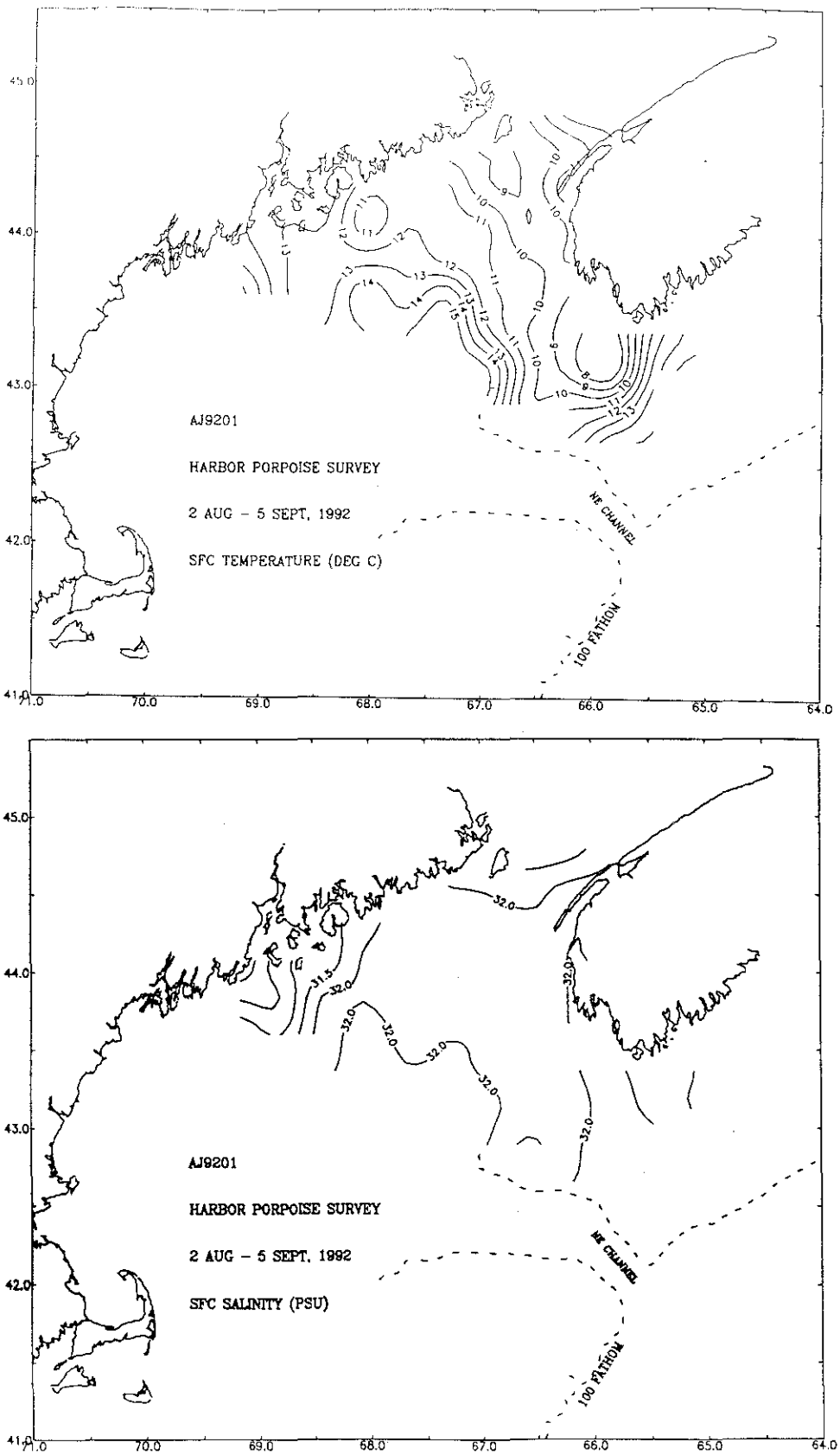


Figure 49. The surface temperature and salinity distribution for the harbor porpoise sighting survey AJ9201.

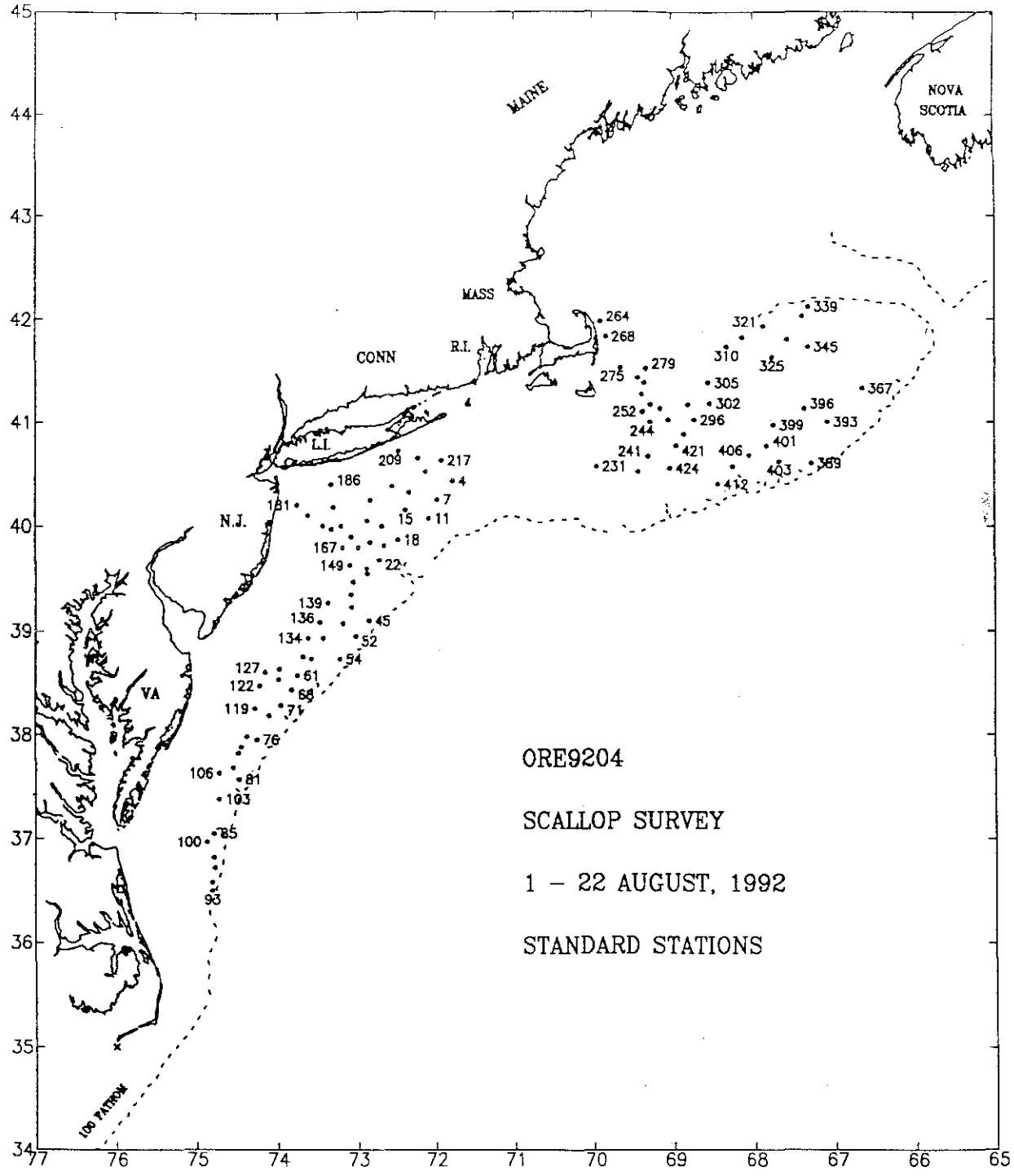


Figure 50. Hydrographic stations occupied during the scallop survey ORE9204.

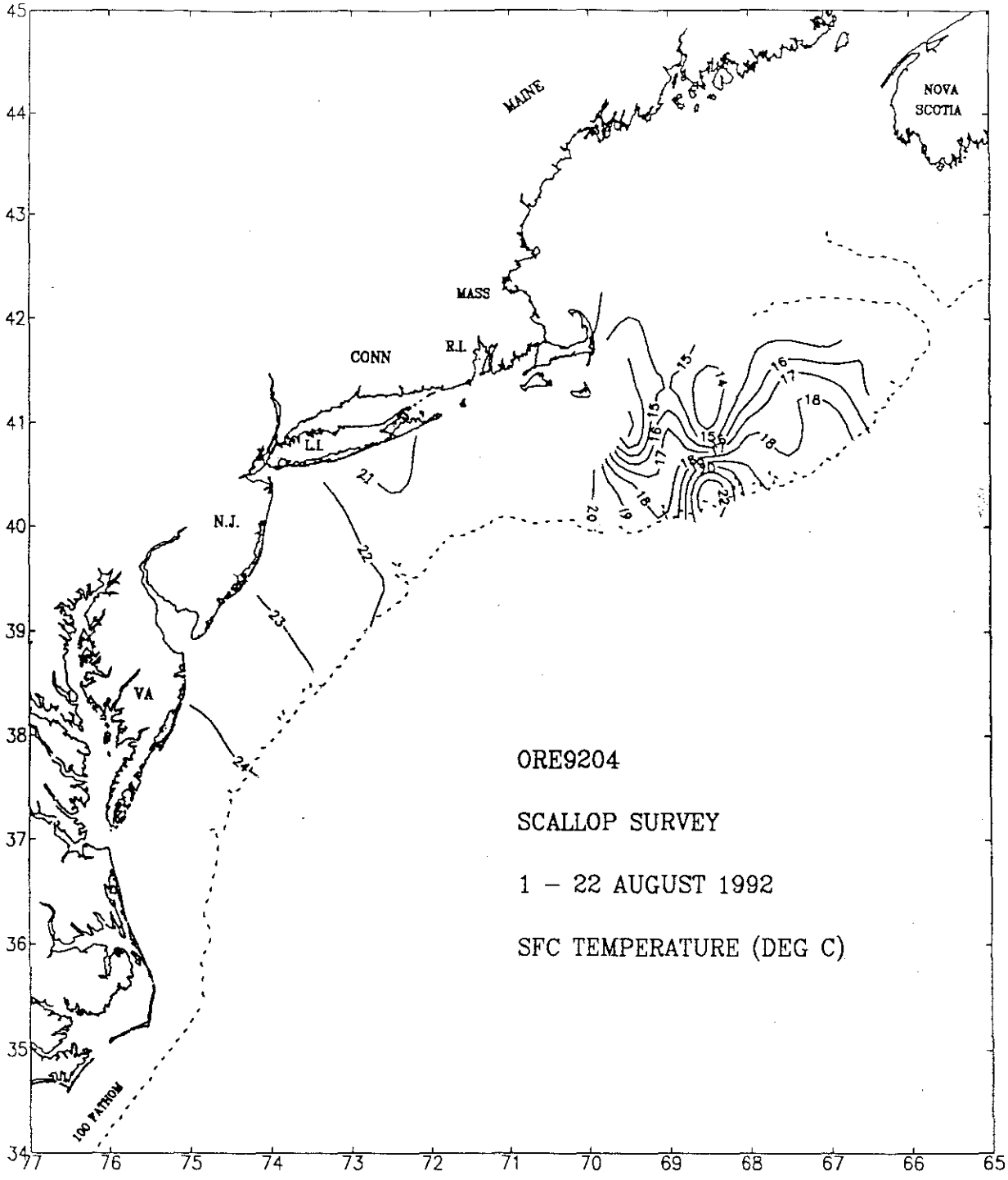


Figure 51. The surface temperature distribution for the scallop survey ORE9204.

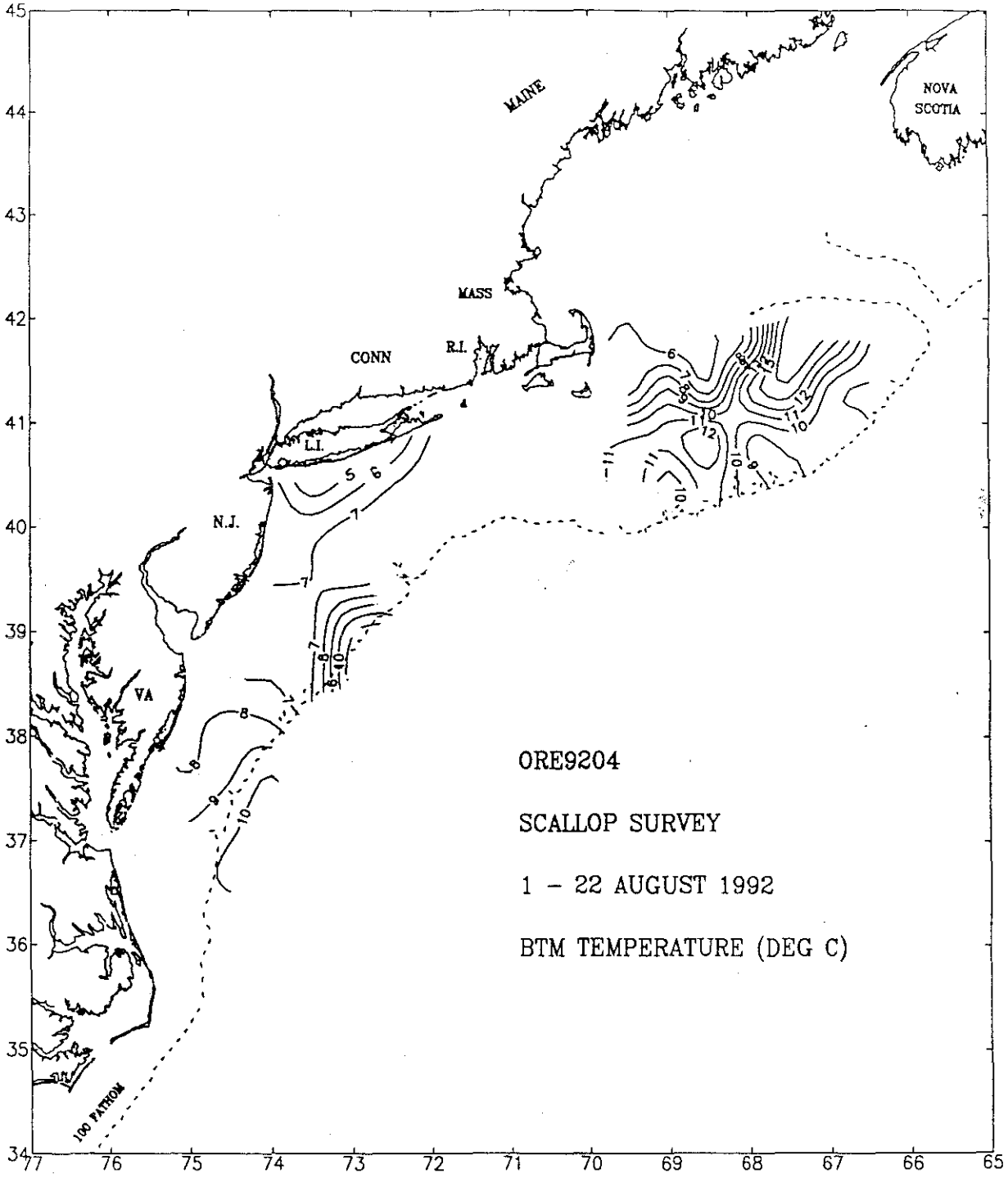


Figure 52. The bottom temperature distribution for the scallop survey ORE9204.

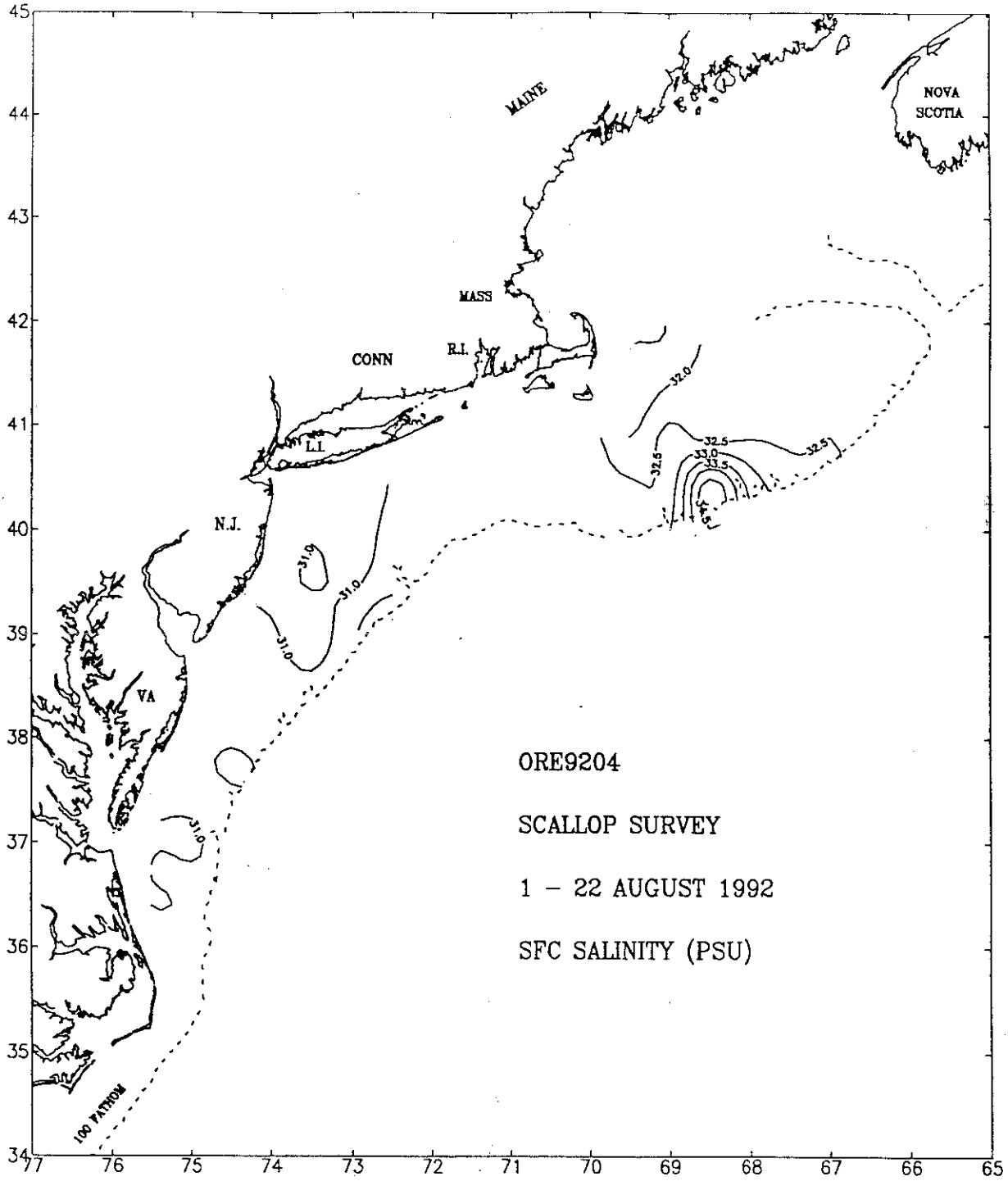


Figure 53. The surface salinity distribution for the scallop survey ORE9204.

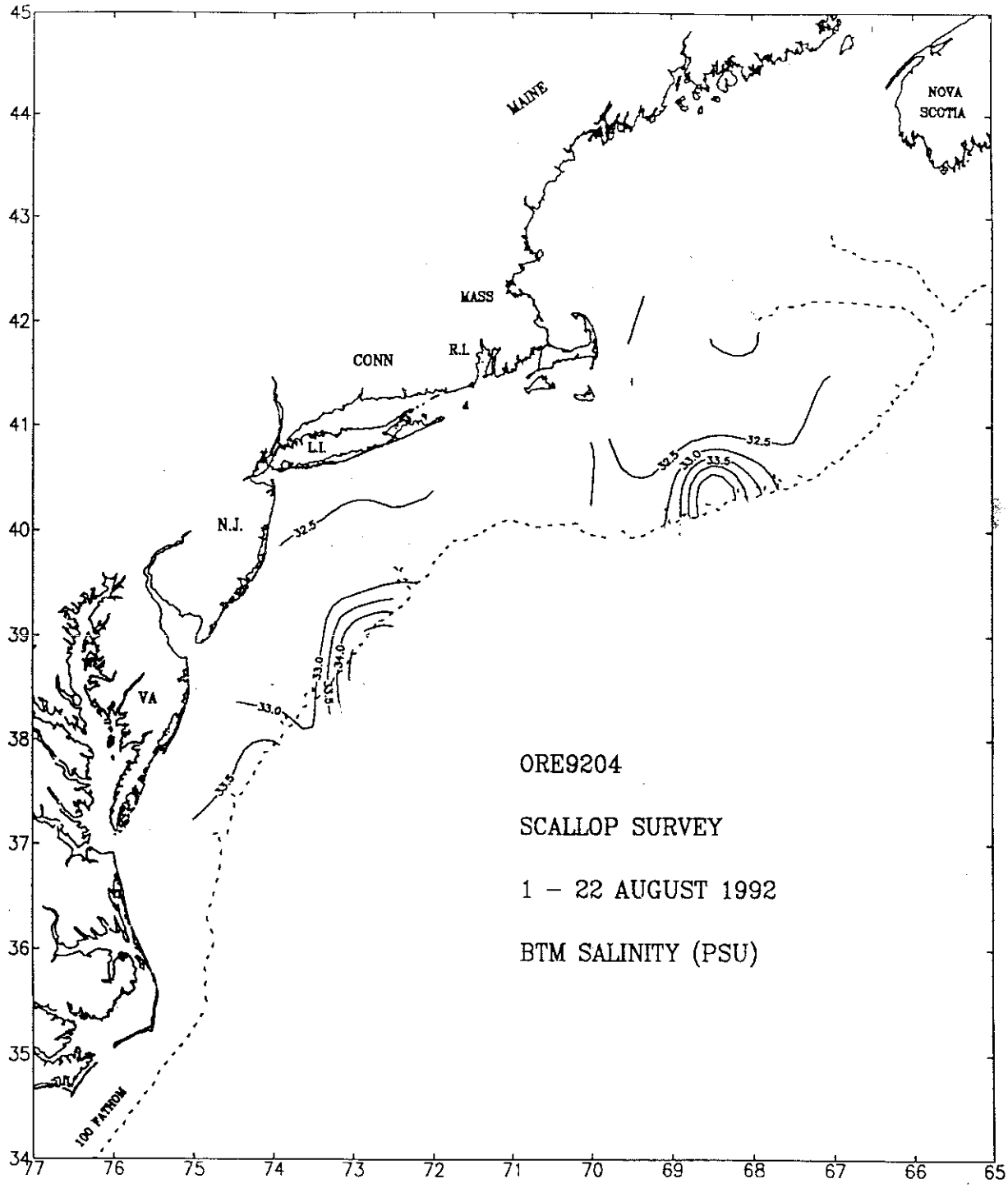


Figure 54. The bottom salinity distribution for the scallop survey ORE9204.

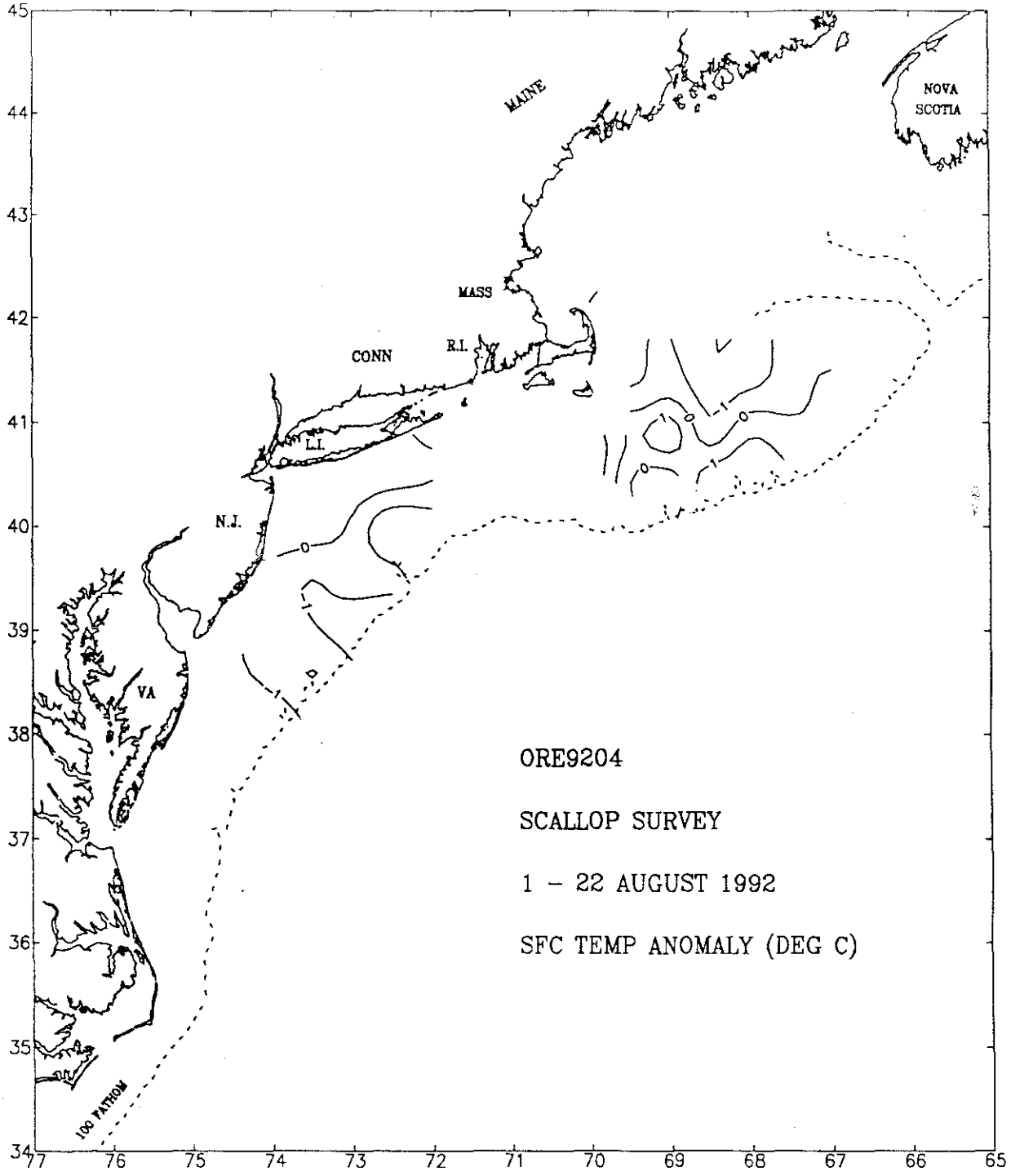


Figure 55. The surface temperature anomaly distribution for the scallop survey ORE9204.

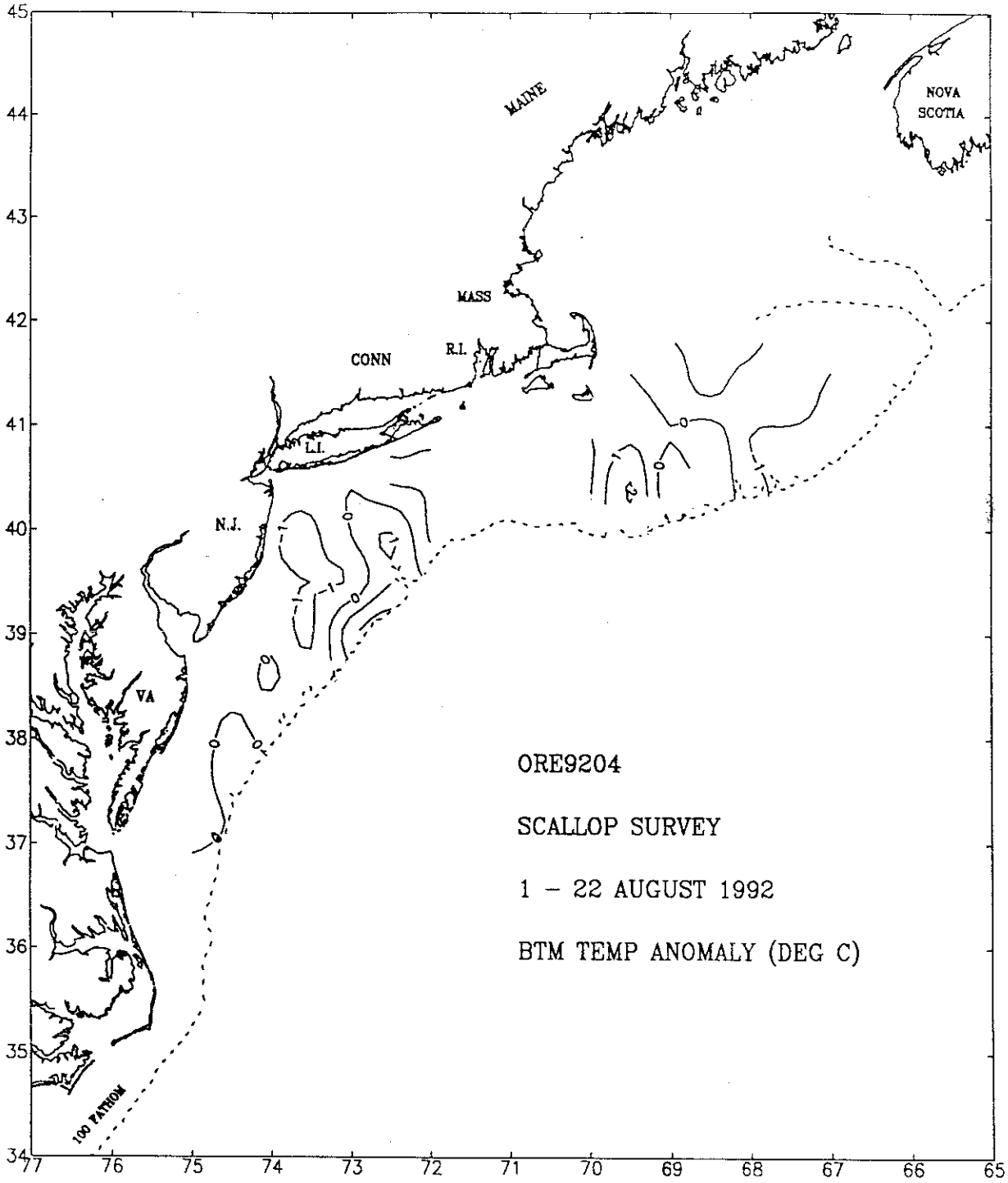


Figure 56. The bottom temperature anomaly distribution for the scallop survey ORE9204.

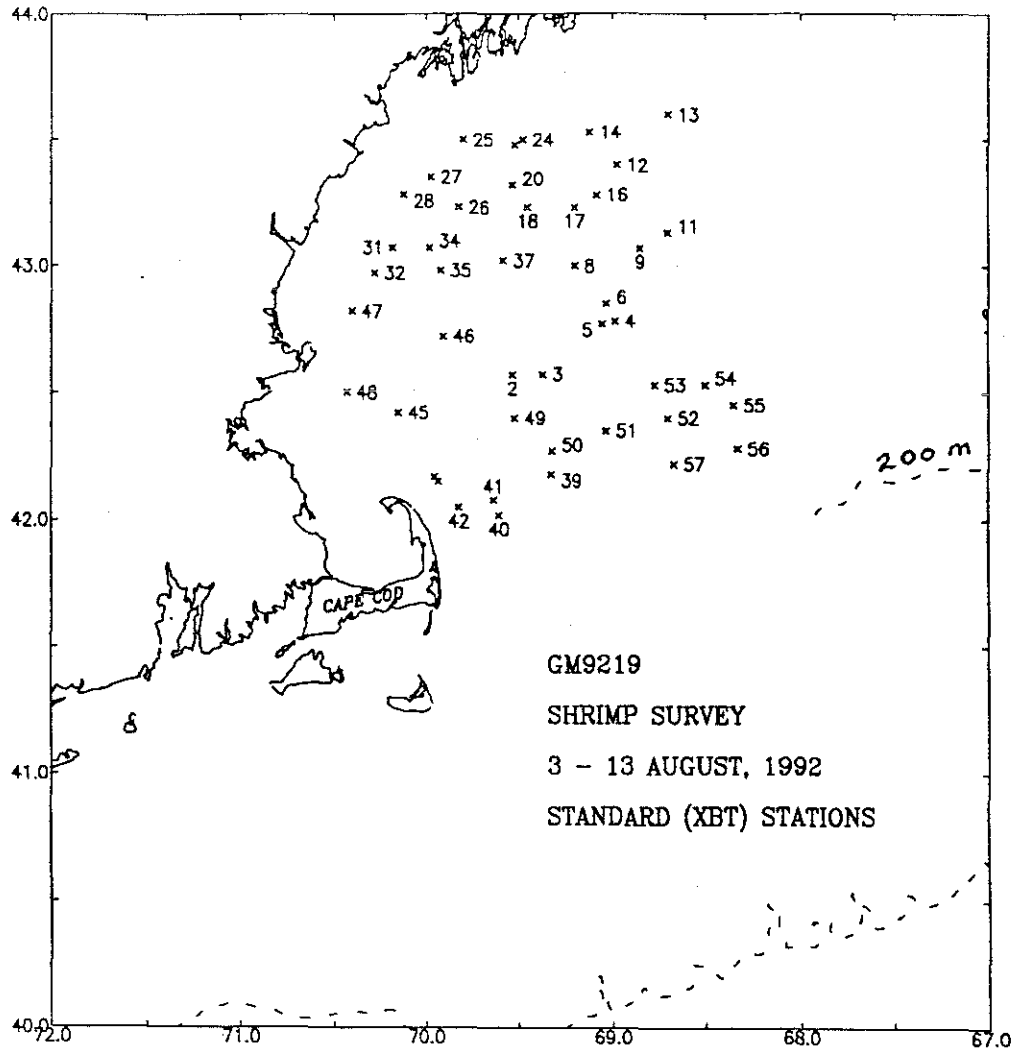


Figure 57. Hydrographic stations occupied during the shrimp survey GM9212.

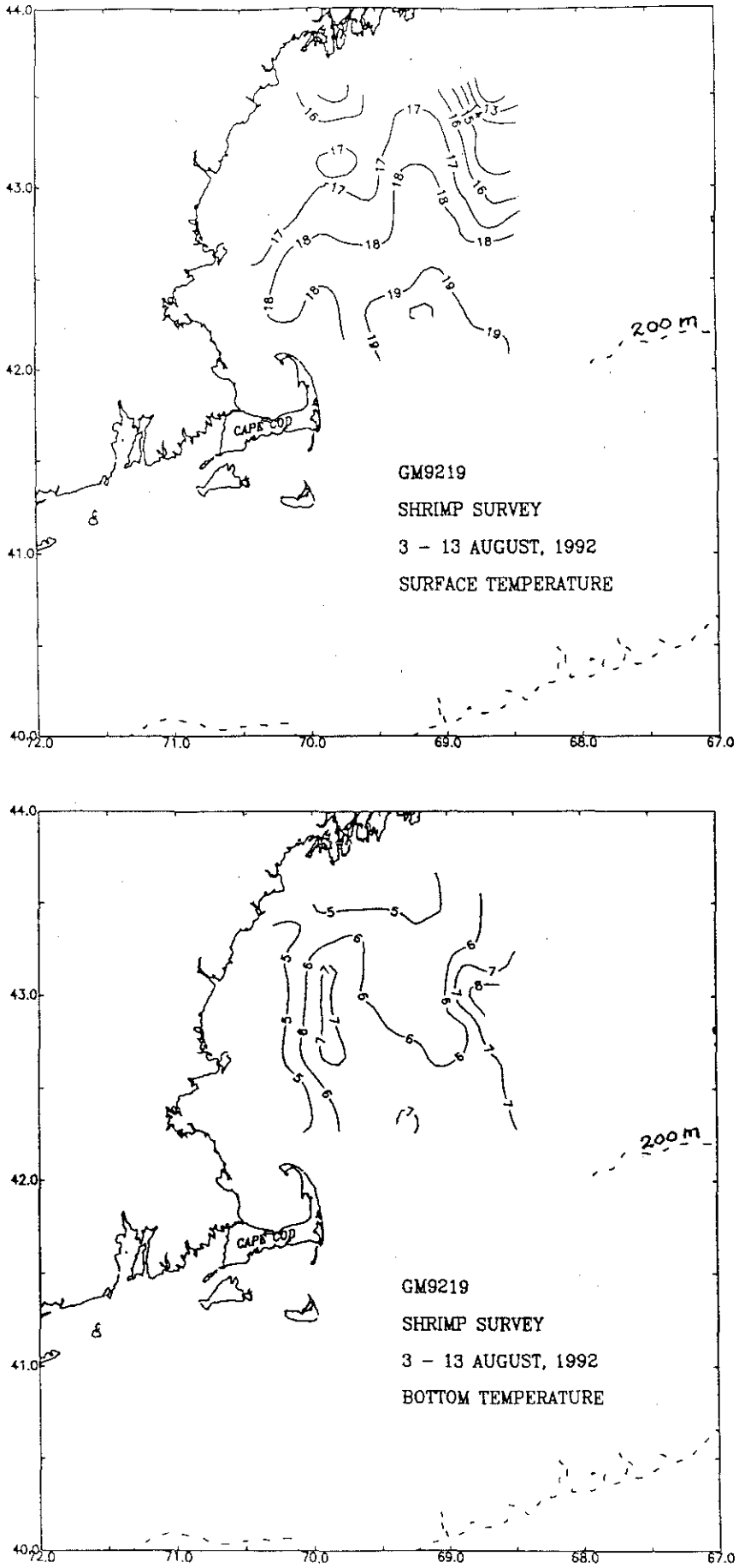


Figure 58. The surface and bottom temperature distribution for the shrimp survey GM9219.

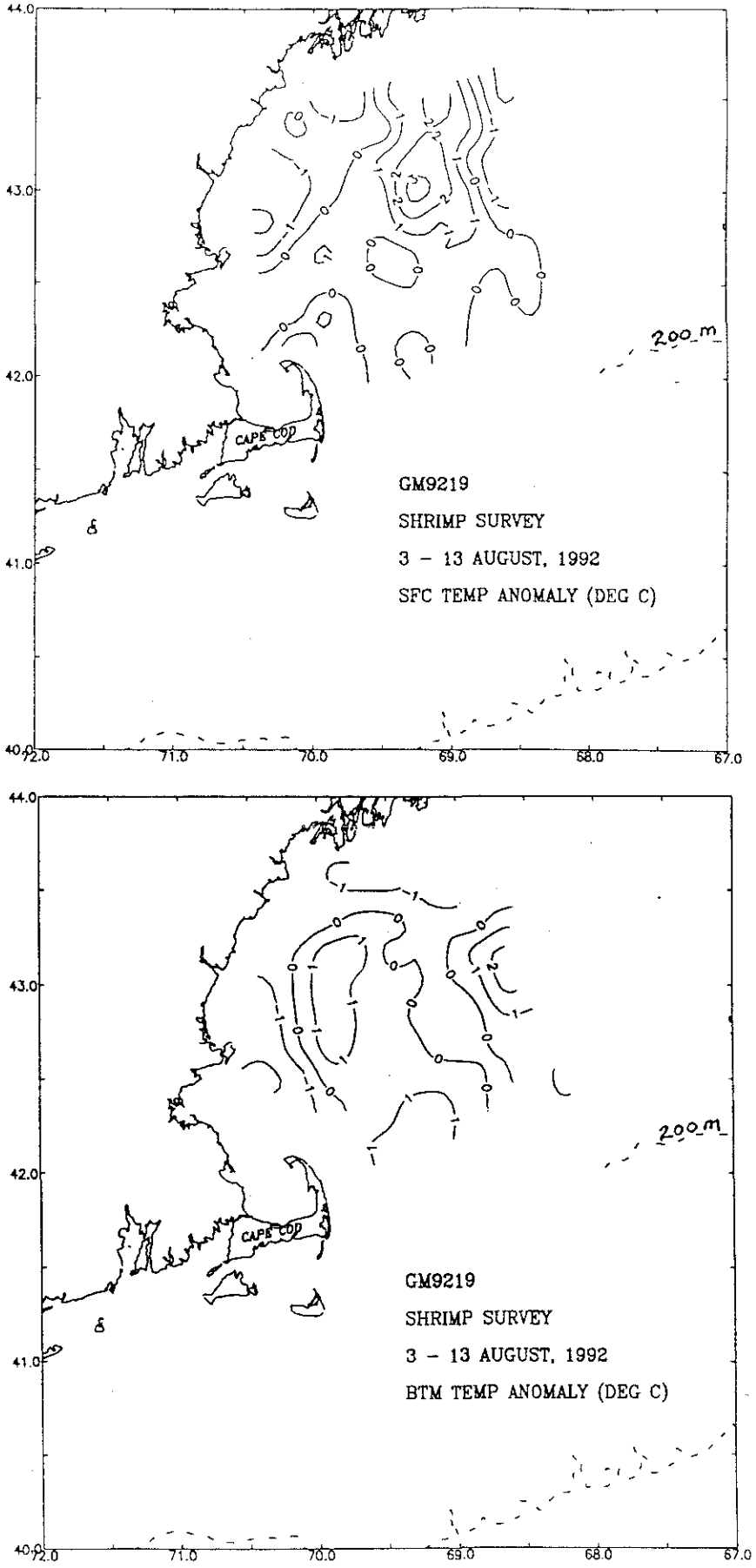


Figure 59. The surface and bottom temperature anomaly distribution for the shrimp survey GM9219.

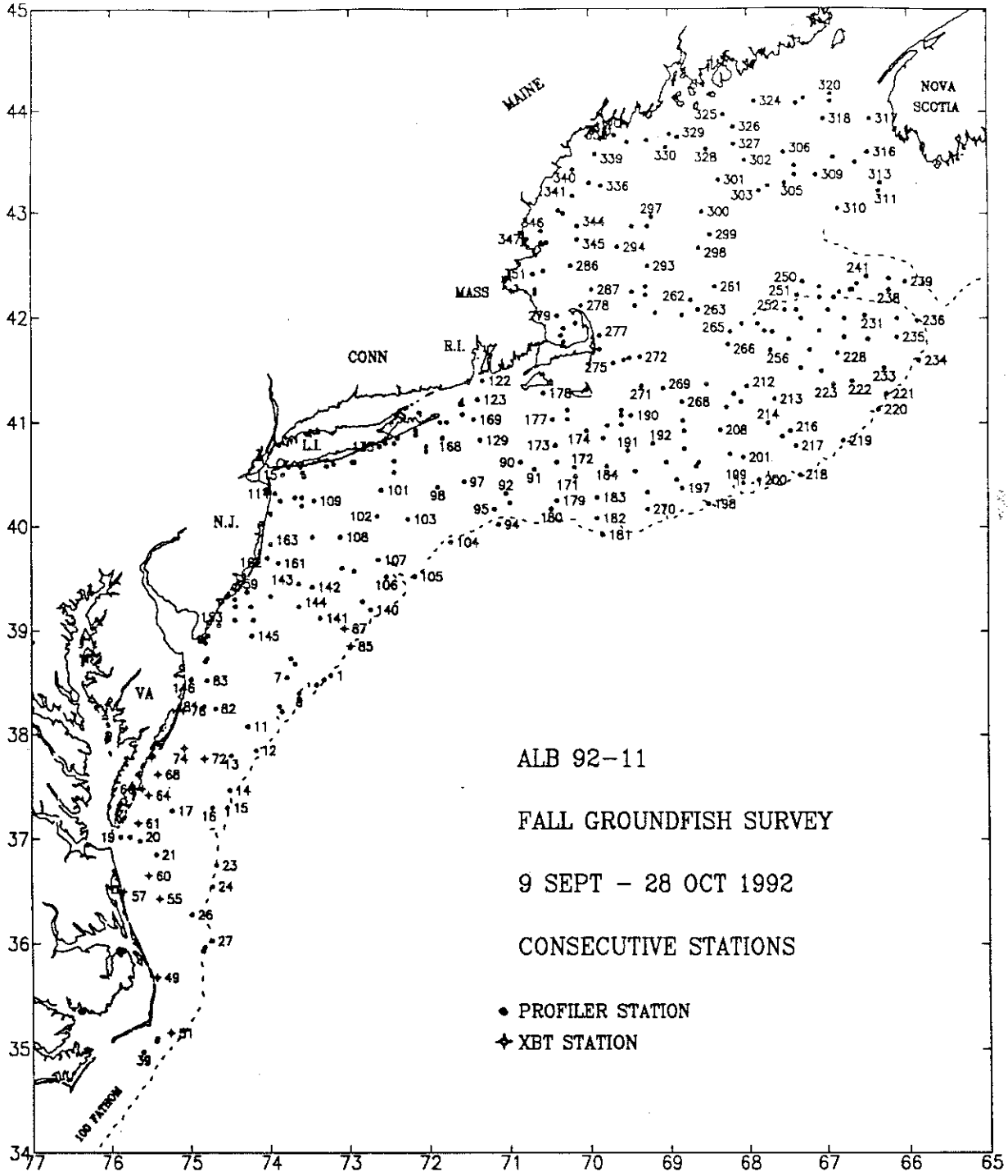


Figure 60. Hydrographic stations occupied during the fall bottom trawl survey ALB9211.

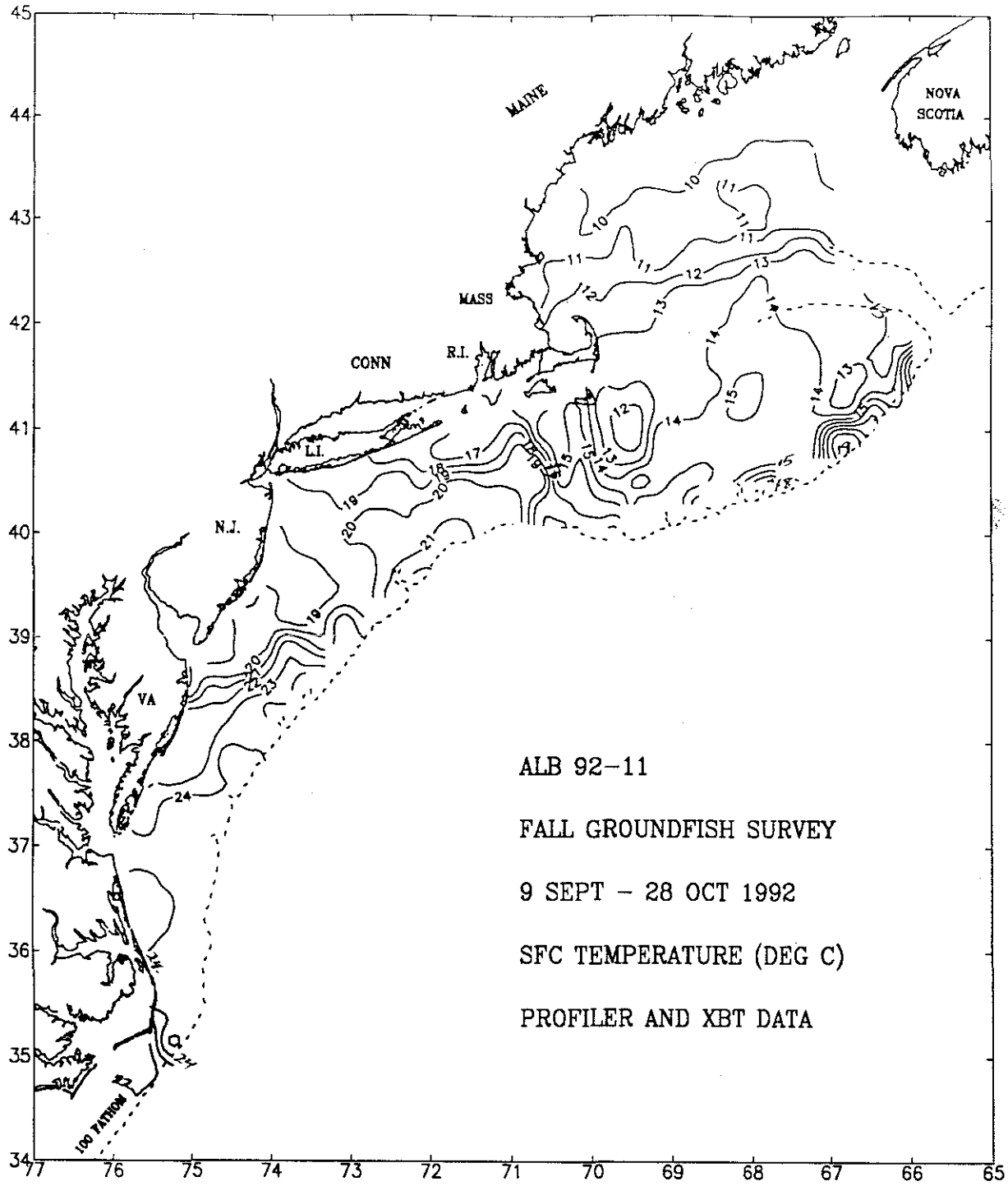


Figure 61. The surface temperature distribution for the fall bottom trawl survey ALB9211.

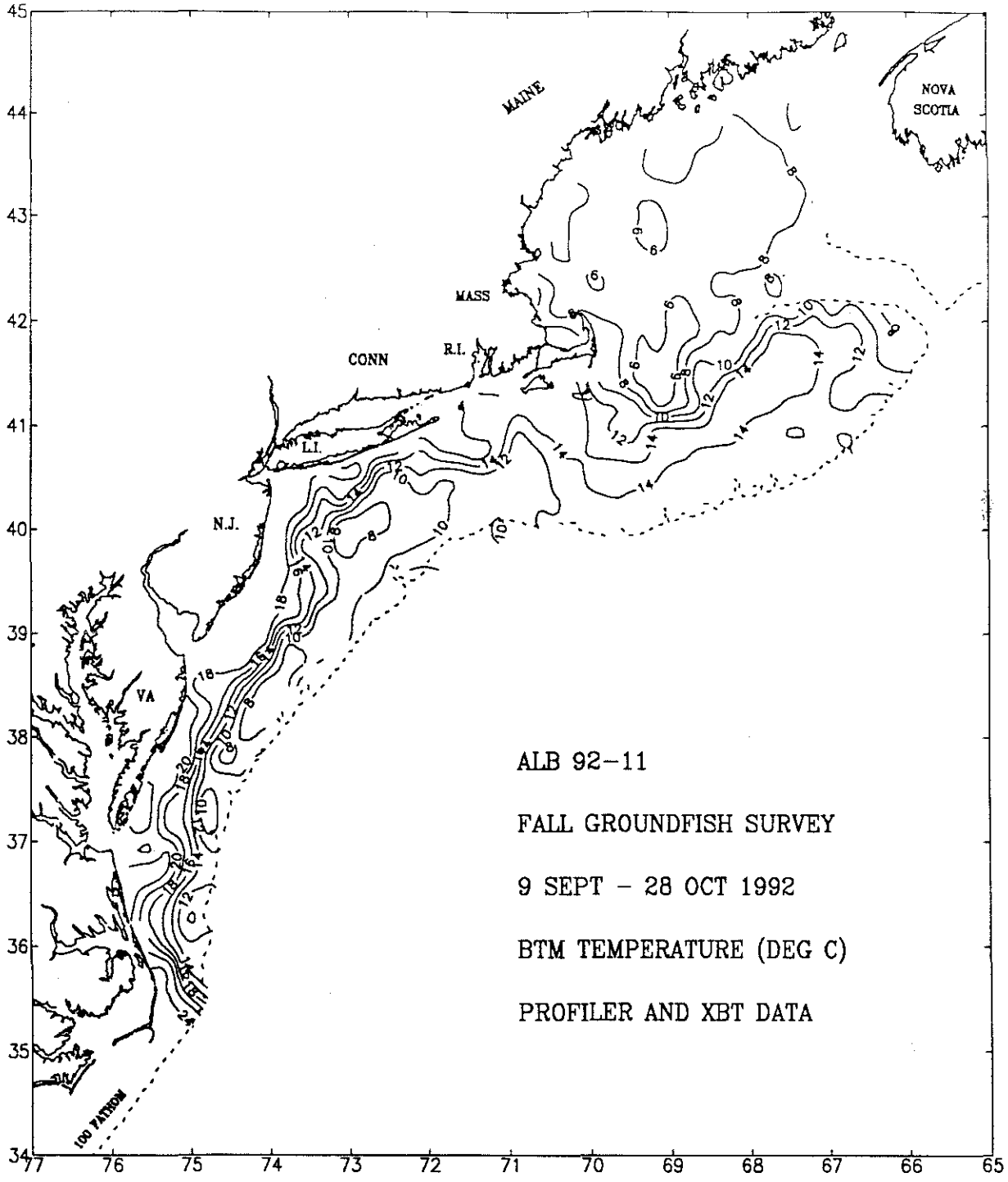


Figure 62. The bottom temperature distribution for the fall bottom trawl survey ALB9211.

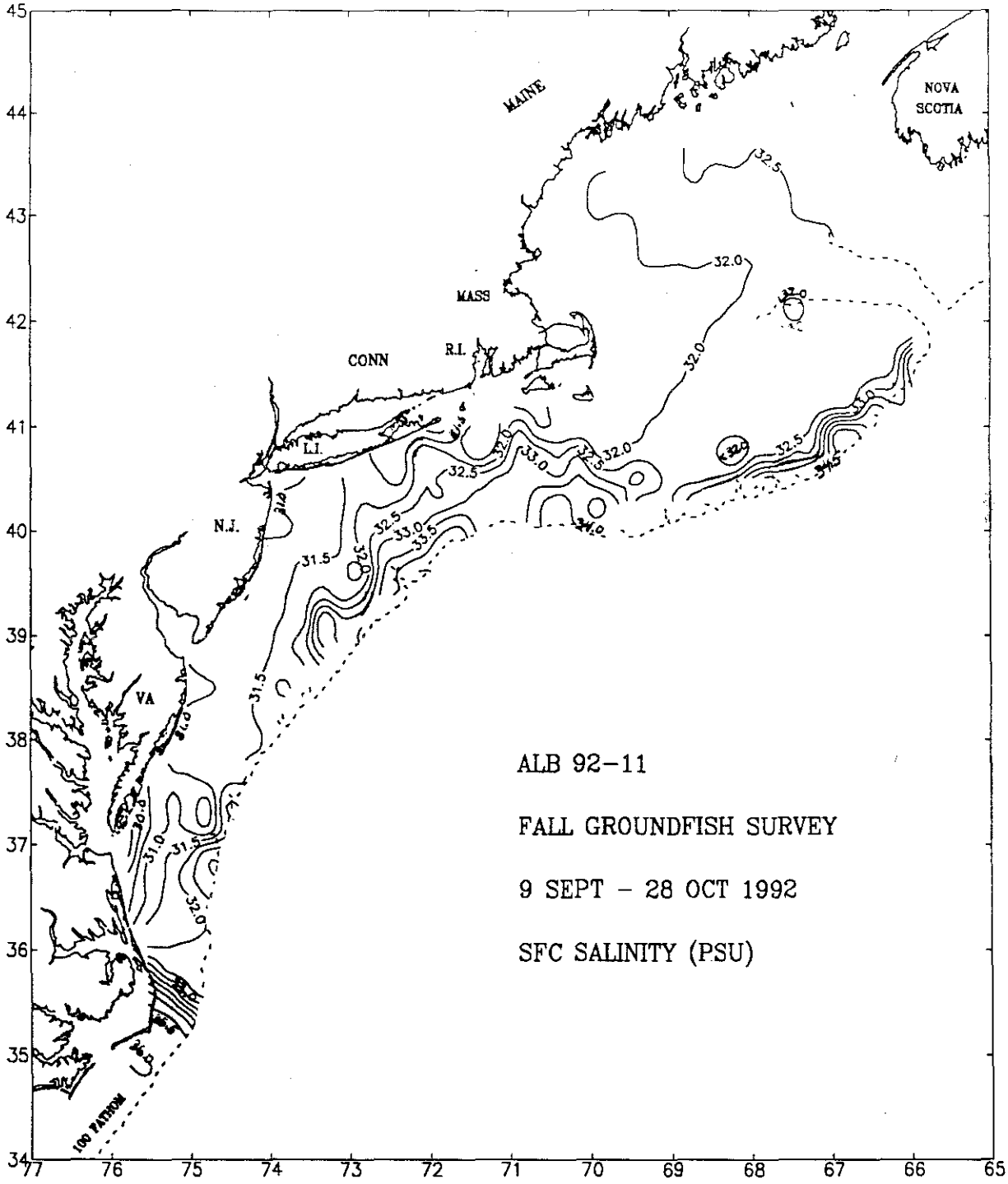


Figure 63. The surface salinity distribution for the fall bottom trawl survey ALB9211.

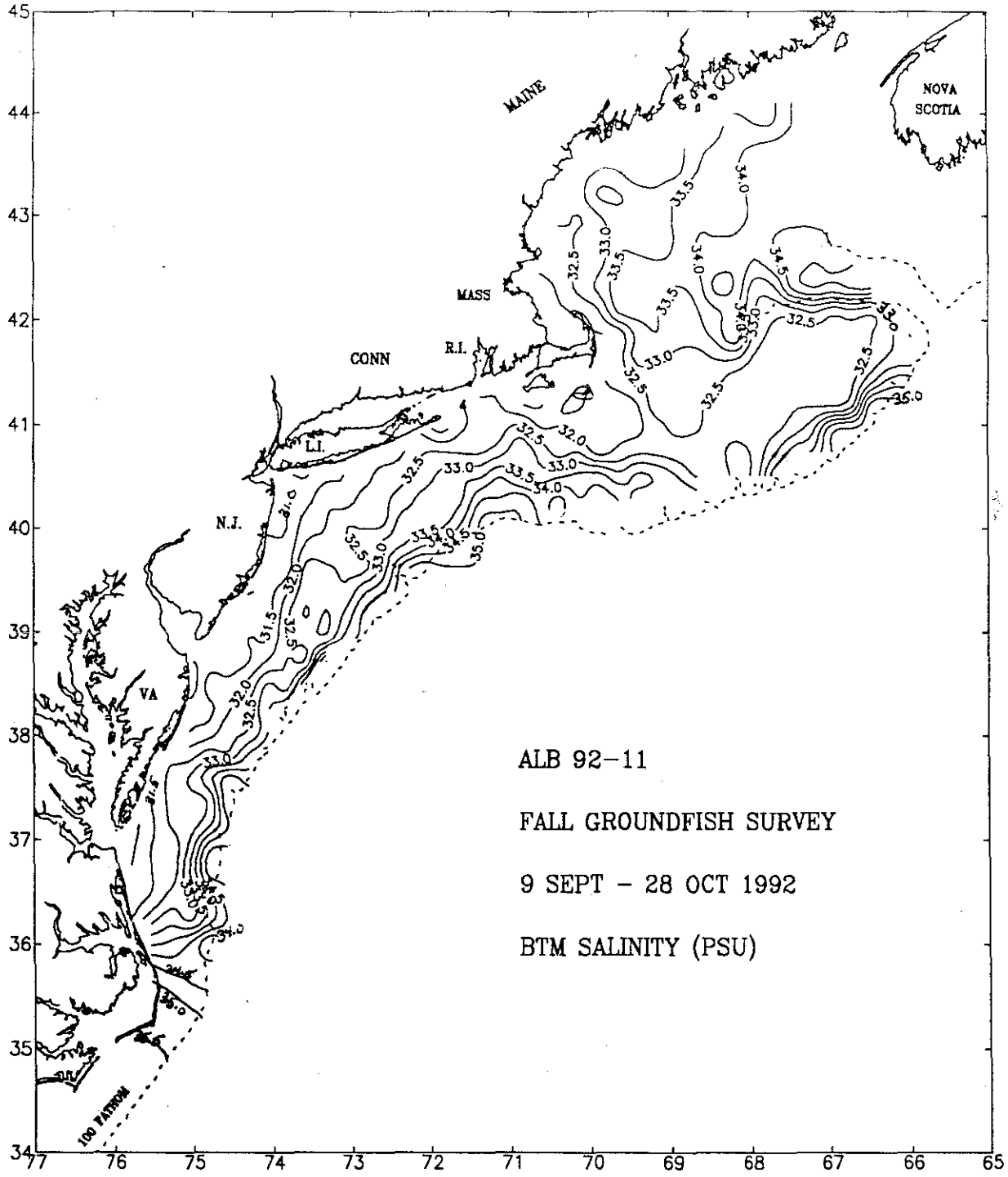


Figure 64. The bottom salinity distribution for the fall bottom trawl survey ALB9211.

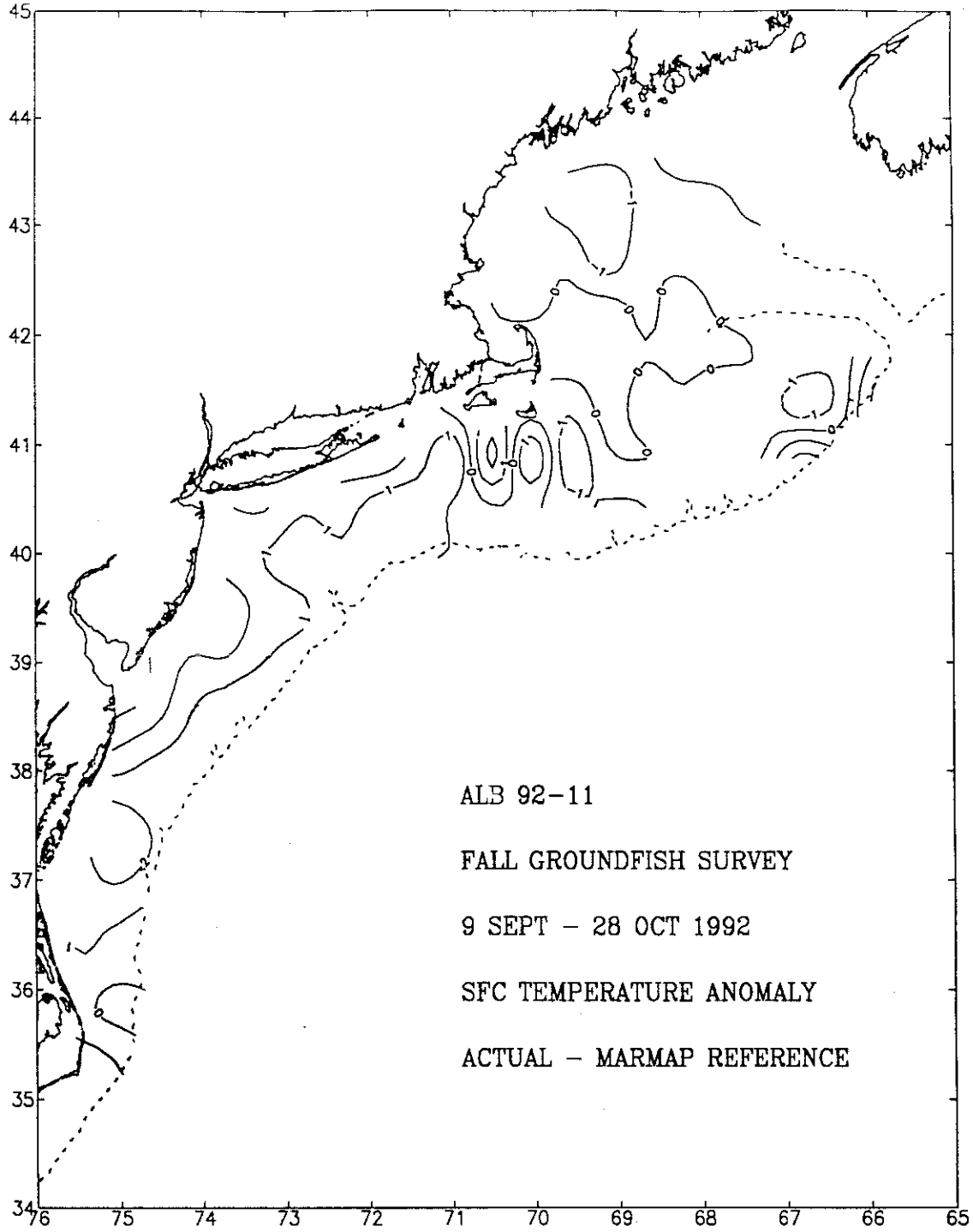


Figure 65. The surface temperature anomaly distribution for the fall bottom trawl survey ALB9211.

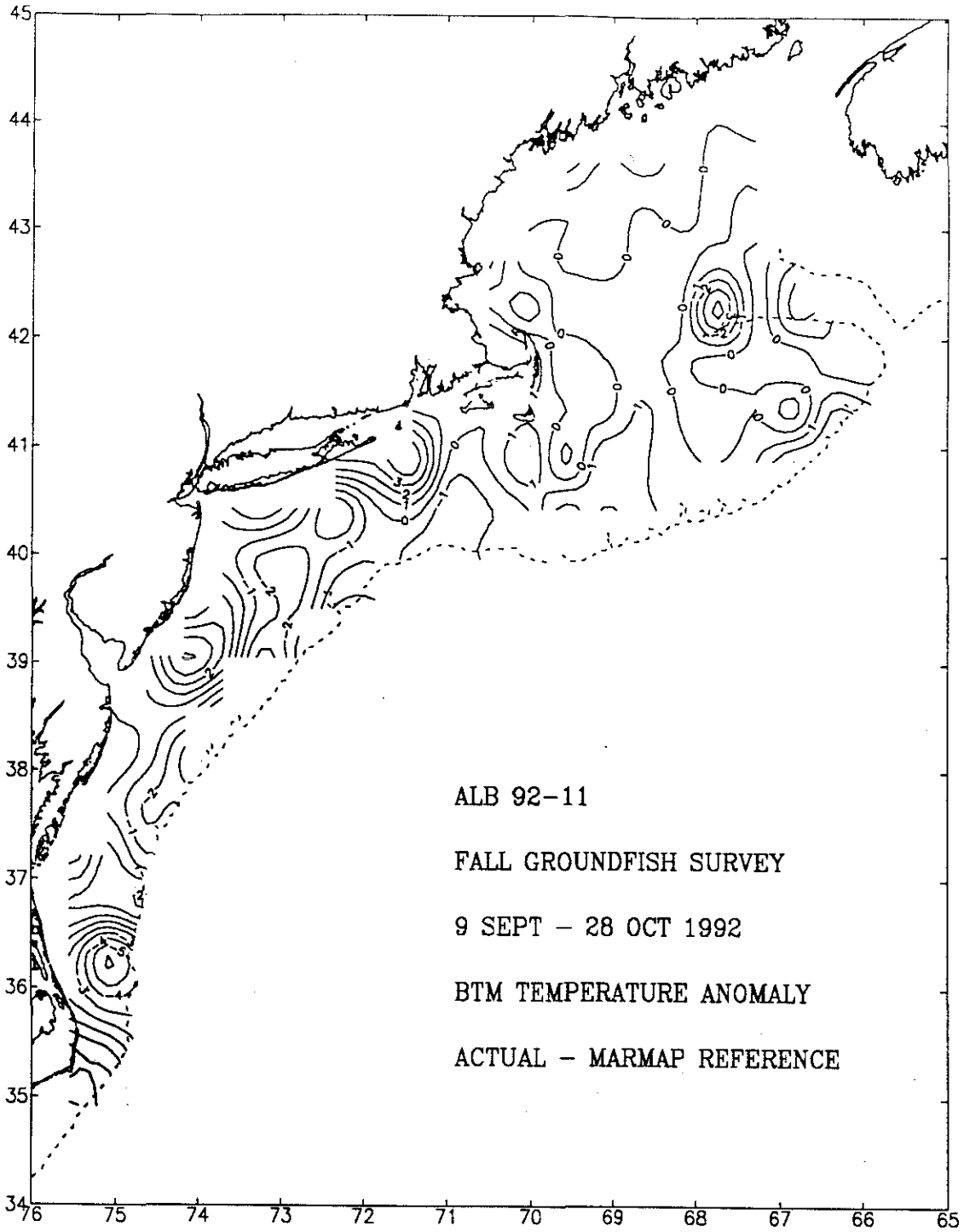


Figure 66. The bottom temperature anomaly distribution for the fall bottom trawl survey ALB9211.

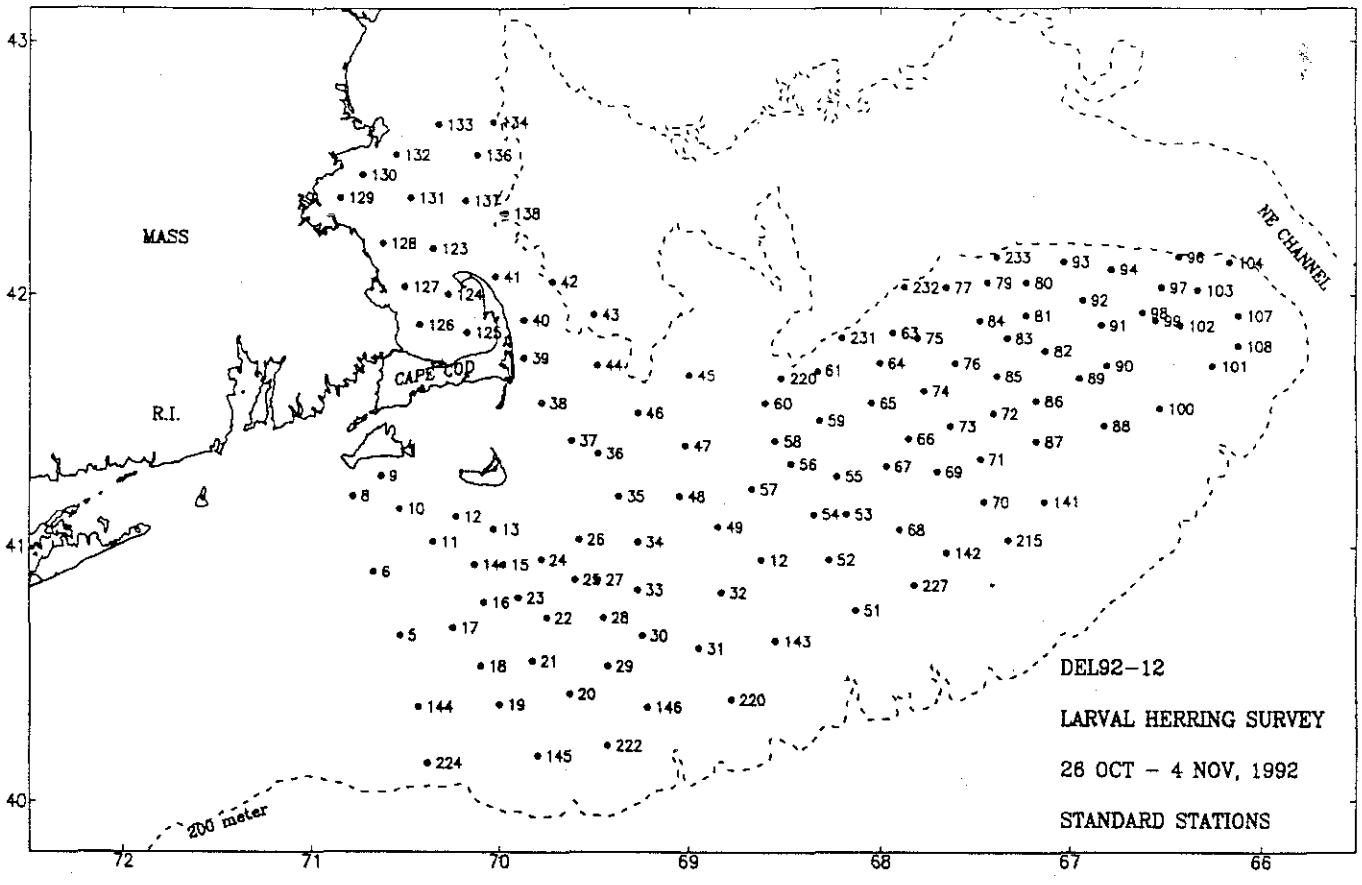


Figure 67. Hydrographic stations occupied during the larval herring/sand lance study DEL9212.

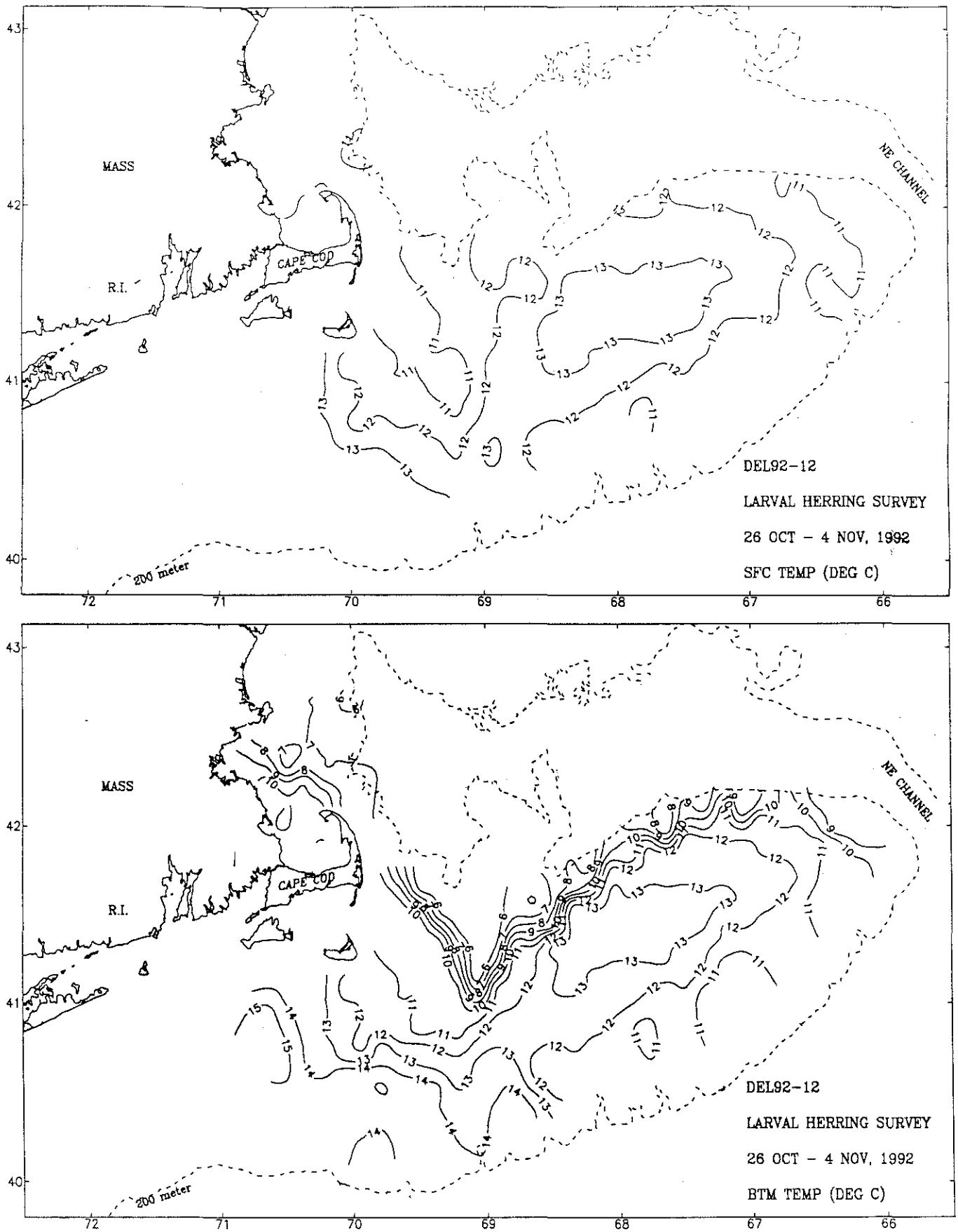


Figure 68. The surface and bottom temperature distribution for the larval herring/sand lance study DEL9212.

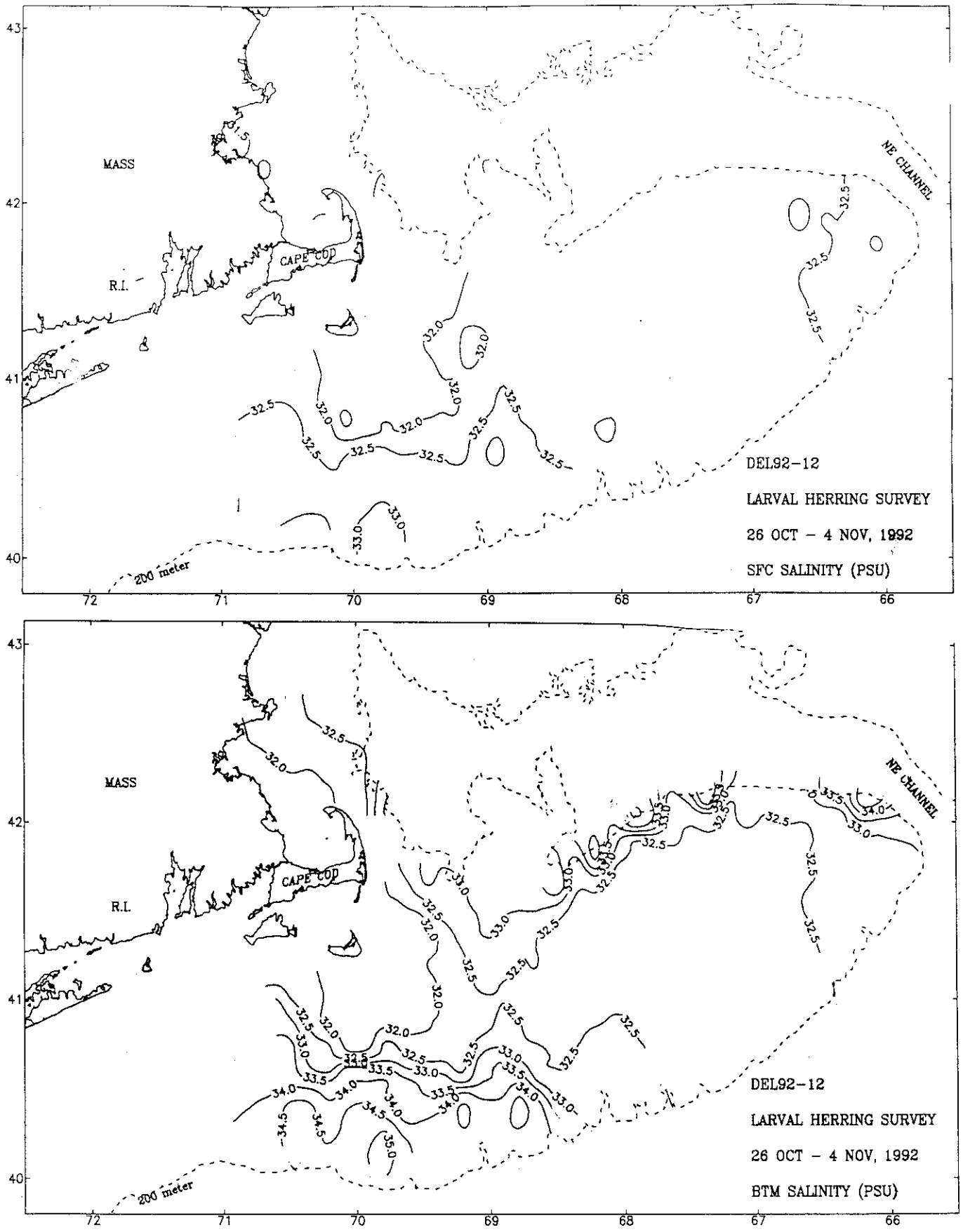


Figure 69. The surface and bottom salinity distribution for the larval herring/sand lance study DEL9212.

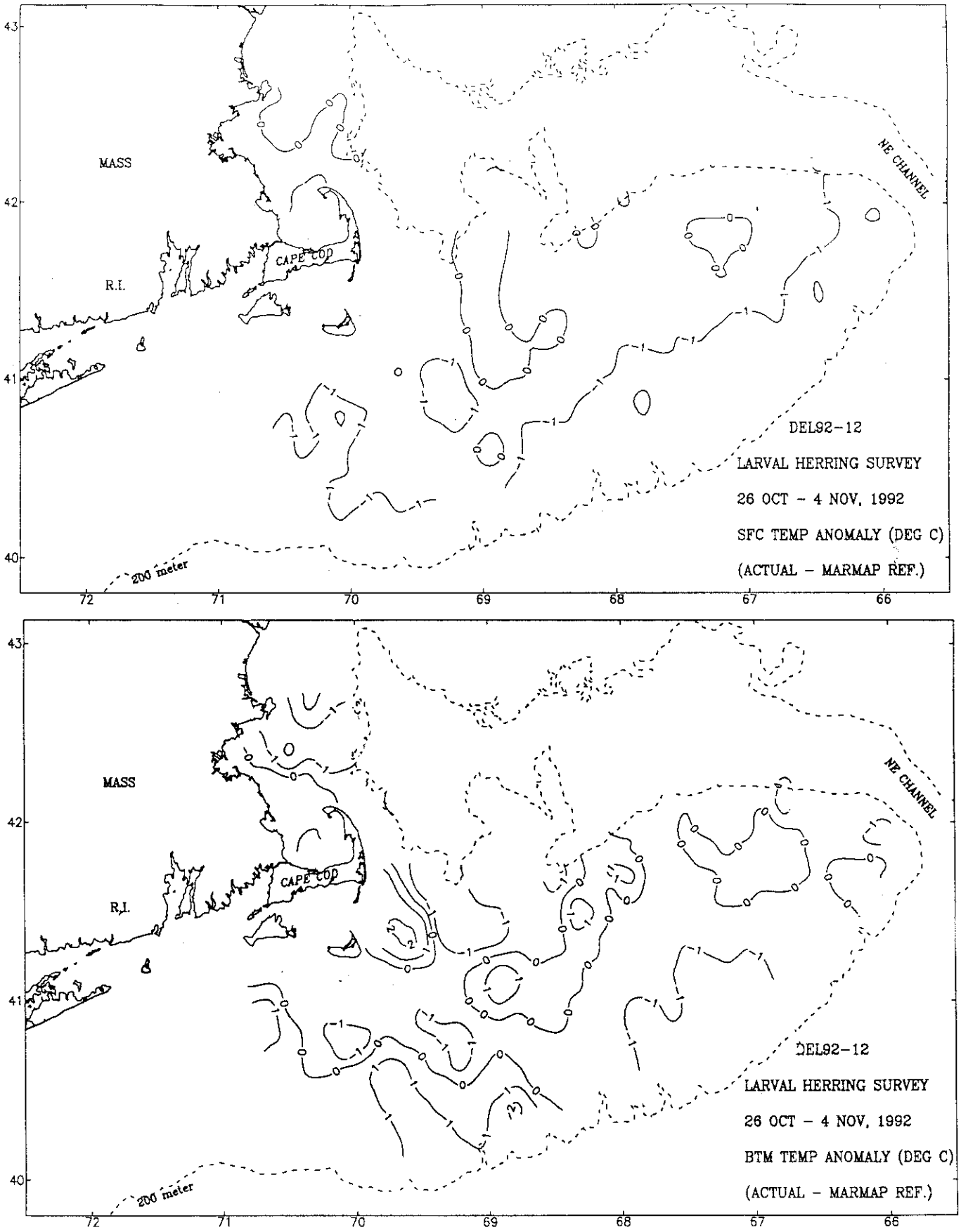


Figure 70. The surface and bottom temperature anomaly distribution for the larval herring/sand lance study DEL9212.

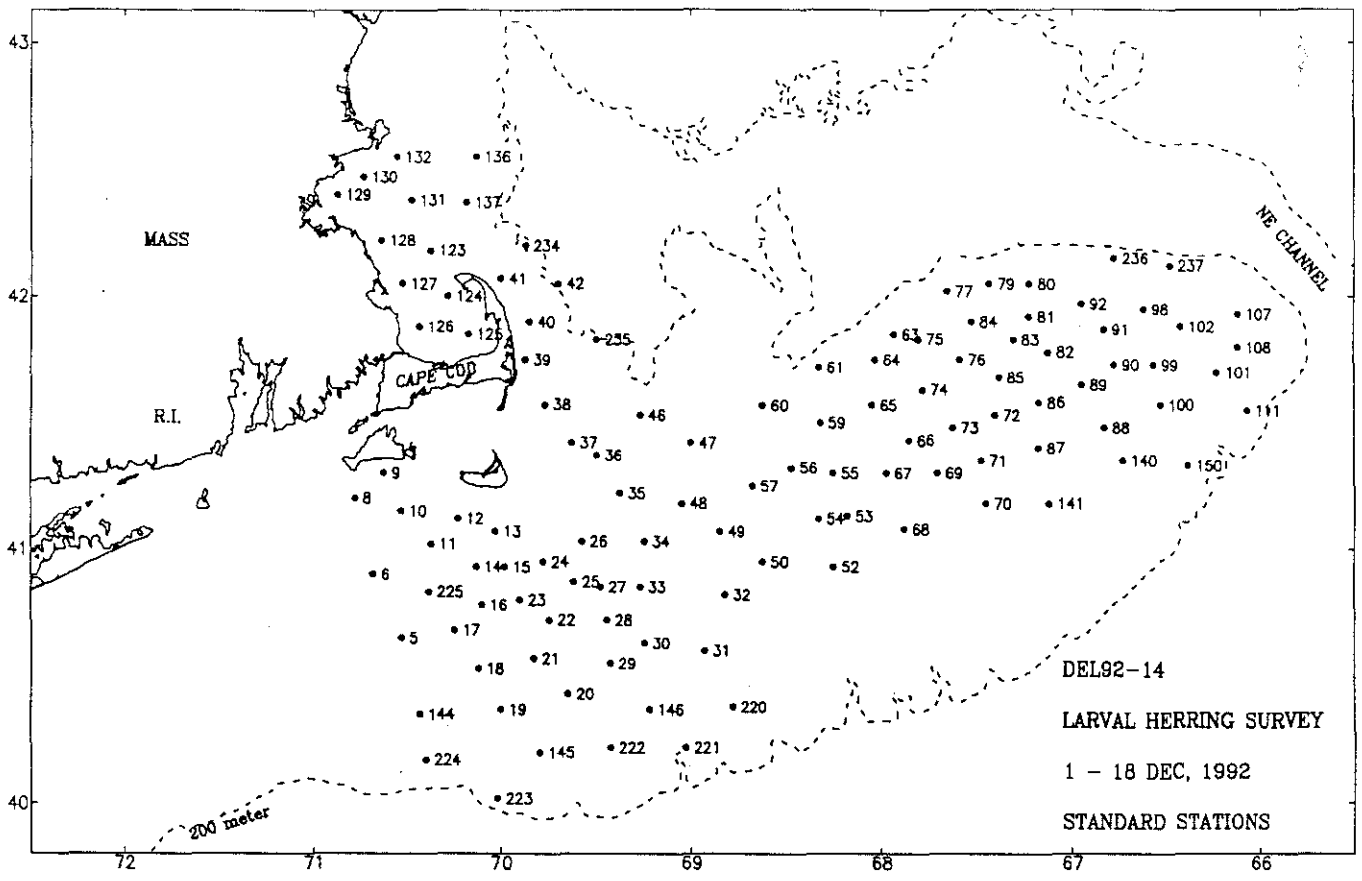


Figure 71. Hydrographic stations occupied during the larval herring/sand lance study DEL9214.

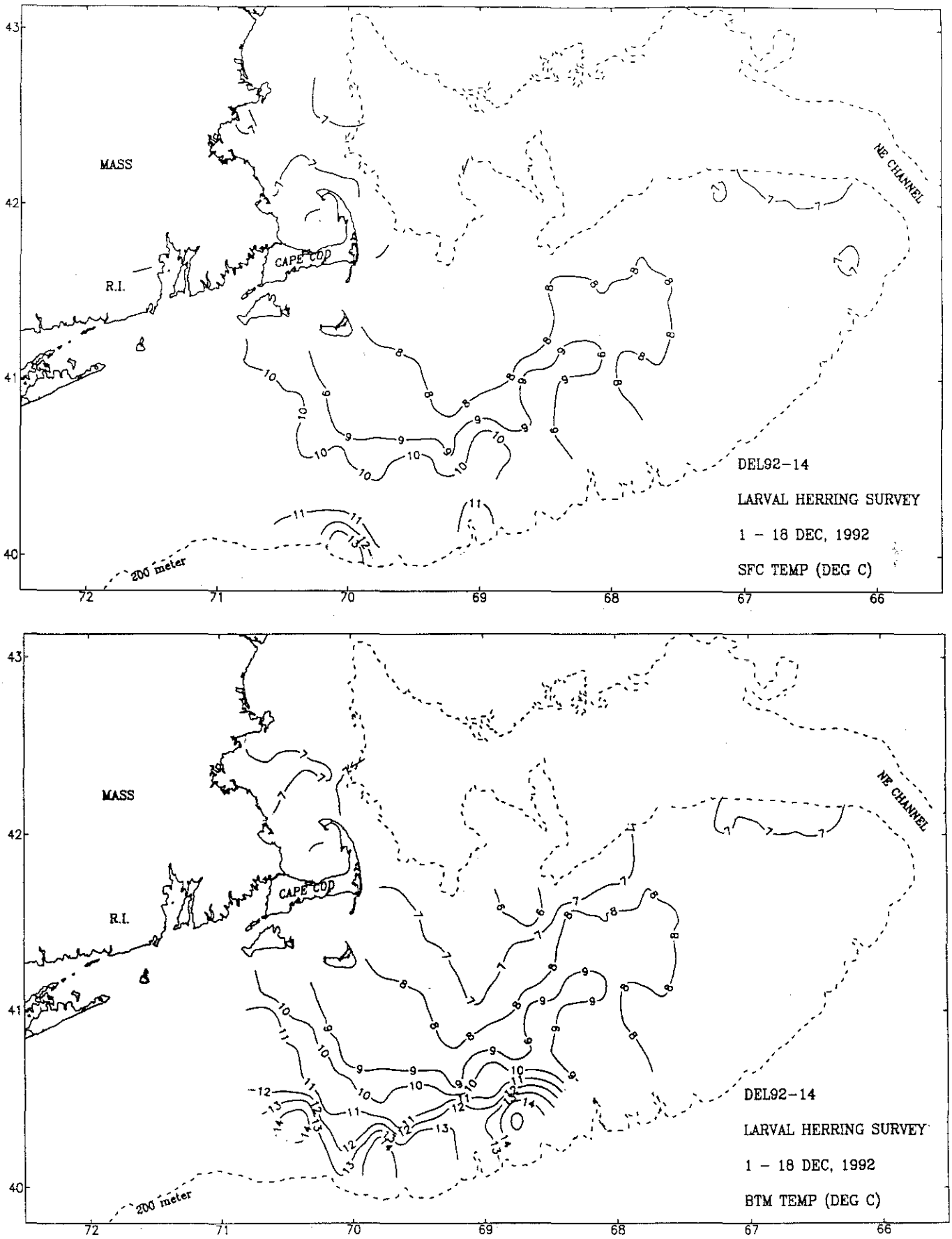


Figure 72. The surface and bottom temperature distribution for the larval herring/sand lance study DEL9214.

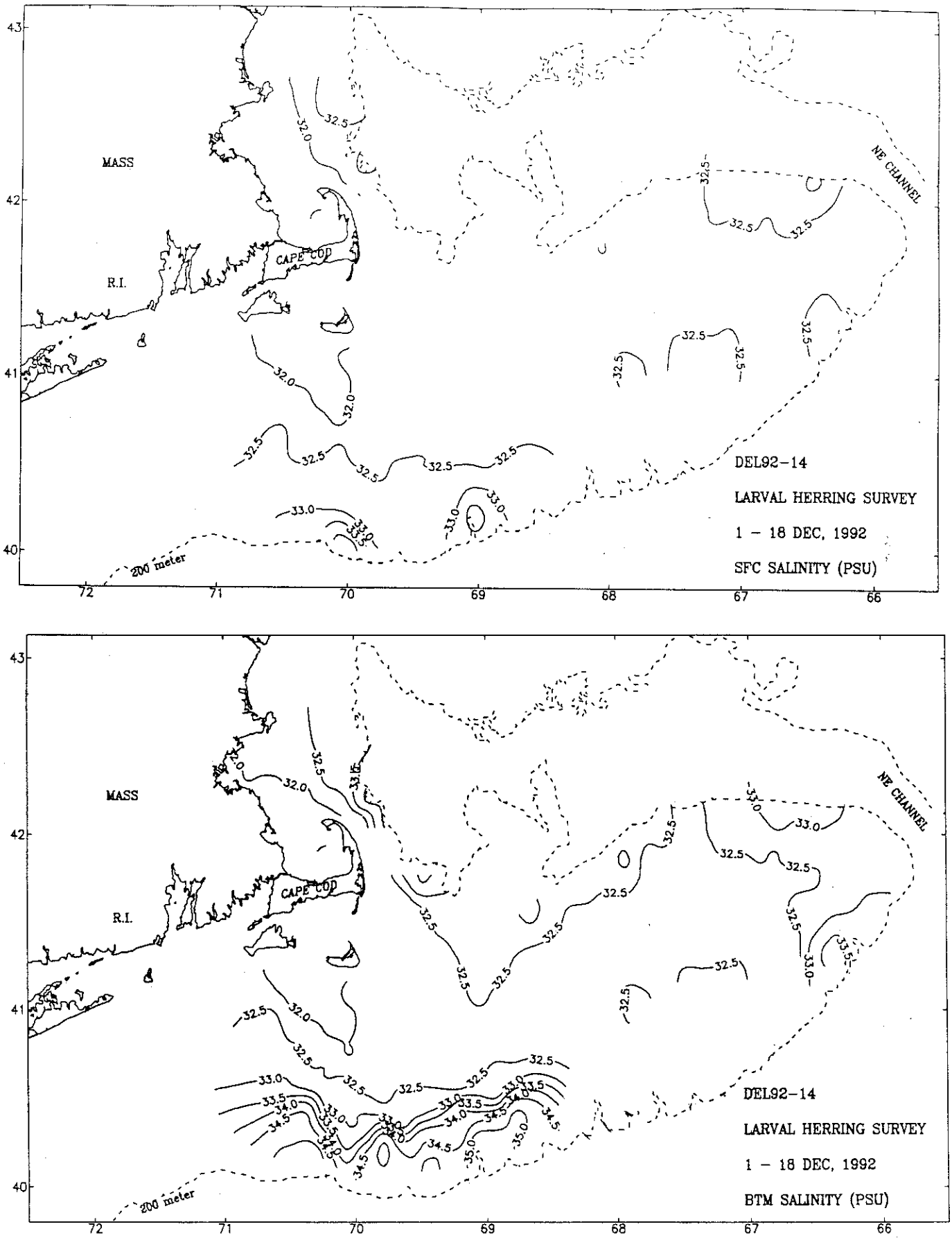
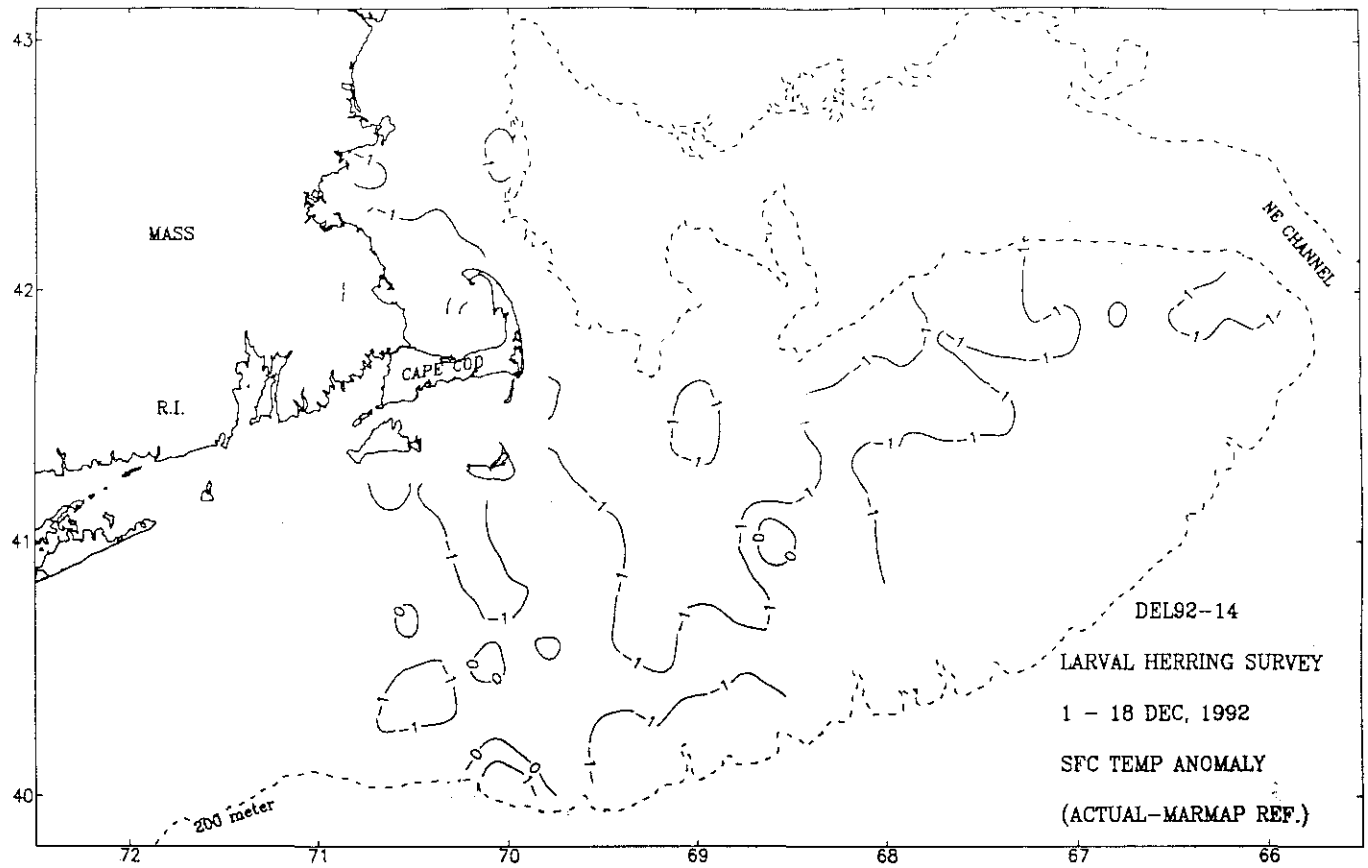


Figure 73. The surface and bottom salinity distribution for the larval herring/sand lance study DEL9214.



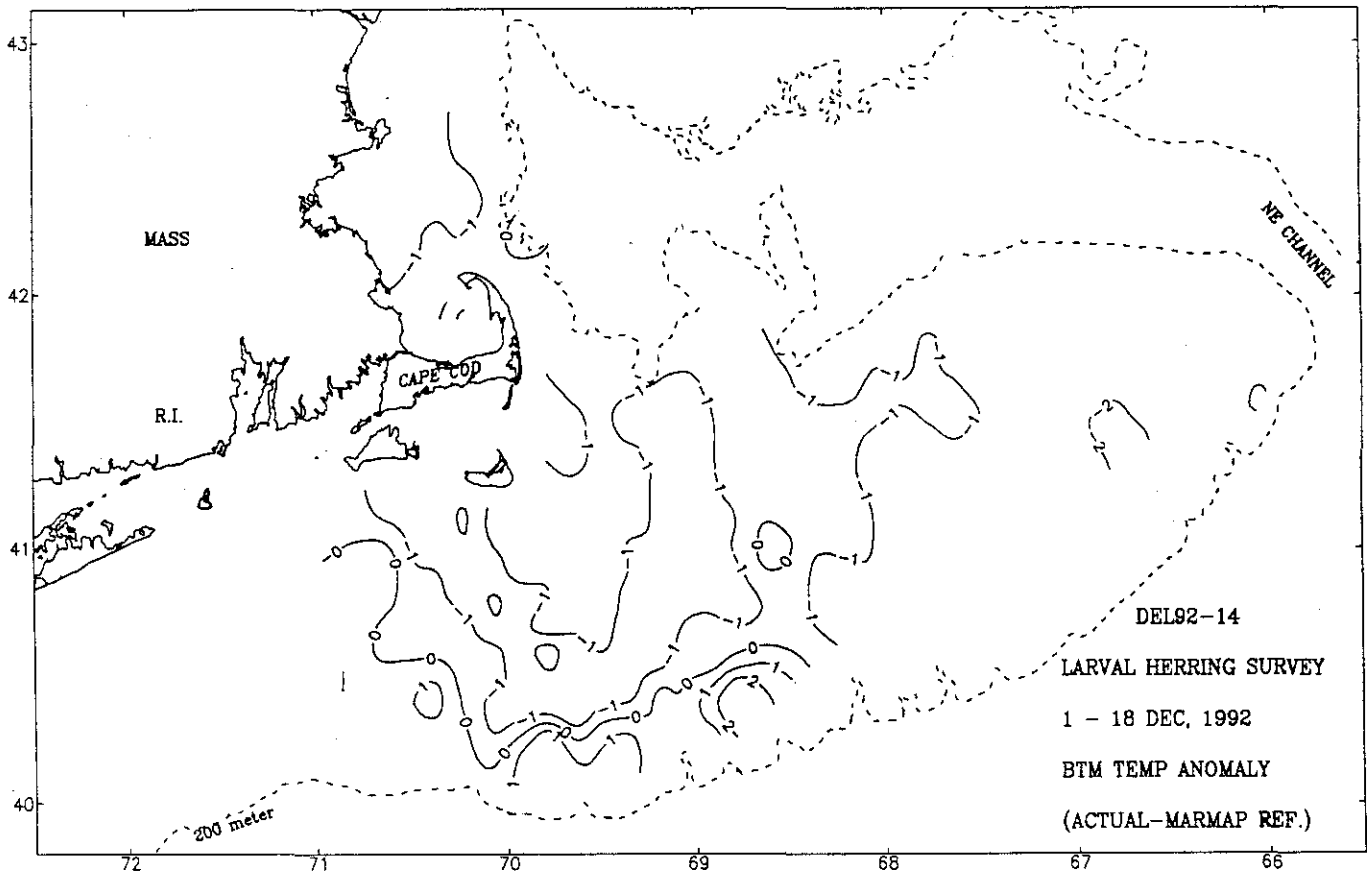


Figure 74. The surface and bottom temperature anomaly distribution for the larval herring/sand lance study DEL9214.