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Georges Bank Stratification Study: 1992 Data Report

Albatross IV 92-04 & 92-05

27 April-29 May, 1992

by

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INTRODUCTION

In late spring 1992, three cruises were conducted as part of the NOAA Climate and Global Change, Marine Ecosystem Response Program study entitled: Stratification variability on Georges Bank and its effect on larval fish survival. The study was conducted by researchers from the Northeast Fisheries Science Center (NMFS), the Woods Hole Oceanographic Institution (WHOI) and the Bigelow Laboratory for Ocean Sciences. The field sampling for the study was accomplished by coordinated sampling from two research vessels, *Albatross IV* (two legs) and *Endeavor*.

The objectives of these cruises were to test and intercalibrate a variety of sampling systems for determining the distribution and abundance of larval fish and their planktonic prey in relation to hydrographic conditions. An additional objective was to test and evaluate different sampling strategies that could be used in future field operations. Tissue samples were collected by NMFS scientists from Narragansett, R.I. and used to compare biochemical indices of larval growth and condition to the observed prey abundance and hydrographic conditions.

This report documents the data collected by the Woods Hole NMFS scientists on the *Albatross* cruises AL9204II and AL9205 (April 27 - May 7 and May 18 - 29, respectively). It is intended to assist collaborating scientists in the process of merging datasets. The sampling systems are described and the data is summarized in the form of basic statistics (tables and graphs). The discussion section is limited to brief notes on the significant unplanned observations of a) the appearance of Scotian Shelf Water, b) a wind event, and c) small-scale structure of the fluorescence signal. A description of the archived data and the procedure to access that data are included in an appendix.

SAMPLING SYSTEMS

SHIPBOARD

The primary shipboard sampling systems used during this cruise to accomplish objectives were:

MOCNESS: Multiple Opening/Closing Net and Environmental Sensing Systems with 1 m^2 (0.333 mm mesh nets) and 1/4 m^2 (0.064 mm mesh nets) mouth openings, each equipped with nine nets and conductivity/temperature/depth measuring packages (identified as MOC1 and MOC1/4, respectively). The MOCNESS systems were deployed on the port side using the boom.

Seabird Electronics Seacat Model 19 CTD (*Profiler*): a conductivity, temperature, and depth measuring instrument with a sampling rate of two observations/second. During a bongo haul, the *Profiler* was attached above the bongo frame and towed double-obliquely through the water. When a bongo haul was not required, the *Profiler* was deployed vertically through the water column. The conductivity cell is "free-flushed."

MK5 CTD: a Conductivity/Temperature/Depth measuring system equipped with a fluorometer and rosette water sampler. The MK5 CTD was deployed from the starboard hydrographic A-frame for both vertical profiles while the vessel was stationary and for tow-yo sampling while the vessel steamed at 2.5 knots. A total of 452 CTD profiles were made (counting down and up casts separately) on AL9205.

Near real-time satellite: Satellite derived SST was sent to the ship *via* radio transmission at 300 baud.

MOORED

A physical oceanographic mooring with instruments to measure the temperature, salinity, and current in the upper 50 m of the water column was deployed to monitor the vertical structure in the water column during the sampling period.

VACM: Vector Averaging Current Meters were attached at 15 m and 45 m to record current velocity and temperature 16 times per hour.

RBR Temperature Loggers (TPODS): Single channel temperature loggers (model series XL-105) used in fixed mode of operation as part of the moored array. Temperature observations were recorded every 2 minutes of their deployment. Instruments were attached at 5, 25, and 35 meters.

Seabird Electronics Seacat Model 16: Internally recording temperature / conductivity instruments intended for fixed mooring operations. The conductivity cell is "free - flushed" (i.e. no mechanical pumping of water through the cell). The moored Seacats recorded temperature and conductivity observations every 2 minutes of their deployment. Instruments were attached at 1, 10, 20, 30, 40, and 50 meters.

DRIFTING

Loran-C Buoy Marker Buoy: This instrument (manufactured by Seimac Limited and loaned to us by Art Allen of USCG Research and Development Lab) received Loran radio signals at a user defined setting (we used 30 minutes) and transmitted the time delays via VHF radio to the ship.

The systems listed and reported on within this document are those used by the NMFS scientists. The other systems deployed during the cruise by WHOI scientists are the Greene Bomber (a dual beam acoustic system towed behind the ship) and the BIOSPAR (Bioacoustic Sensing Platform and Relay, a dual-beam biological echo sounder and satlellite and radio communincations system mounted on a spar buoy).

METHODS

SAMPLING OPERATIONS

In preparation for the subsequent cruise (May 18-29, 1992), the NMFS Fisheries Oceanography Investigation conducted four experiments while aboard the *Albatross IV* from April 27 - May 8, 1992. The first three were instrument tests.

The General Oceanics "Mark5" CTD[1], deployed for the first time at sea, worked as expected but casts were limited due to problems associated with the conductive cable and connection to the unit. The second instrument test, that of a SEIMAC Loran-C Marker Buoy, also had a few problems. The high-flyer/drogue that was attached to the instrument tended to drag the unit along, causing the antennae to lean away from a vertical position. The Loran-C Canadian chains (#5930) the instrument was receiving were different and probably not as strong as the American chain (#9960) typically used by the ship. Finally, the radar signal from a reflector mounted on the high flyer was not strong enough to be distinguished from background sea clutter. On three occasions, MOCNESS hauls were conducted in order to test recent modifications of hardware and software as well as to provide training sessions for MOCNESS operators. Two hauls were done in the stratified region and one in the mixed region.

The final experiment of AL9204, an oceanographic survey of the temperature and salinity distribution, was successful. An anomalous stream of Scotian Shelf Water (cold 3° C & fresh 31.6 ppt) was observed and tracked along the entire southwestern flank of Georges Bank. We conducted 31 Seabird CTD casts, including three cross-bank sections.

During the first three days (19-21 May 1992) of the second cruise (AL9205), a survey was conducted to locate cod and haddock larvae on the southern flank of Georges Bank and to provide an initial indication of the hydrographic conditions in the region. A bongo-net (61 cm diameter, 0.333 mm and 0.505 mm nets) equipped with a Seabird CTD profiler was used on 35 stations (5 to 10 mi spacing) between the 50 and 100 m isobaths.

From the survey information, a site was chosen for deployment of the physical oceanographic mooring, the BIOSPAR mooring, and the drifters (Figures 1 and 2). This site (80 m bottom depth) was selected to be in the region of the bank that characteristically has a stratified water column. It is identified as the stratified site (S). A second site (49 m bottom depth) was selected in the characteristically well-mixed, shallow portion of the bank nearest to the site S. This site is referred to as the mixed site (M).

The physical oceanographic mooring deployed at site S on May 21 (40° 42.49' N, 67° 52.33 W) and the BIOSPAR mooring was then deployed nearby (40° 42.24 N, 67° 51.47' W), within 0.7 mi of each other. After deployment of the moorings, three drifters were deployed near the site S in an equilateral triangular pattern two mi on a side. The drifters consisted of a highflyer with radar reflector and light and a 6 m - long holey sock drogue tethered to 10 m depth. One drifter also had a Loran-C buoy tethered to it (Figure 2a). The vessel had a VHF receiving unit to track the buoy's position. The three drifters formed a third site, the Drifting site (D), which was expected to drift southwest away from the site S during the course of the study.

[1] Conductivity, Temperature, and Depth Recorder originally manufactured by Neal Brown and EG&G of Falmouth

At the three sites, two different sampling schemes were conducted. The first was called a "site transect," which extended from 2 mi south to 2 mi north of the site (essentially across isobath). A MOC1 tow was made starting at the southern end and towed toward the site. After it was completed, the vessel returned to the southern end of the transect and a CTD Tow-Yo was made along the 4 mi section at 2.5 knots with profiles every 5 min (approximately 0.2 mi spacing). The Greene Bomber was towed during both MOC1 and Tow-Yo. On some occasions a MOC1/4 tow was made at the completion of the Tow-Yo. Between May 21 and May 24, three site transects were completed at each of the three sites, including day - night comparisons at the sites S and M. Three of the site transects were conducted jointly with *R/V Endeavor* for intercomparison of systems on the two vessels and for a more complete sampling of the water column by the full suite of available instrument systems.

The second sampling operation was the fine scale "grids." These are attempts to survey a square mile of ocean in a Lagrangian sense. In other words, our objective was to map the physical and biological variables relative to the moving water mass, assuming a slab-like advection over 3 to 4 hr of the tidal cycle. The sampling was conducted on nominally six transects that were 1 mi long and 0.2 mi apart. In some cases, *R/V Endeavor* simultaneously ran grid lines offset by 0.1 mi for the *Albatross IV* grid so that the combined effort sampled the square mile of water with a transect spacing of 0.1 mi. The movement of the water during the sampling had to be taken into account in order to sample the intended parcel of water. The tidal currents are often greater than 50 cm sec^{-1} and, over the 4 hr required to conduct the sampling, would displace the parcel of water a distance three to four times greater than the size of the square. To compensate for movement during the sampling, a drifting buoy (with drogue at 15 m) was used as a reference marker and all grid lines were positioned relative to the drifter at the time the lines were run. The Greene Bomber was deployed on all grid lines. A MOC1 tow was conducted on the first and last lines. A CTD Tow-Yo was conducted on the second through fifth lines with profiles every 3 minutes (for an approximate along-track spacing of 200m). Four grids were completed by *Albatross*, three of which were conducted with *Endeavor* (see Appendix 3: Grid Log). The *Endeavor* conducted one grid alone (Grid #2).

In order to reference the position of samples relative to the moving parcel of water, the following procedure, as suggested by Captain Dean Smehil, was used on Grid numbers 4 and 5. The proposed 1 mi grid pattern was drawn on the *Albatross IV* radar screen with a grease pen. The ship was simply steered such that the signal from the drifter's reflector traced out the pattern on the screen.

The location of the three sites and a summary of the operations conducted at each site is shown in Figure 1.

Some "longer transects" of observations also were occupied. These included two Tow-Yo transects with the Greene Bomber between the site S and M, with CTD profiles every kilometer. An along isobath transect of CTD stations every 5 mi was occupied from 25 miles northeast to 20 mi southeast of the site S. Transects also were occupied near the western end of Georges Bank and across the eastern side of Great South Channel. These transects included sampling by MOC1, Greene Bomber and the MK5 CTD.

On four occasions, the vessel's small boat was used to come alongside BIOSPAR in order to reprogram the instrument's operating system. On two occasions the Greene Bomber was deployed with the vessel drifting near BIOSPAR for an intercomparison between the two systems.

The physical oceanographic mooring and the BIOSPAR mooring were recovered on the morning of May 27. The Loran-C drifting buoy was recovered on the morning of May 28 (40°28.4' N, 69° 5.9' W). (The other two drifters were recovered on the morning of May 24, after they separated some distance from the Loran-C buoy and could not be easily tracked by themselves.)

A chronological listing of the operations conducted during this cruise, with time and position information, is provided in short form in Table 1 and in detail in Appendix 1. A transect log and grid log are included as Appendix 2 and 3, respectively.

PROCESSING OPERATIONS

The MOCNESS and most bongo samples have been sorted and identified for fish larvae, eggs, and zooplankton. Fish larvae were measured to the nearest tenth millimeter and all lengths were converted to live lengths using Bolz and Lough (1983) algorithm. All data includes lengths of larval fish specimens taken for biochemical analysis. Copepods and fish eggs from selected MOCNESS hauls have been staged according to life history traits. Depth distributions have been plotted using total numbers; however, means and standard deviations have been calculated for each haul. Weighted mean depth was calculated for fish eggs and larvae using the following formula:

$$wmd = \Sigma product / \Sigma density$$

where Σproduct = midpoint of depth interval * density of specimens. When more than one depth profile was performed during a haul, each depth profile was considered be be either an up or down haul. Separate sets of analysis were performed for each type of haul (*i.e.* up or down). Day and night distributions have been calculated for selected MOCNESS hauls at stratified, drifter, and mixed sites. Density distributions of fish eggs and larvae have been calculated using MOCNESS volume data.

Depth distribution of MOCNESS temperature, salinity, and sigma-t measurements have been calculated by using the haul start time from the MOCNESS data log and then subsequently adding to it the duration of the time each net was tripped (taken from the MOCNESS computer running time). Raw environmental data from the MOCNESS is missing for MOCNESS hauls 986 and 987.

The Seabird PROFILER (CTD) records were bin-averaged to 1m using Seabird "BINAVG" software. The salinity data was corrected using water samples collected by water bottles and analyzed on an AUTOSAL in the laboratory. Seabird PROFILER data was contoured at sea using Golden Software's SURFER routines in combination with our SURFDR.BAT routine on a 486 machine. The horizontal contour maps presented herein were generated back at the lab using SURFACE3 on the VAX. The vertical sections are SURFER outputs.

The General Oceanics MarkV CTD was deployed 246 times. The General Oceanics software "CTDPOST" was used to generate 1 meter bin averages. A correction of .005 PSU was applied to the CTD salinity data after calibration with Niskin bottle samples. In order to merge position, water depth, and other "header" information with the pressure, temperature, salinity, and fluorometry, several processing steps were developed. Analogous to the "SURFDR.BAT" system for processing SEABIRD data on the PC, we developed a MATLAB routine called "LOOKAT.M" to process/view data on the UNIX machine. This routine conducts the entire process (using several call functions) from merging General Oceanics ".PRS" files with ship position files ("NB2NODC.F") to generating contoured sections ("BARNES.M").

Contouring the Mark V CTD data was done by BARNES.M, a pseudo-objective mapping routine that iteratively grids unequally spaced data (Barnes, 1974). By changing the search radius with each iteration, depending on the difference between observed and estimated values, the gridded field is improved. Estimates of error due to the gridding operation could be calculated and are reported along with the figures.

The Lagrangian coordinates for the grid paths were calculated differently for different grids depending on whether we a) were near the mooring, b) were near the drifter, and c) used the "grease pen" technique. Grids #1 and #2 were near the drifter. In these cases we processed the 30 min position file from the Loran C drifter through two Fortran programs to linearly interpolated to one minute intervals ("interp.exe") and calculate distances (KMs) relative to the start of the grid ("dist.exe"). The "start of the grid" was set to be the time and place the first instrument went over the side of *Albatross*. This "XYT" file along with that of the ship became input to another fortran routine "LAGRD.EXE" to obtain the back calculated Lagrangian positions. Lagrangian positions for Grid #3 (conducted with the Endeavor near the mooring) were calculated using observations of the VACM at 15 m. By running the output of the Buoy Group program "BARRAY.com" through "LAGRIDCM" , the desired result was obtained. For Grids 4 and 5, the "grease pen" method was used. In the the grease pen cases we recorded the ships time and position at the beginning, middle, and end of each leg as well as the drifters range and bearing. This data was input to a routine called "NEWPOS.EXE" which calculated the drifter positions. After interpolation to one minute intervals, calculation of distances relative to the start, and execution of "LAGRD.EXE", the Lagrangian positions were obtained.

The initial processing of the VACM records was done by Fran Hotchkiss at USGS. This including the standard WHOI edited and checking routines (Tarbell *et al.* 1988). The output was stored in BUOY format on the VAX. The data were transferred to ascii format and post-processed using PC-MATLAB routines. Low-pass filtering was done using a 33-hr 3rd order Butterworth filter. The five moored Seabird SEACAT records and three Branker temperature probe records were hourly averaged. Despiking of the data was unnecessary.

The Loran-C buoy data was automatically stored on disk using a PROCOMM communication software at sea. This file was used to monitor the drifter track. Recorded time delays were simply entered into the Northstar Loran console in order to convert to latitude and longitude. The time delays were also stored continually (and with more reliability) within the instrument. Back at the lab, these values were first hand edited to remove bad points due to radio transmission noise and interference. The clean time delay file was then run through a set of three Fortran programs: 1) PREPLNAV.FOR reformats the data for the standard 2) LORNAV.FOR routine which converts the values to geographic coordinates (latitude and longitude) and 3) BLANK3.FOR converts lat and lon to decimal degrees. The 9960 Loran chains W & Y were used in the lat/lon conversion. The output of these routines were then run through a MATLAB plotting routine (PROVEC.M).

A data acquisition system called the Scientific Computing System (SCS) developed by engineers at Atlantic Marine Center (AMC) was in its first year of operation on the ALBATROSS IV. It provides the scientists with continuous records of position, ship speed/direction, wind speed/direction, air temperature, and several other variables. This dataset was processed back at the lab in a series of steps including 1) COMPRESS.FOR, 2) READ_COMPRESS.FOR (routines provided by AMC), and SUBSPOSN.FOR (our own). The position data was essential for the CTD Tow-yo operations when the operators record "time of the cast" without position (Lat/Lon). In order to merge the CTD Tow-yo with positions, a subprocess within the "LOOKAT.M" routine, a) creates a ".lis" file for each transect which includes cast number and time, b) accesses the SCS ship position file ("ap2b.dat"), and then c) merges the two.

Satellite SST records as transmitted from shore were run through a ADD_POSN.For routine that merged temperatures with geographic grid points and then contoured with SURFER at sea.

RESULTS

PHYSICAL OCEANOGRAPHY

The physical oceanographic program consisted of 1) deploying a mooring to measure the water column structure during the course of the study, 2) deploying drifters to track for repeated sampling of the same water parcel, and 3) CTD profiles to measure the water column structure in connection with the other sampling programs on the cruise. Results are presented in that order.

Mooring

The physical oceanographic mooring is shown in Figure 2b. It contained two VACM current meters, six SEACAT conductivity/temperature recorders and three Branker temperature recorders. The deployment and recovery of the mooring were accomplished successfully except for the loss of one SEACAT recorder[2]. All the recovered instruments collected good data. Results are summarized in Table 2.

The hourly averaged time series of detided velocity from the two VACM records and the shipmounted anemometer are presented in Figure 3. Concurrent temperature and salinity records are presented in Figures 4 and 5, respectively. The temporal evolution of the water column structure as measured by the mooring is contoured in Figure 6 including resultant wind speed in the top panel.

Loran-C Buoy

As depicted in Figure 7and 8, the quality of the Loran-C Buoy fixes was variable but sufficient for general tracking. The buoy drifted about 100 km to the WSW in 7 days (15 cms^{-1}), essentially along the isobaths. This velocity is considerably faster than would be expected for mean conditions in this area during this time of year. d represents the estimated track of a water parcel at 15m depth as represented by a 3-d circulation model (Lynch *et al.* 1992) including wind and residual tide (Figure 9).

CTD

The temperature, salinity and fluorescence data collected by the CTD systems showed considerable structure in both the along isobath and cross isobath directions. The SEABIRD station locations and contoured horizontal sections for both cruises AL9204 and AL9205 are presented in Figures 10-13 and 19-22, respectively, including surface and bottom variables. In the case of temperature, anomalies are relative to MARMAP observations (Mountain and Holzwarth 1989) are included as well. The SEABIRD vertical sections

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[2] The shackles that held the missing SEACAT were still attached to the chain when the mooring was recovered. Exactly how the instrument was detached is still unknown. Four other recorders were attached to the mooring line with the same type of bracket, none of which showed any indication of wear.

appear in Figures 14-18 and 23-25, respectively. The AL9205 MarkV-CTD vertical sections (transects #5-18, see Transect Log Appendix 2) are included cronologically as Figure 26-39. Figure 40 displays these same sections by site when more than two were conducted per site.

Grid study figures begin with a summary of cruise tracks in followed by detailed tracks of each grid in . Contoured slices of Grids 1 and 5 are presented in Figures 43 and 44, respectively.

Satellite SST

The two images that were received *via* radio transmission and contoured at sea (May 6 and 21, 1992) are shown in Figure 45.

BIOLOGY

During the initial Bongo survey, very few month-old cod were collected in shoal waters on the Southeast Part; however, a broad area of haddock and cod larvae was located on the Southwest Part from the shoals to the 90 m isobath, centered near 68°W longitude. The abundance of larvae was relatively low, less than 6 larvae per Bongo-net haul was typical (Figure 46). Larval haddock were about four times as abundant as cod. Most larvae were recently hatched, 4 to 5 mm SL. Both cod and haddock were a few weeks older, 5-8 mm, and more abundant in the shoal water < 60 m depth (Figure 47). The patch of larvae was located farther to the southwest (40-70 miles) than expected from previous years' surveys conducted in the last half of May. Perhaps the cold band of water observed in April that moved onto the southern edge of Georges Bank displaced eggs and larvae southwest and more onto the shoals. The cold water (<4 °C) also may have retarded development and induced high mortality of the eggs and larvae.

Seven MOCNESS hauls were made at the drifter site (D), 8 at the stratified site (S), and 10 hauls at the mixed site (M) (Figure 48 and Table 3). Detailed MOCNESS information is given in Table 4. Few cod or haddock larvae were collected at the stratified-water sites; most larvae were collected at the mixed site in water < 50 m bottom depth (Figure 48). The MOCNESS vertical profiles indicated that cod and haddock larvae were distributed broadly through the water column, generally more abundant towards the bottom (Bar Charts, Figures 49 - 58). It is important to note that no bars are plotted for depths where there was no net. The figures must be interpreted accordingly. Haddock larvae were collected in greater numbers at depths deeper than 20 m in several hauls. Zooplankton abundance generally appeared to be highest in the upper 40 m of the water column. The copepod *Calanus finmarchicus* dominated the zooplankton hauls in stratified waters.

Along the transect occupied at the western end of the survey region (68° 20' W) five MOC1 hauls were made simultaneously with the Greene Bomber. Haddock and cod larvae (7-8 mm mode) were collected at the shallowest stations: their abundance and vertical distribution was similar to the previous three-site study (Figures 60-62). On the transect across the eastern side of the Great South Channel three MOC1 hauls were made from 50-80 m bottom depth. Older haddock and cod larvae (6 -11 mm) were collected in all hauls (Figures 63-65). The general distribution pattern of larvae observed during the cruise is consistent with the recirculation of some fraction of larvae on the eastern side of the Great South Channel.

Fish larvae were removed from the Bongo and MOC1 nets and preserved in alcohol or frozen for further analysis:

Larval otolith aging	136 cod, 179 haddock
Biochemical analysis	152 cod, 184 haddock
Isotope analysis	6 cod, 15 haddock
Grazing experiment	> 100 live amphipods

A total of 182 cod and 189 haddock larvae were collected with the 1M MOCNESS and frozen for biochemical studies (Table 5). All but two cod and seven haddock came from the shoal or transect sites. Larvae were sampled from 11 MOC1 hauls, representing both day and night tows. Larvae were sampled from both integrated and discrete depth nets. The majority of gadid larvae were frozen on petri dishes in the ships freezer. Other samples were frozen in liquid nitrogen. These samples will be analyzed for RNA and DNA content using an automated fluorescence procedure. We will attempt to sample otoliths from these larvae. Standard length will either be measured directly or estimated from DNA content.

Live amphipods were collected at night at the shoal site (MOC #997, nets 0, 5, 6, 7, and 8, and MOC #1000, 1001, 1004 all nets) for Ted Durbin at URI GSO. Samples of mixed plankton, consisting mostly (>90%) of *Calanus*, were frozen in liquid nitrogen for isolation of nucleic acids.

DISCUSSION

While most of our cruise went as planned, we were also fortunate to encounter some interesting phenomenon. A very brief description of these unplanned observations are presented in this discussion section. Detailed analysis is expected in forthcoming papers.

SCOTIAN SHELF WASHOVER

The temperature and salinity data on a number of transects indicate the presence of low temperature (<4 °C) and low salinity (<32.00 PSU) in small patches or layers in the water column. This is believed to be a remnant of a large influx of Scotian Shelf Water (SSW) onto eastern Georges Bank which was observed in satellite images from March through June 1992 (Figure 45) and confirmed by shipboard observations on cruise ALB 92-04 in early May. NOAA buoy 44011 SST sensor also recorded unusally cold water from late March through the end of May (Figure 67). The cause of this feature ,as reported by Rusham *et al.* 1994 and Bisagni *et al.* (in prep.), may be the unusally large St. Lawrence River runoff in the spring of 1991. The thickness of the lens as defined by the 32 ppt isohaline varies in both the cross and along-isobath directions (Figure 66). The influx and continued presence of SSW may have important implications for the plankton communities in the bank, both by the unusually cold temperatures and by a westward displacement of the water on the southern flank of the bank.

MAY 25 WIND EVENT

A slight warming period over a few days from May 22 through mid-May 24 (Figure 68) resulted in a build up in stratification in the vicinity of the mooring site of approximately 4°C temperature gradient in the top 20 m of the water column (Figure 6). This was followed by a period of strong northeasterly winds on late May 24 (Figure 69) contributing to mixing of the upper water column (Figure 6) as well as unusually fast westward drift of the surface waters (Figure 8a). This observation supports the hypothesis that the onset of stratification on Georges Bank in late spring is not a steady seasonal process but rather an intermittant addition of the sun's heat interupted by occasional two- to three-day wind events. Examination of the NOAA Buoy 44011 wind record for the entire month of May 1992 reveals at least three other events occurred with magnitudes similar to that observed on May 24th and 25th. Superimposed on these wind-driven cycles are the semi-diurnal advection of both the tidal front and the shelf-slope front. The former advection is clearly evident in the 1992 mooring record as seen by the oscillating isopycnals in the bottom panel of Figure 6 and, as will be demonstated in the 1993 data report (Taylor, *et al.* in prep), the intrusion of slope water is possible in the lower portion of the southern flank water column.

SMALL-SCALE FLUORESCENCE STRUCTURE

The structure of the fluorescence, assumed to be an indicator of chlorophyll-a abundance, showed a patchy distribution that in many instances was associated with similar structure in the temperature and salinity distributions. As depicted in the lower right panel of Figures 26-39, there is often a subsurface maximum, especially for the those cast in the stratified area (see, for example, Transect #14 - Figure 35), but there are horizontal gradients as well. Much of the future analysis on this data set will be estimating the lengths scales of these patches. This requires remapping these parameters in a Lagrangian reference frame as done in Figure 43. One such study already in progress (Wiebe *et al.*, in prep.) relates the acoustic properties of these patches to other physical and biological parameters.

CONCLUSIONS

While the cruises in the Spring of 1992 were meant to be "pilot studies" and instrument "tests," a large volume of data was collected to allow intercomparison of the net, towed-acoustic, CTD, and moored systems under a variety of conditions. The joint operations with *R/V Endeavor* also should allow intercomparison with the video, acoustic, and pumping systems on that vessel. The ability to determine the three dimensional distribution of the organisms in relation to hydrographic conditions on relatively short space scales is believed to be very important to the objectives of the stratification study. The observations made on these cruises potentially provide a significant contribution to our knowledge of the system. The ability to map a small parcel of water that is being advected by the strong tidal currents on Georges Bank is a enormous challenge but we have made great progress in that effort. The "grid" studies in particular provide for the first time an opportunity to conduct a interdiscinplary investigation sub-mesoscale dynamics on the southern flank of Georges Bank. It is hoped that this report which documents little more than the time, place, and distribution of samples may help in the intergration and synthesis of the GLOBEC field study.

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Table 1. Brief listing of events, May 20-28

	May	20	21	22	23	24	25	26	27	28
2				WMS	WMS	TDS		FMS-WMS		
4				"	"	"		"		
6	Bongo	Survey		"	"	"				
8	"	"	Phy Oc		Biospar	Biospar		Grid 4		
10	"	"	Mooring				Grid 2	(WMS)	Mooring	
12	"	"		Biospar	TDS	Grid 1	(FMS)	"	Pick-ups	GSC
14	"	"	Biospar	FMS	"	(TDS)	"			Transect
16	"	"	Deploy	"	Boat	"	"			"
18	"	"		Biospr	TDS		Along Iso		Western	
20	"	"	Drogues		w/END	Biospar	Transect		Transect	
22	"	"	FMS	FMS	WMS	FMS-WMS	"	Grid 5	"	
				w/END	"	"		(WMS)	"	

Table 2. Mooring statistics: temperature (°C), salinity (psu), and current (cm/s)

Temperature

Depth	Instr.	Mean	Stn Dev	Min	Max
1	SC 1045	6.92	0.926	5.59	8.87
5	TPOD 62	6.11	0.459	5.07	7.33
10	SC 359	5.52	0.418	4.44	6.51
15	VMCM 503	5.09	0.465	4.19	6.15
20	SC 365	4.56	0.465	3.20	5.71
25	TPOD 63	4.26	0.369	3.20	5.24
30	SC 561	4.15	0.314	3.12	4.97
35	TPOD 64	4.13	0.264	3.27	4.81
40	SC 595	4.13	0.195	3.69	4.62
45	VMCM 501	4.14	0.169	3.78	4.55

Salinity

Depth	Instr.	Mean	Stn Dev	Min	Max
1	SC1045	31.88	0.069	31.76	32.05
10	SC359	31.93	0.118	31.73	32.20
20	SC365	32.10	0.143	31.78	32.30
30	SC561	32.23	0.112	31.85	32.41
40	SC595	32.32	0.052	31.92	32.42

Velocity

East

Depth	Instr.	Mean	Stn Dev	Min	Max
15	VMCM 503	-10.89	20.51	-45.0	28.3
45	VMCM 501	-7.05	19.31	-40.8	29.0

North

Depth	Instr.	Mean	Stn Dev	Min	Max
15	VMCM 503	0.87	26.18	-48.9	49.7
45	VMCM 501	0.63	26.09	-51.4	44.9

Speed

Depth	Instr.	Mean	Stn Dev	Min	Max
15	VMCM 503	32.96	11.48	3.9	59.4
45	VMCM 501	31.82	9.19	5.8	54.0

Table 3. Listing of MOCNESS hauls by site

Stratified	Mixed	Drifter	Western	Great South Channel
974	975	982	1000	1005
977	976 (1/4)	983 (1/4)	1001	1006
978 (aborted)	980	984	1002	1007 (aborted)
979	981	987	1003 (lost)	1008
991	985	988 (aborted)	1004	
992	986 (1/4)	989 (only 2 depths)		
995	993	990		
996 (1/4)	994			
	997			
	998			
	999 (1/4)			

Table 4. MOCNESS physical data/station information

NOTE: Missing data for the following hauls and nets; 977-all nets, 979.8, 989.1, 989.2, 998.8

Haul.Net	Time	Depth	Botm	D/N	Tem	Sal	Sig-T	Vol	Site
974.1	21:05s	10-20	82+4	n	5.2	31.94	25.23	249.1	stratified
974.2	21:10:20	20-30			4.6	32.09	25.41	268.2	
974.3	21:17:20	30-20			4.7	32.05	25.37	257.3	
974.4	21:28:36	20-10			5.1	31.87	25.18	314.3	
974.5	21:35:24	10-0			6	31.2	24.55	159.2	
974.6	21:41:04	0-10			5.3	31.85	25.14	214.7	
974.7	21:45:32	10-20			4.9	31.89	25.22	264.5	
974.8	21:51:04	20-30	84+4		4.5	32.1	25.43	274.5	
	22:02:20e								
975.0	02:56s	0-10	45+4	n	5.9	32.25	25.38	329.9	mixed
975.1	03:01:12	10-20			6.1	32.27	25.39	270.5	
975.2	03:06:12	20-30			6.1	32.3	25.41	283.9	
975.3	03:12:12	30-20			6.1	32.25	25.37	276.3	
975.4	03:18:12	20-10			6.1	32.24	25.35	264.4	
975.5	03:28:12	10-0			6.1	32.25	25.37	271	
975.6	03:33:04	0-10			6.2	32.26	25.37	271	
975.7	03:39:12	10-20			6.2	32.25	25.36	273.9	
975.8	03:44:52e	20-30	48+4		6.2	32.25	25.36	323	
976.1	08:29s	40-30	46+4	d	6.3	32.3	25.39		mixed
976.2	08:30:44	30-20							1/4m
976.3	08:37:36	20-10							
976.4	08:04:52	10-0							
976.5	08:42:52	0-10							
976.6	08:44:36	10-20							
976.7	08:46:04	20-30							
976.8	08:47:36	30-40	48+4						
	08:50:20e								
977.1	13:40s	70-60	79+4	d				244.6	stratified
977.2	13:45:12	60-50						238.6	
977.3	13:50:12	50-40						241.7	
977.4	13:54:12	40-30						260.3	
977.5	13:59:28	30-20						246.4	
977.6	14:05:12	20-10						259.2	
977.7	14:11:12	10-0						228.2	
977.8	14:16:12	50-0						280.4	
	14:27:20e								
978-aborted									stratified
979.1	21:29s	70-60	79+4	n	4.2	32.3	25.61	232.4	stratified
979.2	21:33:56	60-50			4.3	32.27	25.59	257.6	
979.3	21:39:04	50-40			4.4	32.25	25.57	259.2	
979.4	21:44:04	40-30			4.5	32.23	25.54	253.9	
979.5	21:49:04	30-20			5.5	31.95	25.47	267.1	
979.6	21:54:04	20-10			4.3	32.14	25.2	265.7	
979.7	21:59:04	10-0			7.4	31.82	24.86	272.2	
979.8	22:05:04	50-0	76+4						
	22:16:28e								

Table 4. Continued.

NOTE: Missing data for the following hauls and nets; 977-all nets. 979.8. 989.1. 989.2. 998.8

Haul.Net	Time	Depth	Botm	D/N	Tem	Sal	Sig-T	Vol	Site
980.1	02:59s	40-30	46+4	n	6.4	32.24	25.33	245.9	mixed
980.2	03:04:04	30-20			6.4	32.28	25.36	245.9	
980.3	03:09:04	20-10			6.4	32.26	25.34	255.7	
980.4	03:14:04	10-0			6.4	32.26	25.34	247.8	
980.5	03:19:04	0-10			6.4	32.26	25.34	254.6	
980.6	03:24:12	10-20			6.4	32.27	25.34	256.7	
980.7	03:30:04	20-30			6.4	32.27	25.34	257.6	
980.8	03:35:04	30-40	45+4		6.4	32.27	25.34	267.1	
	03:40:04e								
981.1	06:51s	40-30	46	d	6.4	32.25	25.33	208.7	mixed
981.2	06:55:56	30-20			6.5	32.25	25.33	243.7	
981.3	07:01:12	20-10			6.4	32.25	25.33	264.4	
981.4	07:06:04	10-0			6.5	32.25	25.33	246.3	
981.5	07:11:04	0-10			6.5	32.25	25.32	256.3	
981.6	07:17:04	10-20			6.4	32.25	25.33	253.8	
981.7	07:22:04	20-30			6.4	32.25	25.33	255	
981.8	07:26:56	30-40	45		6.4	32.25	25.33	282.8	
	07:32:20e								
982.1	11:35s	80-70	86+4	d	4.2	32.29	25.61	229.3	drifter
982.2	11:40:28	70-60			4.2	32.28	25.6	215.7	
982.3	11:46:12	60-50			4.3	32.26	25.58	215	
982.4	11:51:20	50-40			4.4	32.25	25.56	212.5	
982.5	11:57:12	40-30			4.5	32.21	25.52	247.2	
982.6	12:01:56	30-20			5.3	32.08	25.32	255.7	
982.7	12:07:20	20-10			7.1	31.96	25.01	275.6	
982.8	12:12:04	10-0			9.4	28.86	22.27	92.8	
	12:16:04e								
983.1	15.31s	60-50	65+4	d	4.5	32.24	25.54	31.1	drifter
983.2	15:33:08	50-40			4.5	32.24	25.55	31.5	1/4m
983.3	15:35:08	40-30			4.5	32.24	25.55	33.3	
983.4	15:38:08	30-20			4.5	32.24	25.54	32.9	
983.5	15:40:08	20-10			4.9	32.17	25.44	33	
983.6	15:42:08	10-0	70+4		6.1	32.05	25.2	35.8	
	15:44:08e								
984.1	17:13s	70-60	76	d	4.3	32.27	25.59	236.6	drifter
984.2	17.22	60-50			4.3	32.27	25.59	236	
984.3	17:27	50-40			4.3	32.26	25:58	240.6	
984.4	17:32	40-30			4.3	32.25	25.56	228.8	
984.5	17:37	30-20			5	32.13	25.4	220.9	
984.6	17:42	20-10			6.6	31.97	25.08	235.8	
984.7	17:48	10-0	72		9.4	31.96	24.67	206.9	
	17:53e								
985.1	22:16s	40-30	48+4	n	6.6	32.27	25.31	226.8	mixed
985.2	22:21:04	30-20			6.7	32.27	25.31	234.3	
985.3	22:26:04	20-10			6.7	32.27	25.31	244	
985.4	22:31:04	10-0			6.7	32.27	25.31	262.1	
985.5	22:36:36	0-10			6.7	32.27	25.31	266.9	
985.6	22:42:28	10-20			6.7	32.27	25.3	261.9	
985.7	22:47:20	20-30			6.7	32.27	25.31	256.1	
985.8	22:53:20	30-40	46+4		6.7	32.27	25.31	267.8	
	22:58:20e								

Table 4. Continued.

NOTE: Missing data for the following hauls and nets: 977-all nets, 979.8, 989.1, 989.2, 998.8

Haul.Net	Time	Depth	Botm	D/N	Tem	Sal	Sig-T	Vol	Site
986.1	21:29s	40-30	46+4	n	6.8	32.32	25.34	38.1	mixed
986.2	21:31:24	30-20			6.8	32.32	25.34	42.1	1/4m
986.3	21:33:32	20-10			6.8	32.32	25.34	29	
986.4	21:35:52	10-0			6.8	32.32	25.34	26.7	
986.5	21:37:44	0-10	47+4		6.8	32.32	25.34	22.3	
	21:39:36e								
987.1	02:33s	80-70	85+4	n	4.2	32.33	25.65	231.2	drifter
987.2	02:38:04	70-60			4.2	32.3	25.62	231.5	
987.3	02:43:04	60-50			4.2	32.28	25.6	235.5	
987.4	02:48:04	50-40			4.3	32.26	25.58	231.8	
987.5	02:52:56	40-30			4.4	32.24	25.55	259.4	
987.6	02:59:04	30-20			4.6	32.18	25.48	268.8	
987.7	03:04:12	20-10			5.7	32.01	25.23	280.4	
987.8	03:09:12	10-0	76+4		8.1	31.92	24.83	278.4	
	03:15:20e								
988-aborted									drifter
990.1	16:04s	70-60	75+4	d	4.4	32.23	25.54	154.1	drifter
990.2	16:07:04	60-50			4.4	32.24	25.55	151.4	
990.3	16:10:04	50-40			4.5	32.23	25.54	153	
990.4	16:13:04	40-30			4.6	32.21	25.51	144.6	
990.5	16:16:04	30-20			4.9	32.17	25.44	147.4	
990.6	16:19:12	20-10			6.9	32.01	25.06	155.3	
990.7	16:22:12	10-0	73+4		10.0	31.9	24.53	144.6	
	16:25:04e								
991.1	10:59s	70-60	76+4	d	4.1	32.33	25.66	163	stratified
991.2	11:02:04	60-50			4.1	32.32	25.65	174.8	
991.3	11:05:36	50-40			4	32.28	25.62	154.3	
991.4	11:09:12	40-30			3.8	32.04	25.45	149.9	
991.5	11:12:12	30-20			4.9	32.01	25.32	151.5	
991.6	11:17:04	20-10			5.7	31.92	25.15	145.5	
991.7	11:19:04	10-0			6.7	31.59	24.77	146.3	
	11:21:48e								
992.1	14:58s	70-60	78+4	d	3.9	32.37	25.7	250.5	stratified
992.2	15:03:04	60-50			3.9	32.38	25.71	247.5	gridII
992.3	15:08:12	50-40			3.9	32.29	25.65	193.2	
992.4	15:14:04	40-30			4.4	32.22	25.53	202	
992.5	15:19:04	30-20			4.9	32.11	25.39	235.1	
992.6	15:24:04	20-10			6.2	31.9	25.08	254.5	
992.7	15:29:04	10-0	79+4		6.3	31.85	25.02	251.2	
	15:34:04e								
993.1	09:20s	40-30	47+4	d	6.6	32.29	25.33	148	mixed
993.2	09:23:04	30-20			6.6	32.29	25.33	162.9	grid III
993.3	09:27:28	20-10			6.7	32.22	25.28	163.3	
993.4	09:30:04	10-0			6.9	32.07	25.12	144.3	
993.5	09:34:12	0-10			6.9	32.06	25.12	137.6	
993.6	09:37:04	10-20			6.7	32.17	25.23	149.8	
993.7	09:40:04	20-30			6.6	32.27	25.33	151.4	
993.8	09:43:04	30-40			6.6	32.28	25.34	152.4	
	09:46:04e								

Table 4. Continued.

NOTE: Missing data for the following hauls and nets: 977-all nets, 979.8, 989.1, 989.2, 998.8

Haul.Net	Time	Depth	Botm	D/N	Tem	Sal	Sig-T	Vol	Site
994.1	12:35s	40-30	45+4	d	6.5	32.26	25.33	132.4	mixed
994.2	12:38:04	30-20			6.5	32.25	25.32	114.5	gridIII
994.3	12:41:04	20-10			6.5	32.24	25.3	126.8	
994.4	12:45:12	10-0			6.9	32.1	25.15	152.8	
994.5	12:48:04	0-10			6.9	32.1	25.15	145.8	
994.6	12:51:04	10-20			6.6	32.23	25.29	152	
994.7	12:53:56	20-30			6.5	32.26	25.33	146.4	
994.8	12:58:04	30-40	44+4		6.5	32.27	25.33	144.2	
	13:01:04e								
995.1	15:21s	70-60	74+4	d	3.8	32.32	25.67	236.7	stratified
995.2	15:26:12	60-50			3.8	32.32	25.67	244	
995.3	15:31:04	50-40			3.8	32.32	25.67	243.2	
995.4	15:36:04	40-30			3.8	32.29	25.65	237	
995.5	15:41:12	30-20			3.8	31.98	25.4	246.7	
995.6	15:47:04	20-10			5.5	31.79	25.08	253.8	
995.7	15:52:12	10-0	77+4		5.9	31.78	25.02	255.4	
	15:57:04e								
996.1	16:50s	70-60	77+4	d	3.9	32.36	25.7	26.3	stratified
996.2	16:52:08	60-50			3.9	32.36	25.7	27	1/4m
996.3	16:54:08	50-40			3.9	32.36	25.7	27.1	
996.4	16:56:00	40-30			3.7	32.26	25.63	26.4	
996.5	16:58:08	30-20			4	31.93	25.34	26.7	
996.6	17:01:08	20-10			5.5	31.82	25.1	30	
996.7	17:03:08	10-0			5.9	31.81	25.04	29.2	
	17:05:00e								
997.1	23:10s	40-30	45+4	n	6.7	32.29	25.32	175	mixed
997.2	23:13:28	30-20			6.8	32.29	25.32	174	gridIV
997.3	23:17:12	20-10			6.8	32.28	25.3	189.2	
997.4	23:20:44	10-0			7	32.09	25.13	167.4	
997.5	23:24:12	0-10			7.1	32.07	25.1	153.5	
997.6	23:28:08	10-20			6.8	32.26	25.29	167.2	
997.7	23:31:04	20-30			6.7	32.28	25.31	173.4	
997.8	23:34:12	30-40			6.7	32.28	25.32	181.6	
	23:38:20e								
998.1	02:34s	40-30	45+4	n	6.6	32.26	25.3	146.2	mixed
998.2	02:37:04	30-20			6.7	32.26	25.31	145.1	grid IV
998.3	02:40:12	20-10			6.7	32.26	25.3	155.5	
998.4	02:44:04	10-0			6.8	32.25	25.29	147.1	
998.5	02:47:12	0-10			6.8	32.25	25.28	155.2	
998.6	02:50:04	10-20			6.7	32.26	25.3	144.9	
998.7	02:53:12	20-30			6.7	32.27	25.31	151.2	
998.8	02:57:04	30-40	40+4					157.8	
	03:02:28e								
999.1	04:10s	40-30	40+4	n	6.7	32.28	25.32	16.6	mixed
999.2	04:12:58	30-20			6.7	32.29	25.33	24.3	1/4m
999.3	04:14:16	20-10			6.7	32.29	25.33	17.1	
999.4	04:17:08	10-0			6.7	32.29	25.32	17.2	
999.5	04:19:08	0-10			6.7	32.29	25.32	14.8	
999.6	04:21:08	10-20			6.7	32.3	25.33	12	
999.7	04:24:08	20-30			6.7	32.3	25.33	16.4	
999.8	04:26:08	30-35	37+4		6.7	32.3	25.33	11.5	
	04:28:08e								

Table 4. Continued.

NOTE: Missing data for the following hauls and nets; 977-all nets, 979.8, 989.1, 989.2, 998.8

Haul.Net	Time	Depth	Botm	D/N	Tem	Sal	Sig-T	Vol	Site
1000.1	17:54s	96-80	97+4	d	4.8	32.84	25.99	500.7	western
1000.2	18:08:00	80-60			4.4	32.59	25.82	424.9	
1000.3	18:18:16	60-50			4.3	32.57	25.83	232.7	
1000.4	18:23:12	50-40			4.9	32.49	25.69	213.5	
1000.5	18:30:20	40-30			5.8	32.42	25.54	245	
1000.6	18:35:28	30-20			6.8	32.39	25.39	306.9	
1000.7	18:42:40	20-10			7.1	32.33	25.63	233.3	
1000.8	18:47:04	10-0	95+4		7.4	32.29	25.24	275.7	
	18:53:44e								
1001.1	21:28s	80-70	91+4	n	4	32.54	25.83	228.5	western
1001.2	21:33:04	70-60			4	32.53	25.82	215.7	
1001.3	21:38:56	60-50			3.9	32.51	25.81	230.7	
1001.4	21:44:12	50-40			4	32.48	25.78	220.8	
1001.5	21.49:20	40-30			4.1	32.33	25.65	228.9	
1001.6	21:54:12	30-20			4.4	32.2	25.52	254.9	
1001.7	22:00:20	20-10			5.6	32.01	25.24	241.6	
1001.8	22:05:04	10-0	87+4		5.9	31.97	25.16	303.1	
	22:11:08e								
1002.1	00:22s	65-60	69+4	n	4.8	32.18	25.47	278	western
1002.2	00:27:12	60-50			4.8	32.17	25.45	284.8	
1002.3	00:32:12	50-40			4.9	32.17	25.44	256.4	
1002.4	00:38:04	40-30			5.3	32.16	25.39	265.9	
1002.5	00:43:12	30-20			5.5	32.18	25.38	256.8	
1002.6	00:48:12	20-10			5.8	32.06	25.25	256.1	
1002.7	00:53:12	10-0			6.3	32.07	25.2	256	
	00:59:04								
1003.1	03:15s	55-50	57+4	n	6.5	32.12	25.22	248	western
1003.2	03:20:04	50-40			6.5	32.12	25.21	259.2	
1003.3	03:30:20	40-30			6.5	32.12	25.21	274.9	
1003.4	03:35:04	30-20			6.5	32.09	25.19	267.1	
1003.5	03:40:04	20-10			6.6	32.09	25.18	270.5	
1003.6	03:46:04	10-0			6.6	32.11	25.19	270.7	
	03:51:04e								
1004.1	05:26s	50-40	53+4	d	6.7	32.11	25.18	180.4	western
1004.2	05:31:12	40-30			6.7	32.16	25.22	226.5	
1004.3	05:36:20	30-20			6.7	32.17	25.22	247.7	
1004.4	05:41:12	20-10			6.7	32.17	25.23	243.2	
1004.5	05:47:20	10-0			6.7	32.18	25.23	242.1	
	05:52:12e								
1005.1	13:13s	50-40	55+4	d	7	32.24	25.24	252.4	channel
1005.2	13:18:04	40-30			7	32.26	25.25	260.7	
1005.3	13:23:04	30-20			7	32.25	25.25	262.5	
1005.4	13:28:04	20-10			7.1	32.25	25.24	225.9	
1005.5	13:33:12	10-0			7.8	32.24	25.14	239.6	
1005.6	13:39:04	0-50			7.2	32.26	25.23	555.6	
	13:51:56e								

Table 4. Continued.

NOTE: Missing data for the following hauls and nets: 977-all nets, 979.8, 989.1, 989.2, 998.8

Haul.Net	Time	Depth	Botm	D/N	Tem	Sal	Sig-T	Vol	Site
1006.1	15:57s	60-50	63+4	d	7	32.3	25.29	227.3	channel
1006.2	16:02:04	50-40			7	32.28	25.28	233.1	
1006.3	16:07:04	40-30			7	32.27	25.27	226.9	
1006.4	16:12:04	30-20			7	32.29	25.29	221.3	
1006.5	16:16:56	20-10			7	32.29	25.29	227.8	
1006.6	16:22:04	10-0	71+4		7.6	32.44	25.33	179.6	
	16:28.04e								
1007-aborted									channel
1008.1	18:28s	60-50	73+4	d	6.4	32.23	25.31	202.7	channel
1008.2	18:32:56	50-40			6.4	32.23	25.32	237.7	
1008.3	18:38:28	40-30			6.4	32.23	25.32	234.3	
1008.4	18:44:20	30-20			6.4	32.23	25.31	202.6	
1008.5	18:49:56	20-10			6.4	32.22	25.31	243.7	
1008.6	18:55:30	10-0			6.5	32.21	25.28	211.9	
1008.7	19:00:04	0-71	80+4		6.5	32.22	25.29	616.8	
	19:15:12e								

Table 5. Summary of samples taken for biochemistry/molecular biology

MOC#	Site	Day		Night		
	S/F/D	Cod	Haddock	Cod	Haddock	F/N
979	S			2	7	F
980	M	28	6			F
981	M	69	42			F
985	M			19	6	F
985	M			17	11	N
993	M	9	24			F
994	M	4	5			N
997	M			18	17	F
1004	T	15	53			F
1005	T	8	13			F
1008	T	3	5			F
Total		126	148	56	41	

Notes:
S = stratified site
M = mixed site
T = transect site
F = freezer
N = liquid nitrogen

APPENDIX 1
Detailed Event Log (*Albatross* IV 92-05, 18-29 May 1992)

APPENDIX 1. Detailed Event Log (ALBATROSS IV 92-05, 18-29 May 1992).

Sta#	CTD#	Op#	Start	Lat	Lon	Description	Investigation
************************* Initial Bongo Survey *************************							
1	1	519.01	0600	40 47.83	67 59.92	CTD853	Mountain
1	1b	519.02	0619	40 47.47	67 59.53	Bongo/CTD853	Lough
2	2	519.03	0740	40 48.98	67 47.07	Bongo/CTD456	Lough
3	3	519.04	0905	40 53.11	67 35.19	Bongo/CTD456	Lough
3		519.05	0947	40 54.07	67 35.34	MK5 CTD tow-yow	Mountain
3		519.06	1122	40 58.75	67 34.83	GB-10 (Greene Bomb)	Wiebe
4	4	519.07	1500	41 01.73	67 25.51	Bongo/CTD	Lough
5	5	519.08	1700	41 06.36	67 13.35	Bongo/CTD	Lough
6	6w	519.09	1814	41 01.5	67 26.00	CTD456 water cast	Mountain
6	6	519.10	1824	41 12.7	67 03.4	Bongo/CTD	Lough
7	7	519.11	1947	41 22.8	67 00.8	Bongo/CTD	Lough
8	8	519.12	2102	41 18.1	66 48.4	Bongo/CTD	Lough
9	9	519.13	2236	41 09.2	66 40.4	Bongo/CTD	Lough
10	10	519.14	2352	41 02.8	66 49.6	Bongo/CTD	Lough
11	11	520.01	0102	40 56.7	67 00.6	Bongo/CTD	Lough
12	12w	520.02	0221	40 53.7	67 13.2	CTD456 water cast	Mountain
12	12	520.03	0238	40 53.7	67 13.2	Bongo/CTD	Lough
13	13	520.04	0408	40 43.5	67 25.0	Bongo/CTD	Lough
14	14	520.05	0510	40 42.1	67 35.1	Bongo/CTD	Lough
15	15w	520.06	0628	40 38.5	67 46.9	CTD456 water cast	Mountain
15	15	520.07	0641	40 38.14	67 46.68	Bongo/CTD	Lough
16	16	520.08	0756	40 40.03	68 01.12	Bongo/CTD	Mountain
17	17	520.09	0926	40 37.5	68 23.45	Bongo/CTD	Lough
18	18	520.10	1133	40 32.0	68 00.07	Bongo/CTD	Lough
19	19	520.11	1216	40 36.0	62 59.9	Bongo/CTD	Lough
20	20	520.12	1310	40 41.1	67 59.5	Bongo/CTD	Lough
21	21	520.13	1343	40 46.3	67 59.9	Bongo/CTD	Lough
22	22	520.14	1424	40 57.1	67 59.9	Bongo/CTD	Lough
23	23	520.15	1509	40 56.4	67 59.7	Bongo/CTD	Lough
24	24	520.16	1557	41 01.68	67 59.56	Bongo/CTD	Lough
25	25	520.17	1754	40 55.0	67 52.8	Bongo/CTD	Lough
26	26	520.18	1831	40 50.86	67 49.27	Bongo/CTD	Lough
27	27w	520.19	1912	40 46.61	67 46.05	Bongo/CTD	Mountain
27	27	520.20	1920	40 46.57	67 45.98	Bongo/CTD	Lough
27		520.21	1945	40 45.72	67 44.84	GB-11	Wiebe
28	28	520.22	2104	40 42.73	67 42.18	Bongo/CTD	Lough
29	29	520.23	2151	40 37.81	67 37.48	Bongo/CTD	Lough
30	30	520.24	2257	40 37.01	67 49.53	Bongo/CTD	Lough
31	31	520.25	2339	40 41.63	67 50.99	Bongo/CTD	Lough
32	32	521.01	0020	40 46.3	67 53.1	Bongo/CTD	Lough
33	33	521.02	0133	40 43.24	68 06.25	Bongo/CTD	Lough
34	34	521.03	0228	40 37.97	68 06.25	Bongo/CTD	Lough
35	35	521.04	0330	40 32.57	68 06.63	Bongo/CTD	Lough
****************** End of Bongo Survey ****************************							
36		521.05	0823	40 42.49	67 52.33	PO Mooring Deploy	Mountain
36		521.06		40 43.5	67 52.4	Biospar tethered	Wiebe
36		521.07	1530	40 42.08	67 51.06	Biospar deployed	Wiebe
36		521.07	1557	40 42.24	67 51.47	anchor released	Wiebe
36		521.08	1616	40 41.98	67 52.47	MarkV CTD cast	Mountain
37		521.09	1922	40 42.24	67 54.77	Drogue #1 released	Mountain
38		521.10	1958	40 43.11	67 57.51	Drogue #2 released	Mountain

39	521.11	2022	40 41.18	67 51.55	Drogue #3 released	Mountain
40	521.12	2040	40 40.18	67 51.58	GB-12	Wiebe
41	521.13	2104	40 39.03	67 51.82	Mocl #974	Lough
42	521.14	2246	40 40.90	67 52.37	GB-13	Wiebe
42	521.15	2250	40 40.90	67 52.36	MKV Tow-Yo	Mountain
43	522.01	0249	40 57.46	68 01.87	GB-14	Wiebe
43	522.02	0254	40 57.69	68 01.97	Mocl #975	Lough
43	522.03	0438	40 56.9	68 01.84	GB-15	Wiebe
43	522.04	0519	40 58.5	68 58.5	MKV Tow-yo	Mountain
44	522.05	0520	40 56.26	68 02.08	Mocl/4 #976	Lough

********************** End of Well Mixed Site ************************

45	522.06	1133	40 42.26	67 51.51	Biospar Service	Wiebe

********************** Beginning of Fixed Site ************************

46	522.07	1319	40 40.76	67 52.31	GB-16	Wiebe
46	522.08	1324	40 41.12	67 52.27	Mocl #977	Lough
46	522.09	1505	40 40.54	67 52.31	GB-17	Wiebe
46	522.10	1510	40 40.64	67 52.29	MKV Tow-yo	Mountain
46	522.11	1714	40 45.91	67 50.40	MOC1/4 #978	Lough

********************* End of Fixed Site ******************************

47	522.12	1817	40 42.21	67 51.24	Biospar service	Wiebe
48	522.13	1923	40 41.6	67 51.5	MKV/Rossette	Mountain

********************** Begin Fixed Site with ENDEVOUR *****************

49	522.14	2106	40 40.12	67 51.75	GB-18	Wiebe
49	522.15	2118	40 40.47	67 51.77	MOC1 #979	Lough
49	522.16	2309	40 40.39	67 52.72	GB-19	Wiebe
49	522.17	2314	40 40.50	67 52.	MKV Tow-yo	Mountain

*************************End of Fixed Site ******************************

********************* Begin Well Mixed Site ****************************

50	523.01	0241	40 58.29	68 01.95	GB-20	Wiebe
50	523.02	0259	40 58.46	68 01.98	MOC1 #980	Lough
50	523.03	0449	40 57.11	68 01.74	GB-21	Wiebe
50	523.04	0450	40 57.13	68 01.73	MKV Tow-yo	Mountain
50	523.05	0646	40 59.85	68 01.44	MOC1 #981	Lough

************************* End Well Mixed Site *************************

51	523.06	0914	40 42.19	67 51.49	Biospar service	Wiebe

************************** Begin Drogue Site **************************

52	523.07	1105	40 39.67	68 05.16	Drifter #1 repair	Mountain
52	523.08	1121	40 38.61	68 05.32	GB-22	Wiebe
52	523.09	1125	40 38.73	68 05.38	MOC1 #982	Lough
52	523.10	1345	40 ?????	68 06.53	GB-23	Wiebe
52	523.11	1348	40 40.28	68 06.60	MKV Tow-yo	Mountain
52	523.12	1525	40 45.01	68 07.09	MOC1/4 #983	Lough

***************************** End Drogue Site ***********************

53	523.13	1634	40 40.83	68 07.87	Boat to ENDV	

************************ Begin Drogue Site with ENDV ****************

54	523.14	1709	40 41.47	68 07.94	GB-24	Wiebe
54	523.15	1713	40 41.68	68 07.89	MOC1 #984	Lough
54	523.16	1840	40 41.31	68 07.69	GB-24	Wiebe

54	523.17	1842	40	41.3	68	07.7	MKV Tow-yo	Mountain

****************************** End Drogue Site ******************************

**************************** Begin Well Mixed Site ************************

55	523.18	2205	40	56.97	68	02.08	GB-26	Wiebe
55	523.19	2206	40	56.97	68	02.11	MOC1 #985	Lough
55	523.20	2321	40	58.75	68	02.11	MOC1/4 #986	Lough

******************************** End Well Mixed Site *********************

*************************** Beginning of Drogue Site ********************

56	524.01	0225	40	39.14	68	09.80	GB-27	Wiebe
56	524.02	0228	40	39.21	68	09.83	MOC1 #987	Lough
56	524.03	0400	40	38.87	68	09.83	GB-28	Wiebe
56	524.04	0403	40	38.84	68	09.52	MKV Tow-yo	Mountain
56	524.05	05??	40	42.??	68	09.??	MOC1/4 #988	Lough

******************************* End Drogue Site *************************

57	524.06	0739	40	42.20	67	51.4	Biospar service	Wiebe
58	524.07	0936	40	45.4	67	59.7	Recover highflyer34	Mountain
59	524.08	0951	40	45.64	67	58.10	Recover highflyer28	Mountain

******************************** Begin Grid 1 ****************************

60	524.09	1247	40	39.70	68	12.93	Begin leg 1 of grid	
60	524.10						GB-29	Wiebe
60	524.11	1331	40	40.28	68	12.86	MOC1 #989	Lough
60	524.12	1600	40	42.42	68	11.91	MOC1 #990	Lough
60	524.10	1628	40	41.70	68	12.17	End leg 6 of grid	

**************************** End Grid 1 *********************************

61	524.11	1906	40	42.12	67	51.46	GB30-Biospar	Wiebe

***************************** Begin Transect FMS - WMS *****************

62	524.12	2243	40	42.56	67	51.66	GB-31	Wiebe
62	524.13	2321	40	44.4	67	52.7	MKV Tow-yo	Mountain

************************* Begin Grid #3 at FMS (see detailed grid log sheet)

63	525.01	1036	40	42.46	67	53.0	Begin leg 1 GB-32	Wiebe
63	525.02	1059	40	42.50	67	52.89	MOC1 #991	Lough
63	525.03	1458	40	40.50	67	52.74	MOC1 #992	Lough
63	525.04	1600	40	40.32	67	50.60	End leg 5 of grid #2	

******************************** End Grid #3 ***************************

********************** Begin Along Isobath Transect with CTD **********

64	525.05	1818	40	40.56	67	52.60	MKV CTD/Rossette	Mountain
65	525.06	1906	40	45.5	67	46.6	MKV CTD/Rossette	Mountain
66	525.07	1958	40	47.54	67	40.32	MKV CTD/Rossette	Mountain
67	525.08	2101	40	49.60	67	34.09	MRV CTD/Rossette	Mountain
68	525.09	2232	40	52.40	67	27.40	MRV CTD/Rossette	Mountain
69	526.01	0010	40	54.80	67	22.00	MRV CTD/Rossette	Mountain

*********************** Begin Transect FMS - WMS ***************************

70	526.02	0242	40	42.60	67	52.70	MRV CTD Tow-Yo	Mountain

********************** Begin Grid #4 (see detailed grid log sheet) ***

71	526.03	0802	40	58.97	68	02.04	High Flyer w/drogue	Mountain
71	526.04	0920	40	58.98	68	00.62	MOC1 #993	Lough
71	526.05	0920	40	58.60	68	00.53	Start Leg #1 GB-33	Wiebe

71		526.06	1233	40 54.02	68 02.48	MOC1 #994	Lough
71		526.07	1304	40 54.63	68 03.08	End of Leg #6	
71		526.08	1340	40 53.84	68 03.32	High Flyer recover	Mountain

************************* End of Grid #3 ************************************

************************* Begin Assorted FMS operations**********************

72		526.09	1516	40 41.84	67 52.74	MOC1 #995	Lough
72		526.10	1621	40 42.84	67 52.60	MRV Bottle Cast	Mountain
72		526.11	1645	40 42.39	67 53.70	MOC1/4 #996	Lough
72		526.12	1758	40 42.53	67 51.51	GB-34 at Biospar	Wiebe

************************* Begin Grid #5 (see detailed grid log sheet) *****

73		526.13	2250	40 59.40	68 01.06	GB-35 in water	Wiebe
73		526.14	2256	40 59.19	67 00.97	Mocl #997	Lough
73		526.15	2211	40 58.79	68 01.91	Grid #4 Start	
73		527.00	0234	40 54.89	68 04.66	Mocl #998	Lough
73		527.01	0259	40 57.77	68 05.31	Grid #4 End	
73		527.02				recover high fly	Mountain

************************* End of Grid ***

73		527.03	0406	40 56.00	68 05.66	Mocl/4 #999	Lough
74		527.04	0941	40 42.53	67 52.27	MKV CTD Cast	Mountain
74		527.05	1025	40 42.30	67 51.38	Biospar Recovered	Wiebe
74		527.06	1111	40 42.41	67 52.28	Mooring Recovery	Mountain
75	198	527.07	1443	40 40.05	68 01.51	MKV CTD	Mountain
76	199	527.08	1517	40 38.69	68 07.31	MKV CTD	Mountain
77	200	527.09	1549	40 37.50	68 13.70	MKV CTD	Mountain
78	201	527.10	1624	40 36.02	68 20.13	MKV CTD	Mountain

*************************Begin Western Transect****************************

79		527.11	1744	40 28.79	68 20.81	GB-36	Wiebe
79		527.12	1746	40 28.90	68 20.58	MOC1 #1000	Lough
79		527.13	1945	40 29.27	68 21.83	Begin Tow-YO	Mountain
79		527.14	2128	40 32.85	68 22.91	MOC1 #1001	Lough
79		527.15	2219	40 34.09	68 22.41	Begin Tow-Yo	Mountain
79		527.16	0017	40 36.03	68 28.68	MOC1 #1002	Lough
79		528.01	0121	40 37.05	68 28.12	Begin Tow-Yo	Mountain
79		528.04	0517	40 45.70	68 36.07	MOC1 #1004	Lough

**************************** End Western Transect *************************

80		528.05	0944	40 28.40	69 05.93	Picked up Drifter	Mountain

******************** Begin Great South Chan. Transect ****************

81		528.06	1301	40 50.01	68 37.78	GB #37	Wiebe
81		528.07	1307	40 49.93	68 37.95	MOC1 #1005	Lough
81		528.08	1404	40 49.52	68 40.48	Begin Tow-yo	Mountain
81		528.09	1557	40 50.87	68 47.77	MOC1 #1006	Lough
81		528.10	1745	40 50.12	68 56.66	MOC1 #1007	Lough
82		528.11	1828	40 50.85	68 58.20	MOC1 #1008	Lough

APPENDIX 2
Transect Log

APPENDIX 2. Transect Log.

	type	Date (local)	Yearday (local)	Hour (local)	Site / direction	Instrs. deploy	Cast #
5	site	May 21	142.8528-143.????	2028-????	D	VPR	9
				2250-0015		CTD	5-13
						GB	12-13
				2105-2200		MOC1	974
6	Site	May 22	143.1174-143.2222	0249-0???	M	GB	14
				0254-0345		MOC1	975
				0438-????		GB	15
				0519-0647		CTD	14-22
				0829-0853		MOC1/4	976
7	Site	May 22	143.5549-143.7181	1319-????	S	GB	16
				1324-1422		MOC1	977
				1505-????		GB	17
				1510-1647		CTD	23-42
				1714abort		MOC1/4	978
8	Site	May 22-23	143.8792-144.0414	2106-0114	S	GB	18
				2118-2221		MOC979	979
				2309-????		GB	19
				2314-2359		CTD	36-41
9	Site	May 23	144.1118-144.3653	0241-0846	M	GB	20
				0259-0340		MOC1	980
				0449-????		GB	21
				0453-0618		CTD	43-51
10	Site	May 23	144.4729-144.6424	1121-????	D	GB	22
				1125-1216		MOC1	982
				1345-????		GB	23
				1348-1501		CTD	52-58
11	Site	May 23	144.7146-144.8625	1709-????	D	GB	24
				1713-1758		MOC1	984
				1840-????		GB	25
				1842-2040		CTD	59-70
	Site	May 23*	144.9201-144.9729	2205-2321	M		
12	Site	May 24	145.1001-145.2083	0225-????	D	GB	27
				0228-0315		MOC1	987
				0400-????		GB	28
				0403-0520		CTD	71-78
13	Long	May 24-25	145.9465-146.4417	2243-1036	S-M	GB	31
				2321-0412		CTD	90-114
14	Long	May 25-26	146.7625-147.0069	1818-0242	NE	CTD	131-136
15	Long	May 26	147.1125-147.3347	0242-0802	S-M	CTD	137-162
16	Long	May 27	148.6132-147.7833	1443-1626	SW	CTD	198-201
17	Long	May 27-28	148.7389-149.3201	1744-0944	NW	GB	36
				1746-1853		MOC1	1000
				1945-????		CTD	202-208
				2128-2211		MOC	1001
				2219-0008		CTD	209-219
				0017-0059		MOC	1002
				0121-0300		CTD	220-228
				0403-0505		CTD	229-234
				0517-0555		MOC	1004
18	Long	May 28	149.5424-149.7646	1301-1800	GSC	GB	37
				1307-1352		MOC1	1005
				1406-1642		CTD	235-246
				1557-1628		MOC1	1006
				1745abort		MOC1	1007
				1828-1917		MOC1	1008

APPENDIX 3
Grid Log

APPENDIX 3. Grid Log.

#	Date (1992)	Yearday (local)	Hour (local)	Ship	Site
1	May 24	145.5326-145.6861	1247-1628	A&E	D
2	May 24	145.9472-146.0549	2000-0145	E	D
3	May 25	146.3854-146.6666	0915-1600	A&E	S
4	May 26	147.3764-147.5444	0902-1304	A	M
5	May 26-27	147.9240-148.1243	2211-0259	A&E	M

APPENDIX 4
Naming Conventions and Archive Access

APPENDIX 4. Naming Conventions and archive access

SITE NAMES
M = Mixed, S = Stratified, D = Drifter
TIME is LOCAL time in 1-minute intervals
GEOGRAPHIC POSITION
DECIMAL DEGREES
NEGATIVE LONGITUDES
LAGRANGIAN POSITION
LISTED IN KMS FROM DRIFTER IS X,Y COORDINATES
POSITION FILE NAMES
VT#CY.dat and VT#CY.hdr
where "V" is the vessel
(**A**LBATROSS, **E**ndeaver, **D**rifter, **H**igh-flyer, or **C**urrent-meter)
where "T" is the type of file (**P**osition, **G**rid, or **T**ransect)
where "#" is the incremental number including both ships
(the same # for both ships in joint operations)
where "C" is cruise code (**A**,**B**,**C** for 1st,2nd,3rd that year)
where "Y" is a one digit code for year (9**2**, 9**3**, etc.)
where the ".hdr" file has miscellaneous info. on the .dat file

examples:"AG3B2.dat" is ALBATROSS, grid #3, 2nd cruise, 1992
"ET14A2.dat" is Endeaver, trnsct#14, 1st cruise, 1992
"AT14B2.dat" is ALBATROSS,trnsct#14, 2nd cruise, 1992
"APA3.dat" will be ALBATROSS pos'ns on 1st cruise in '93

POSITION FILE FORMAT

	yearday	yymmdd	hhmm	hhmm	lat	lon	xl	yl
example:	145.2500	920524	0600	1000	40.4724	-67.3945	-2.93	1.38
	146.2507	920524	0601	1001	40.4735	-67.3920	-2.33	1.72

DATA ARCHIVES at the time of this writing are in two forms: 1) Anonymous FTP and 2) JGOFS.

1) To get position files type:

```
ftp ftp.wh.whoi.edu
connect...
username: anonymous
        311 Guest login ok, send ident as password
password: (your email address)
        230 Guest login ok, access restrictions apply.
ftp>cd pub/gbs/shipposn
ftp>get <filename>
ftp>quit
```

2) To browse and access GLOBEC data in general use Georges Bank Information System under development. In MOSAIC open: http://globec.whoi.edu/globec.html

APPENDIX 5
Personnel

APPENDIX 5. Personnel

AL9204

Greg Lough	ChiefScientist
Jim Manning	Oceanographer
Alex Penkrat	BiologicalTech.
Betsy Broughton	BiologicalTech.
Glenn Strout	Oceanographer
Jeff Kinder	ET
Geoff. Laurence	Fish.Biologist

AL9205

David Mountain	ChiefScientist
Greg Lough	Oceanographer
Geoff Laurence	Fish.Biologist
Larry Buckley	Fish.Biologist
Glenn Strout	Oceanographer
Jim Manning	Oceanographer
Maureen Taylor	Phys.Sci.Tech.
Peter Wiebe	Biologist
Betsy Broughton	BiologicalTech.
Alex Penkrat	BiologicalTech.
Ken Prada	DesignEngineer
Neil McPhee	ET
Stein Kaartvedt	Post Doc.
Jim Dawson	Acoustics Tech.

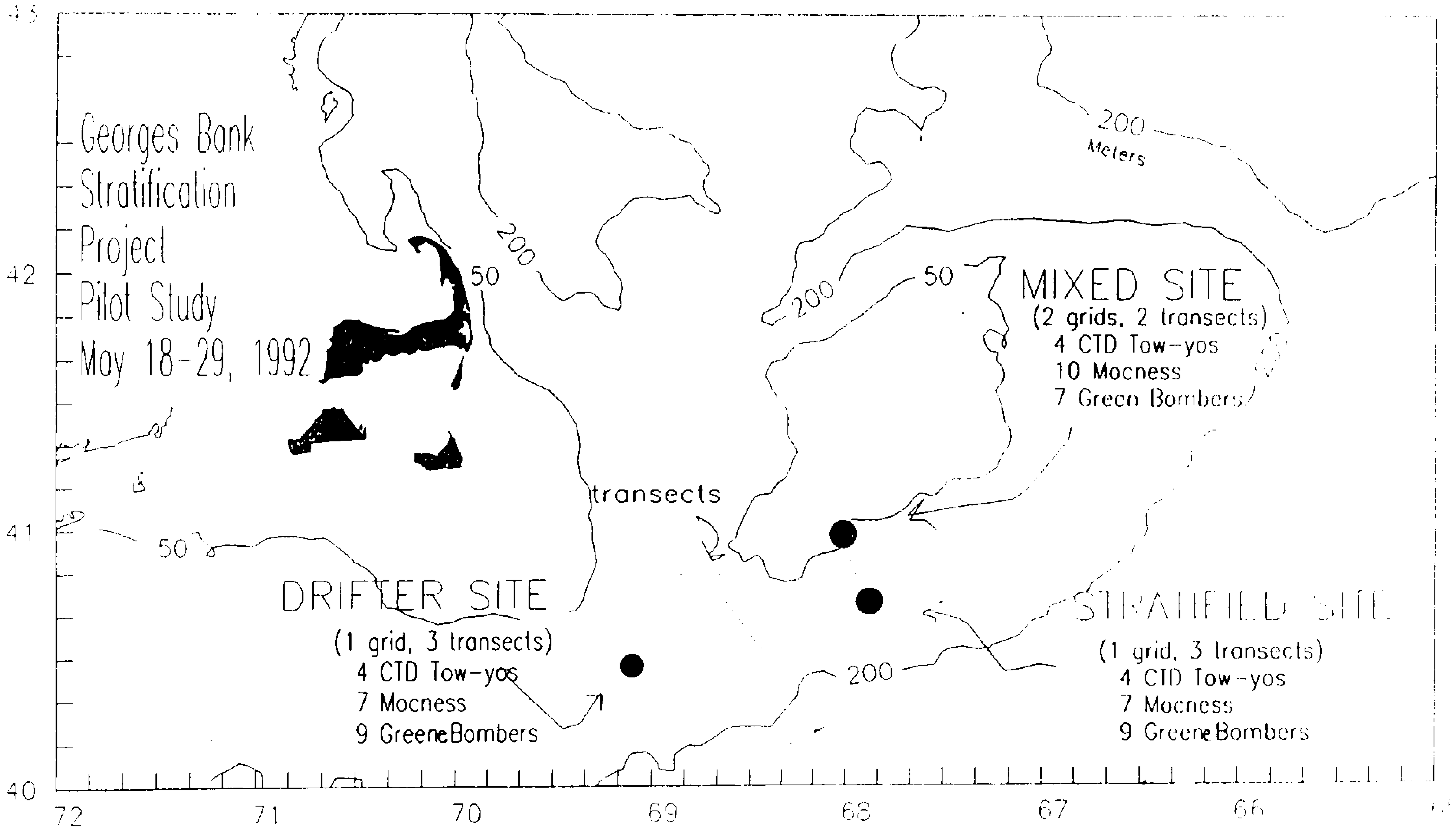


Figure 1a. Station map of operations on the main leg of the ALBATROSS cruises in the spring of 1992.

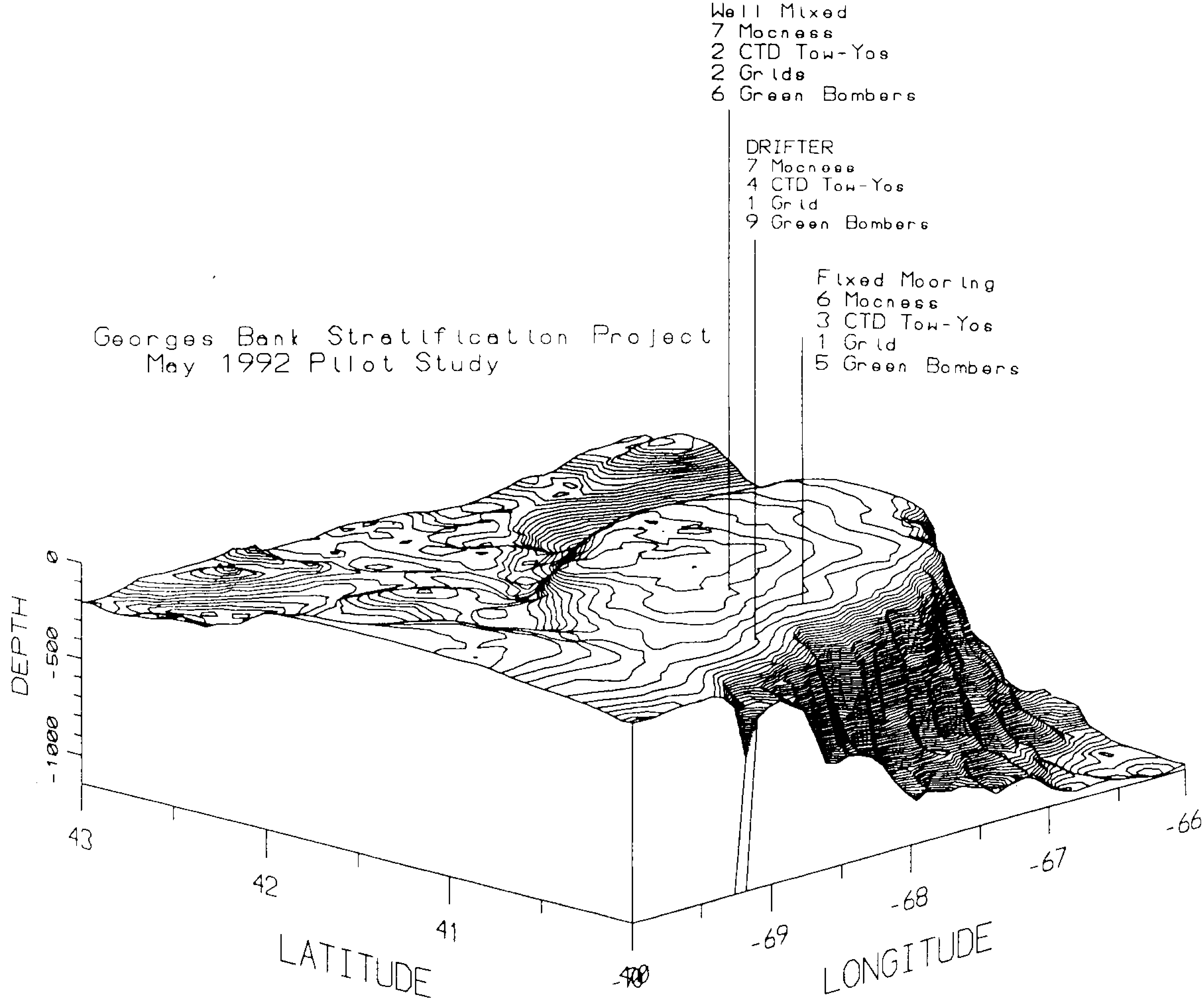


Figure 1b 3-D prospective of Figure 1a.

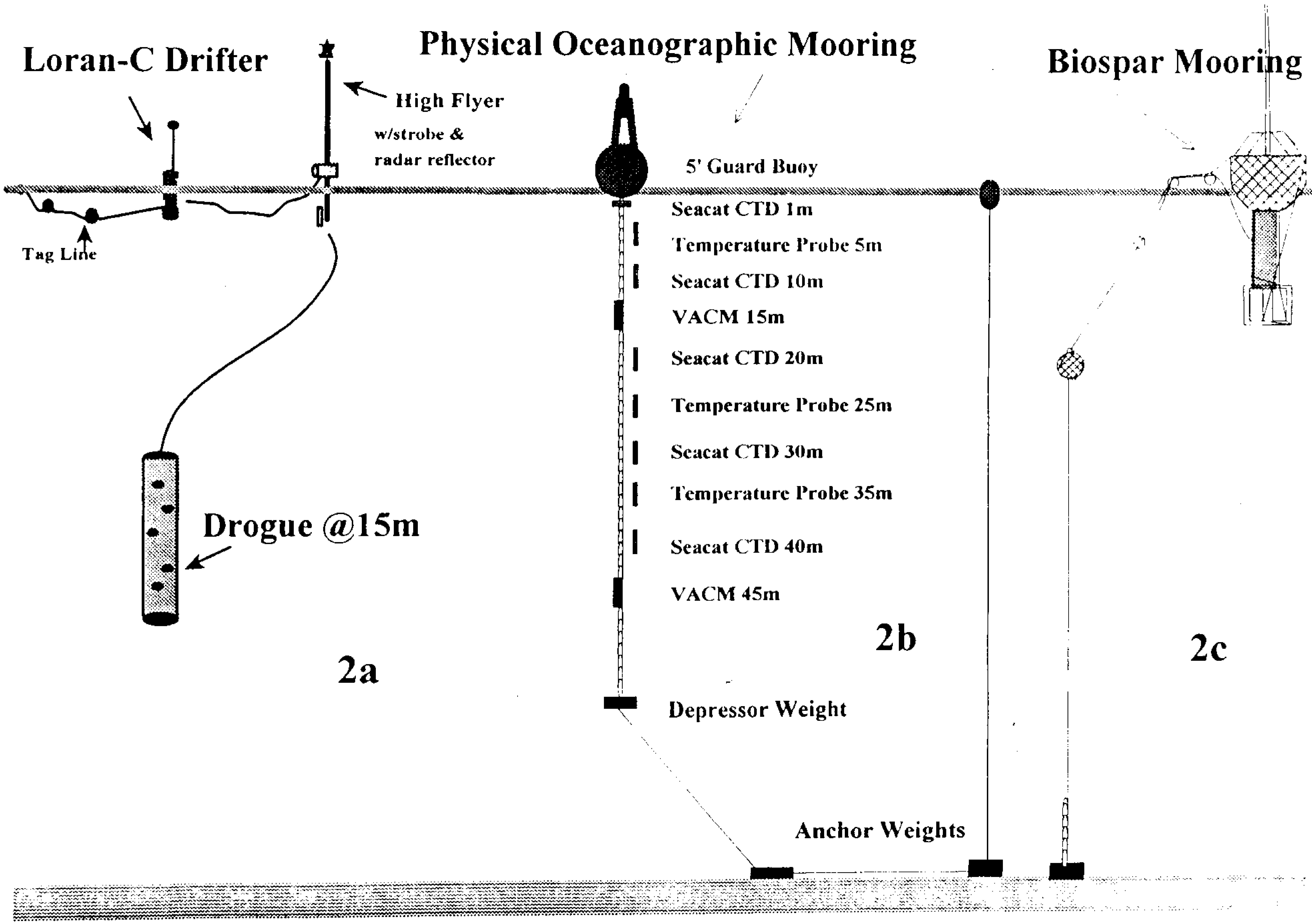


Figure 2. Configuration of a) Loran-C Marker Buoy (Drifter), b) physical oceanographic mooring, and c) the BIOSPAR mooring

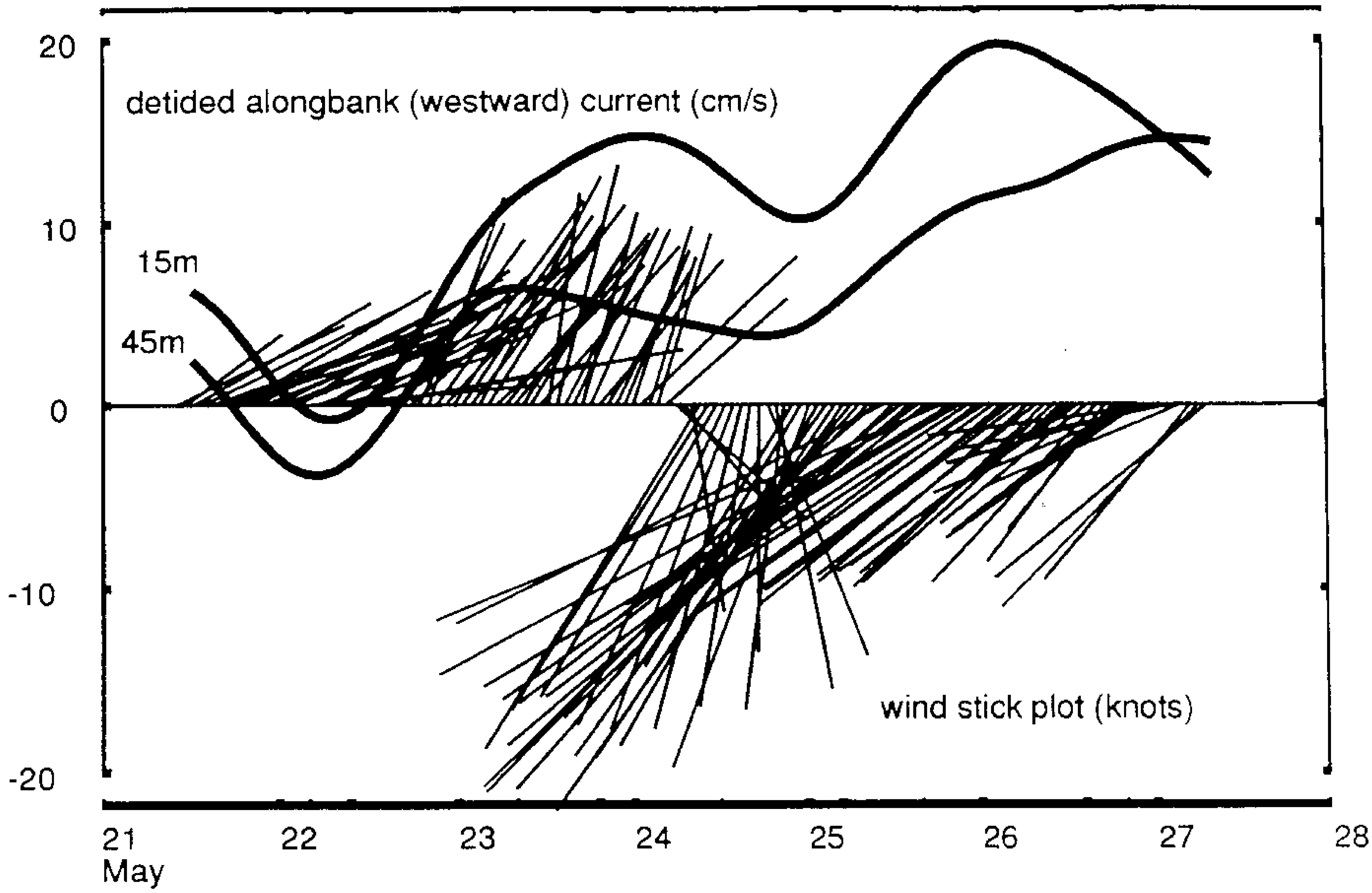


Figure 3. Time series of wind (shipboard anemonmeter) and detided current (VACMs).

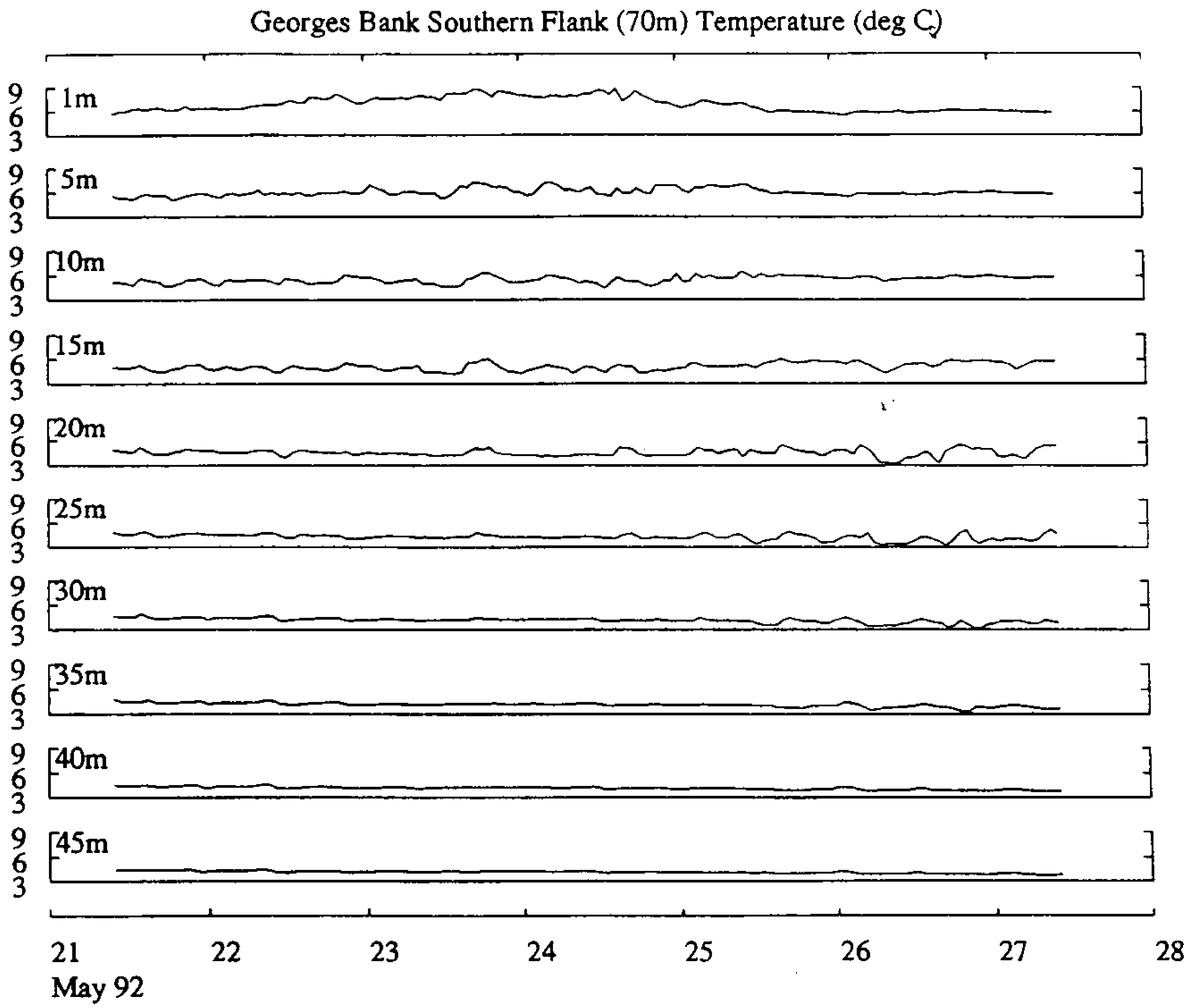


Figure 4. Time series of temperature as measured by Seacats, Tpods, and VACM at their respective depths.

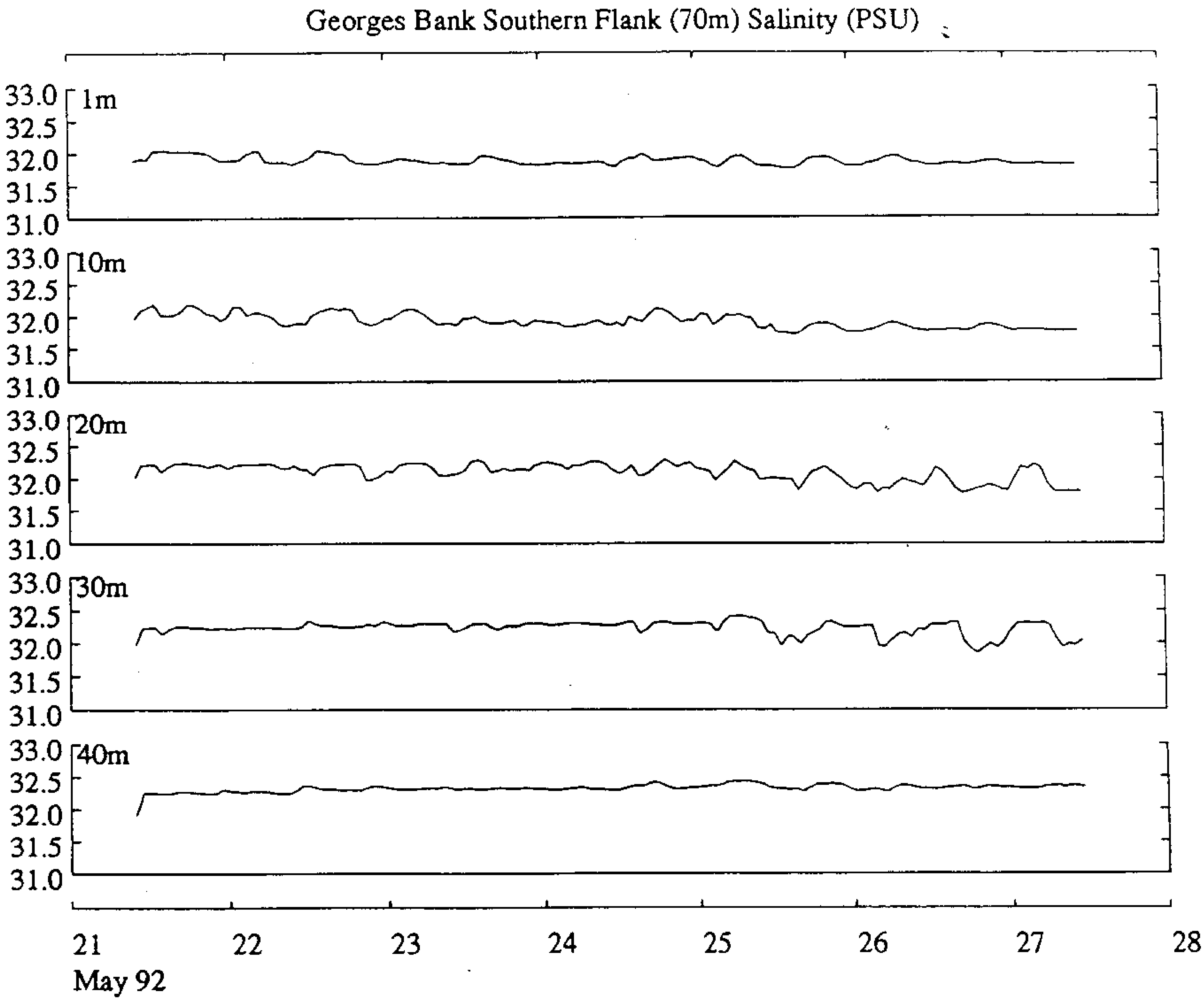


Figure 5. Time series of salinity as measured by Seacats.

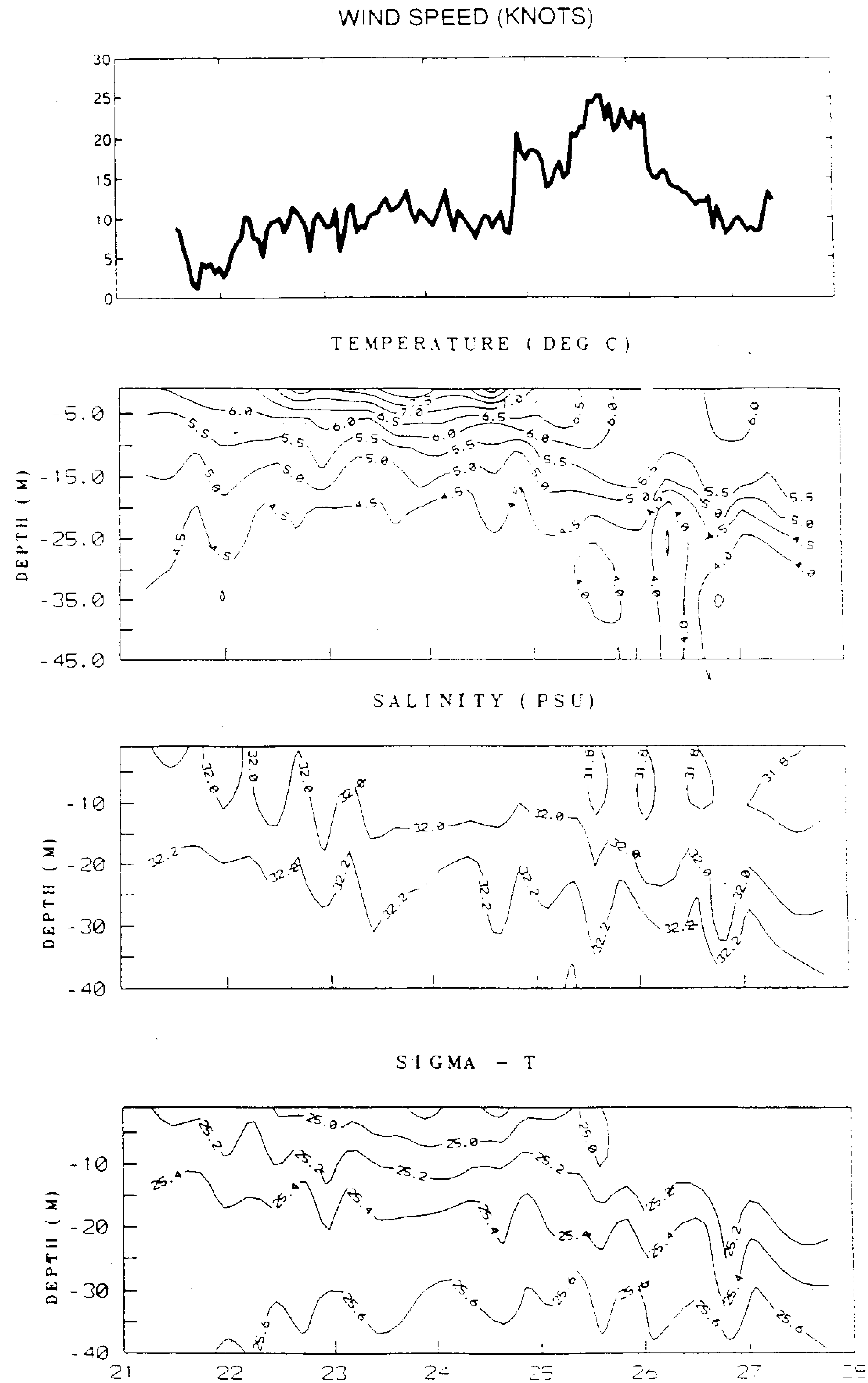


Figure 6. Evolution of water column structure as measured by the mooring. Wind speed is depicted in the top panel above the contoured structure of temperature, salinity, and density in the lower 3 panels.

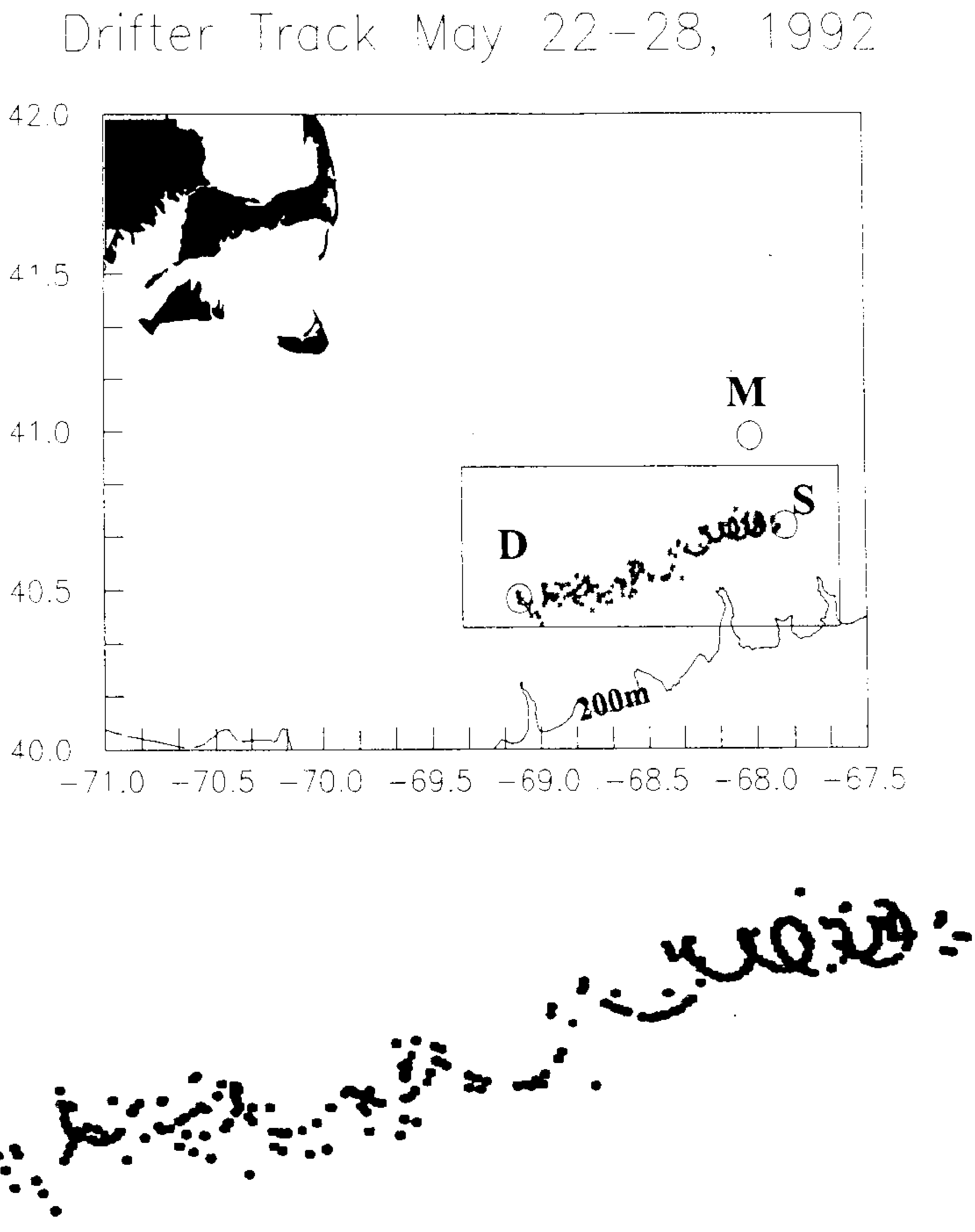


Figure 7. Drifter track including a blown-up version in the lower plot t resolve the "lane-jumping" scatter of Loran-C fixes.

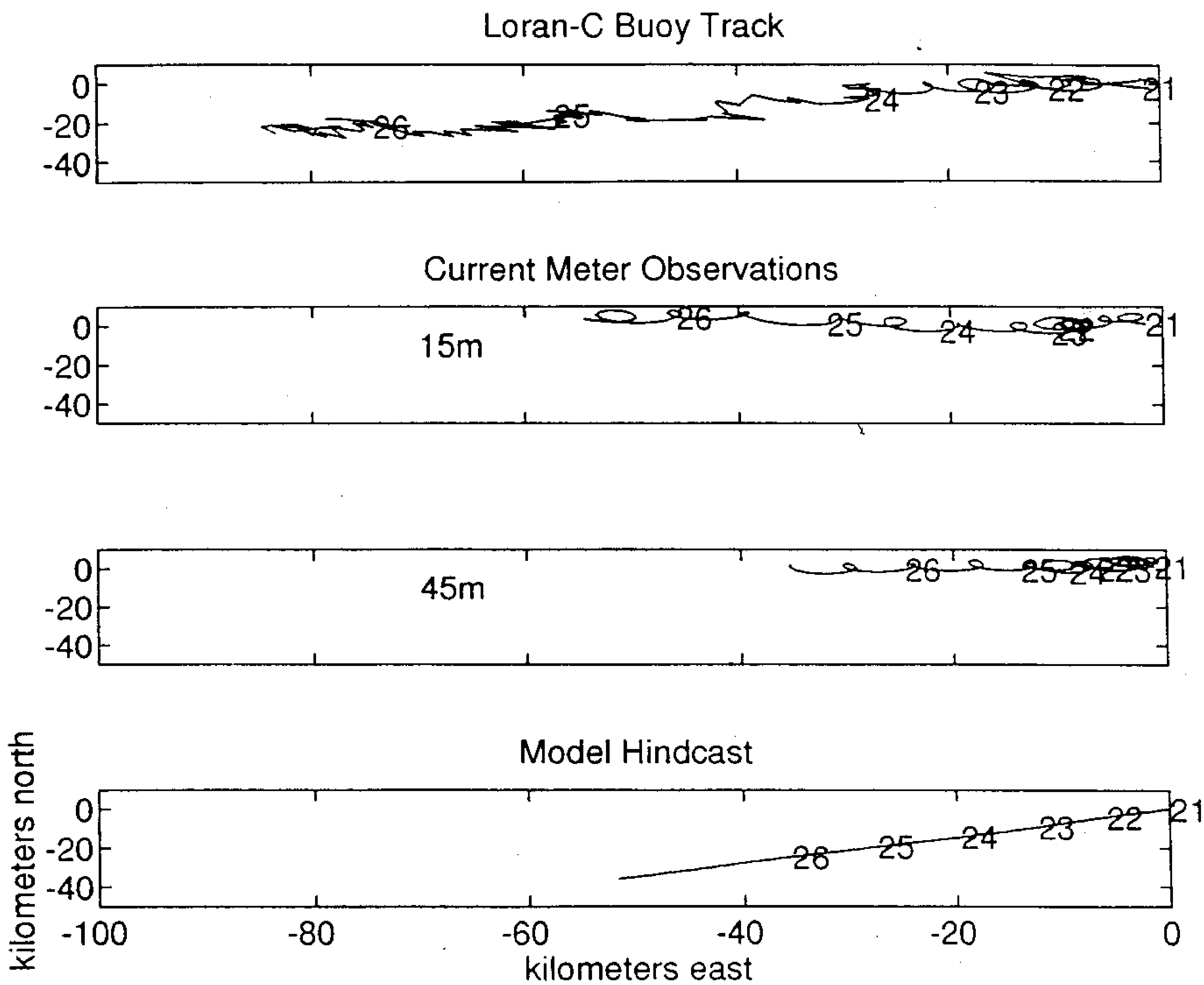


Figure 8. Trajectory of the drifter, VACM observations at 15m and 45m, and model simulation (subtidal) given a 15m release at site S during the Feb-June season not including density.

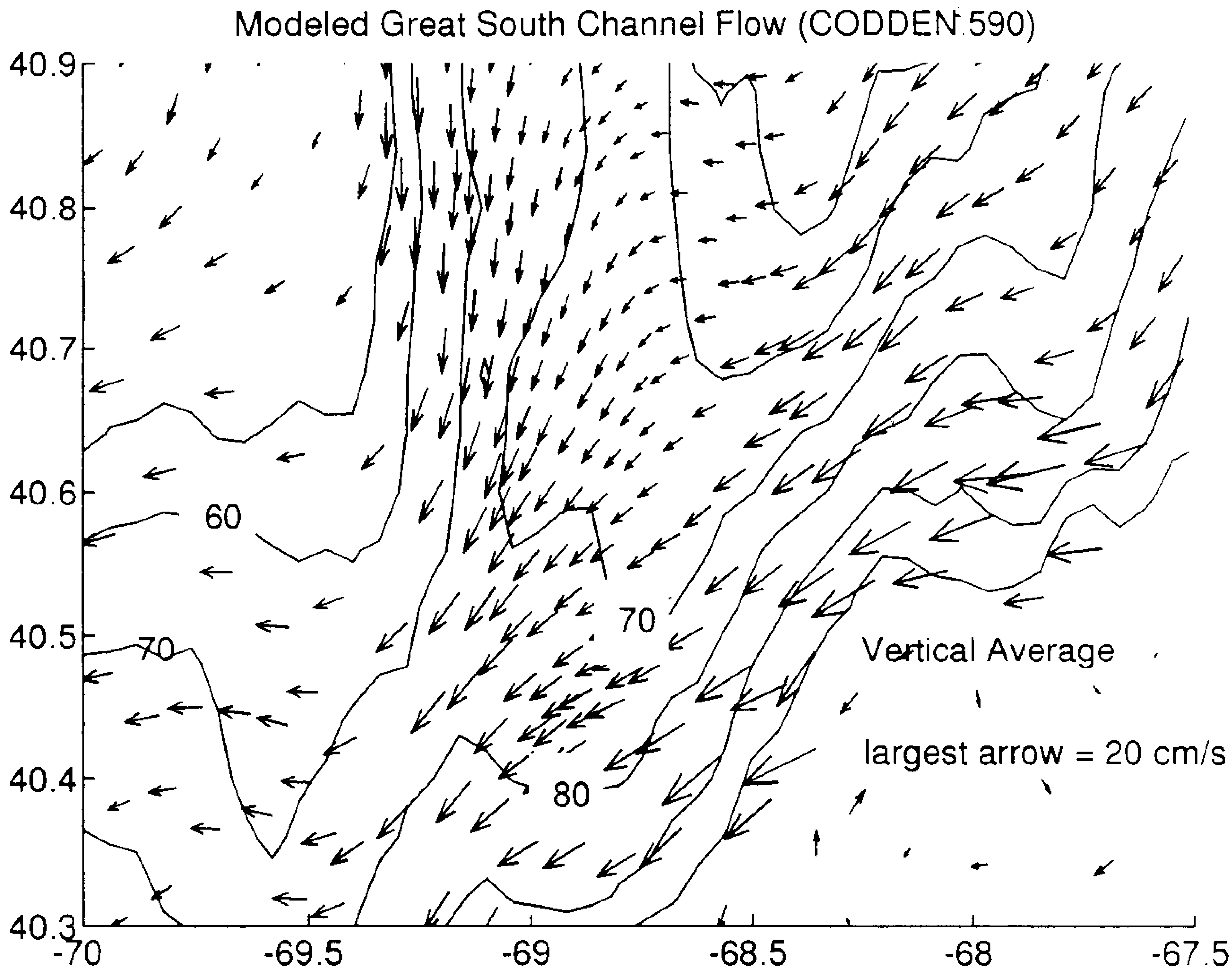


Figure 9. Model simulation (subtidal) given a 15m release at site during the Feb-June season not including density.

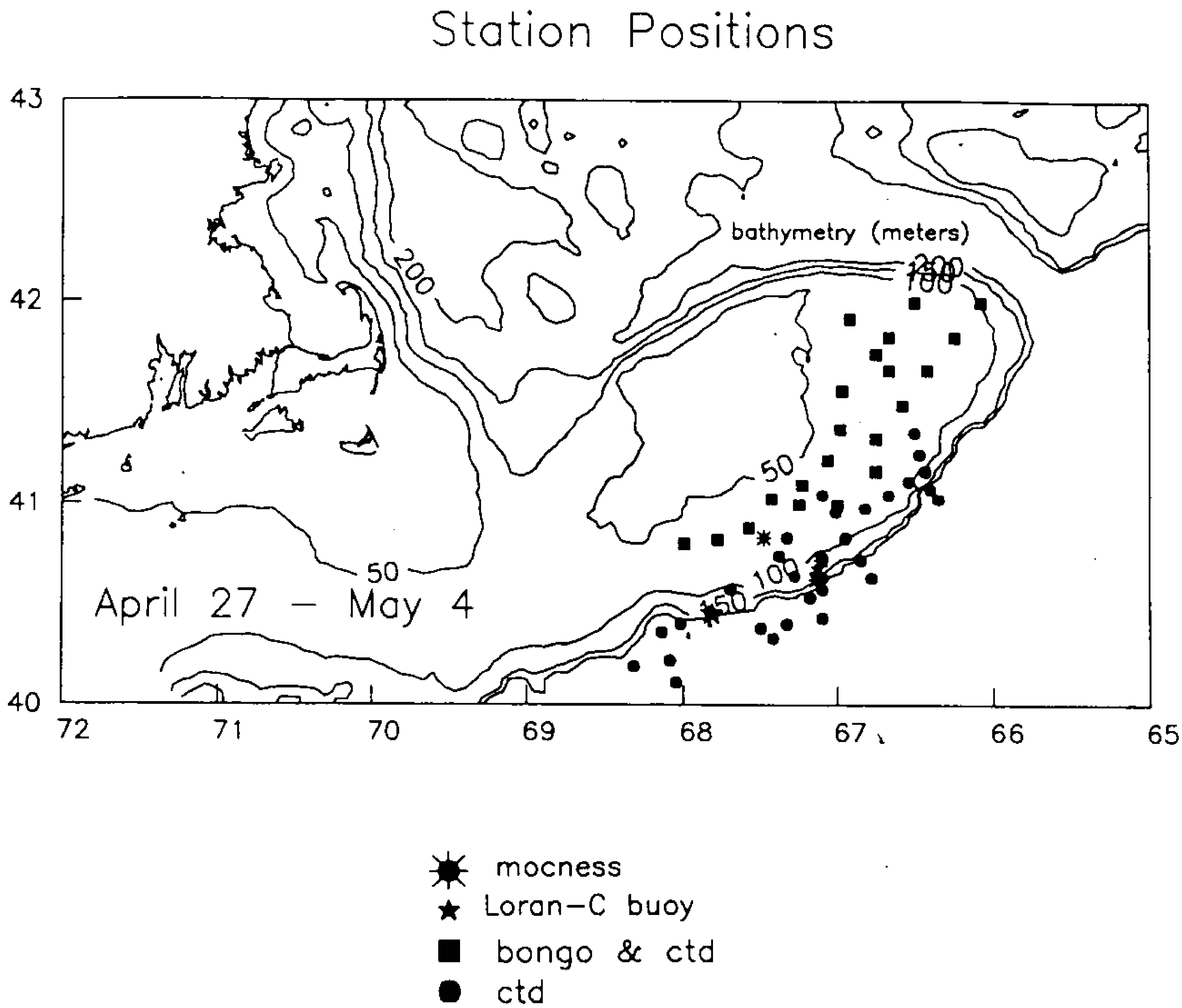


Figure 10a. All station positions on cruise AL9204.

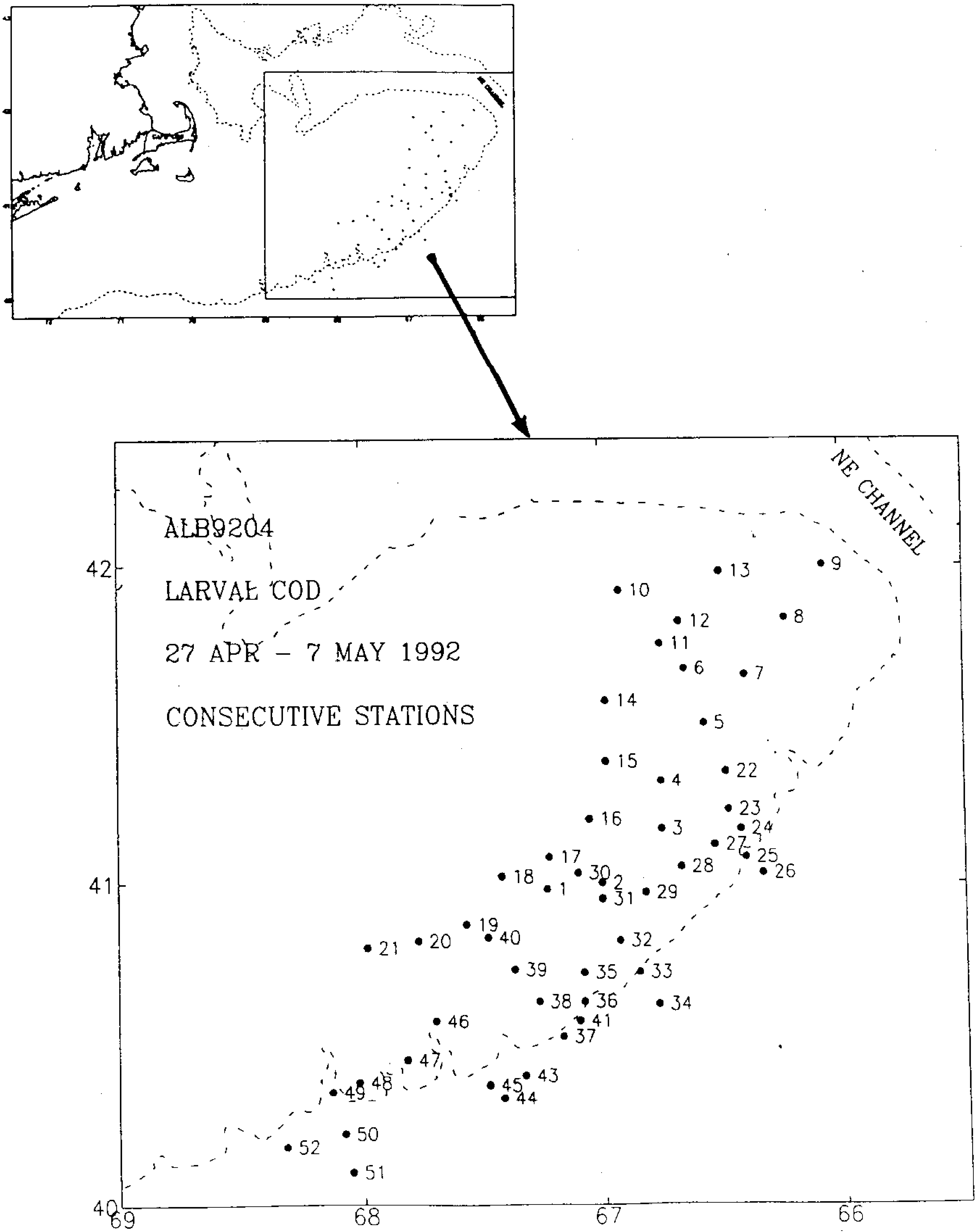


Figure 10b. CTD station positions on cruise AL9204. The dashed lin represents the 200m isobath.

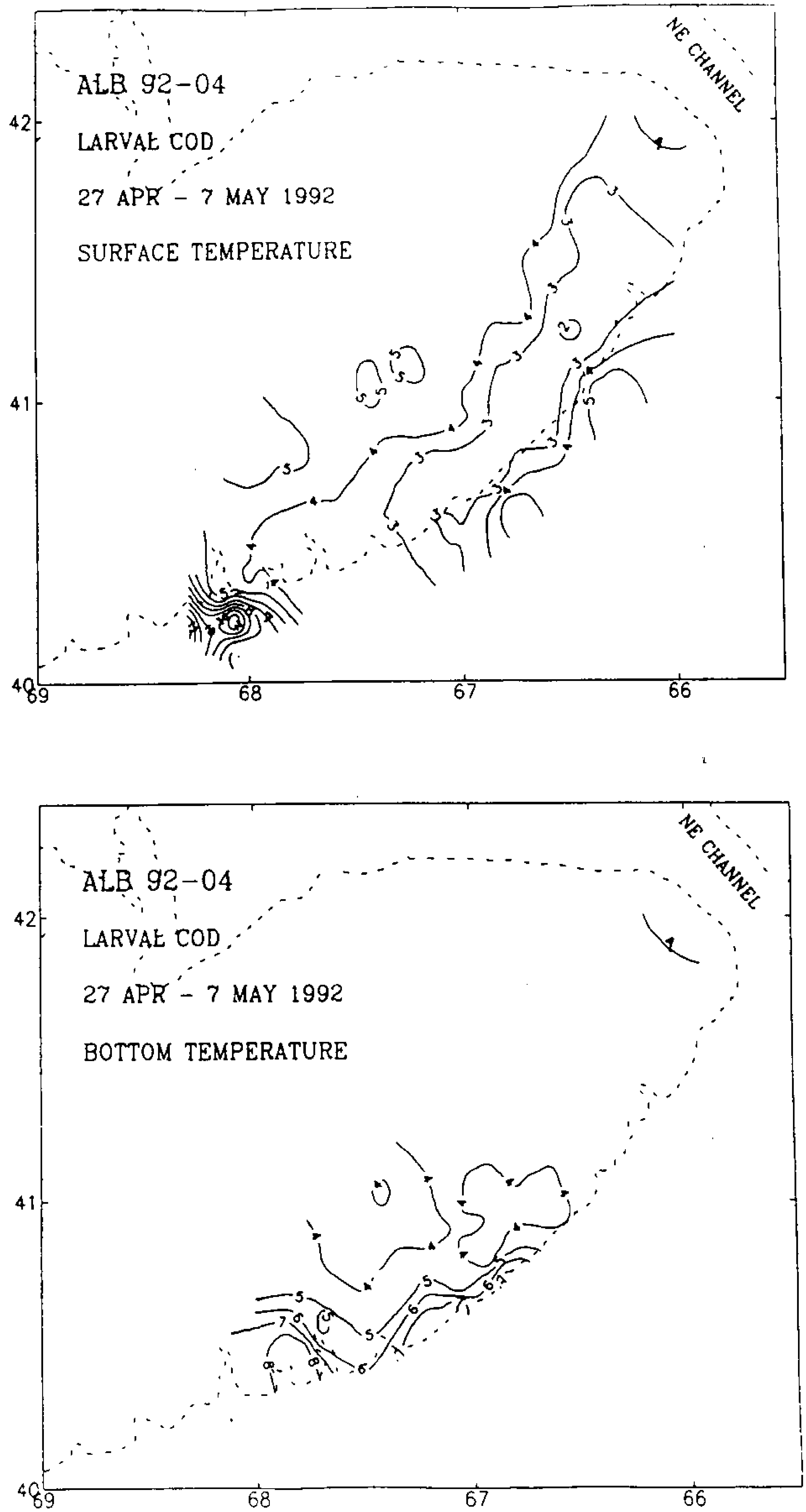
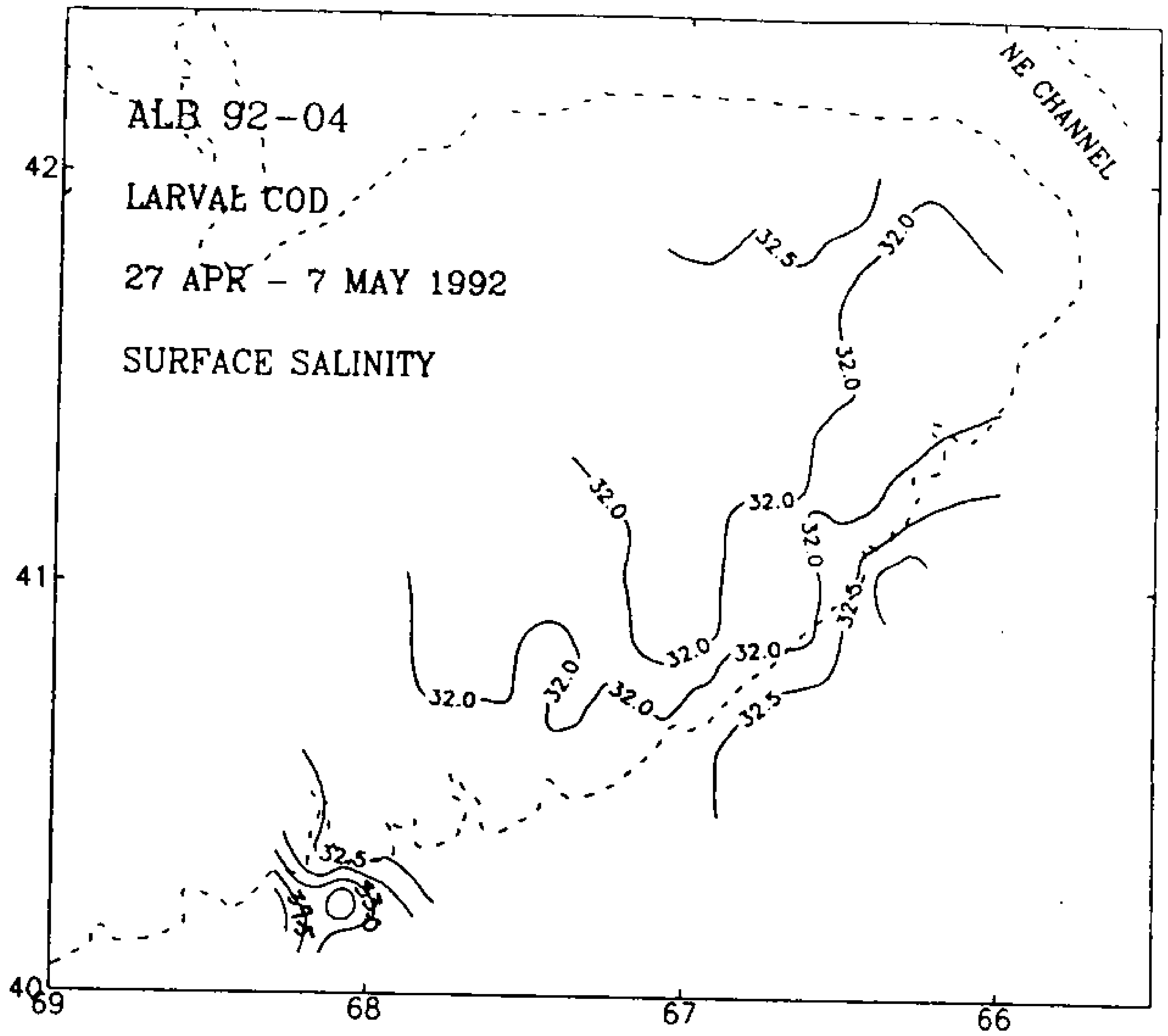


Figure 11. Surface (top) and bottom (bottom) temperature measured on AL9204. Dashed line represents the 200m isobath.



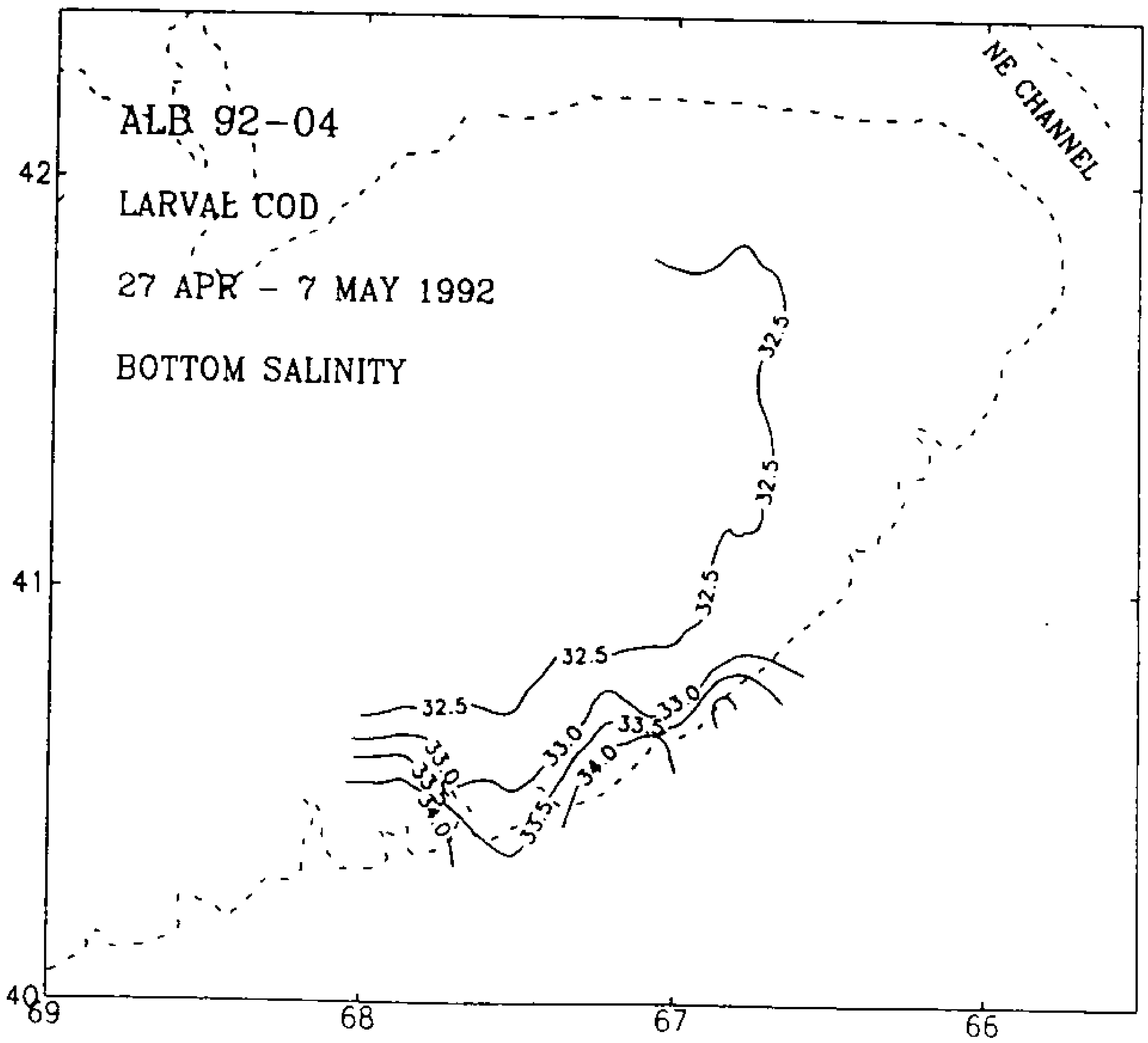
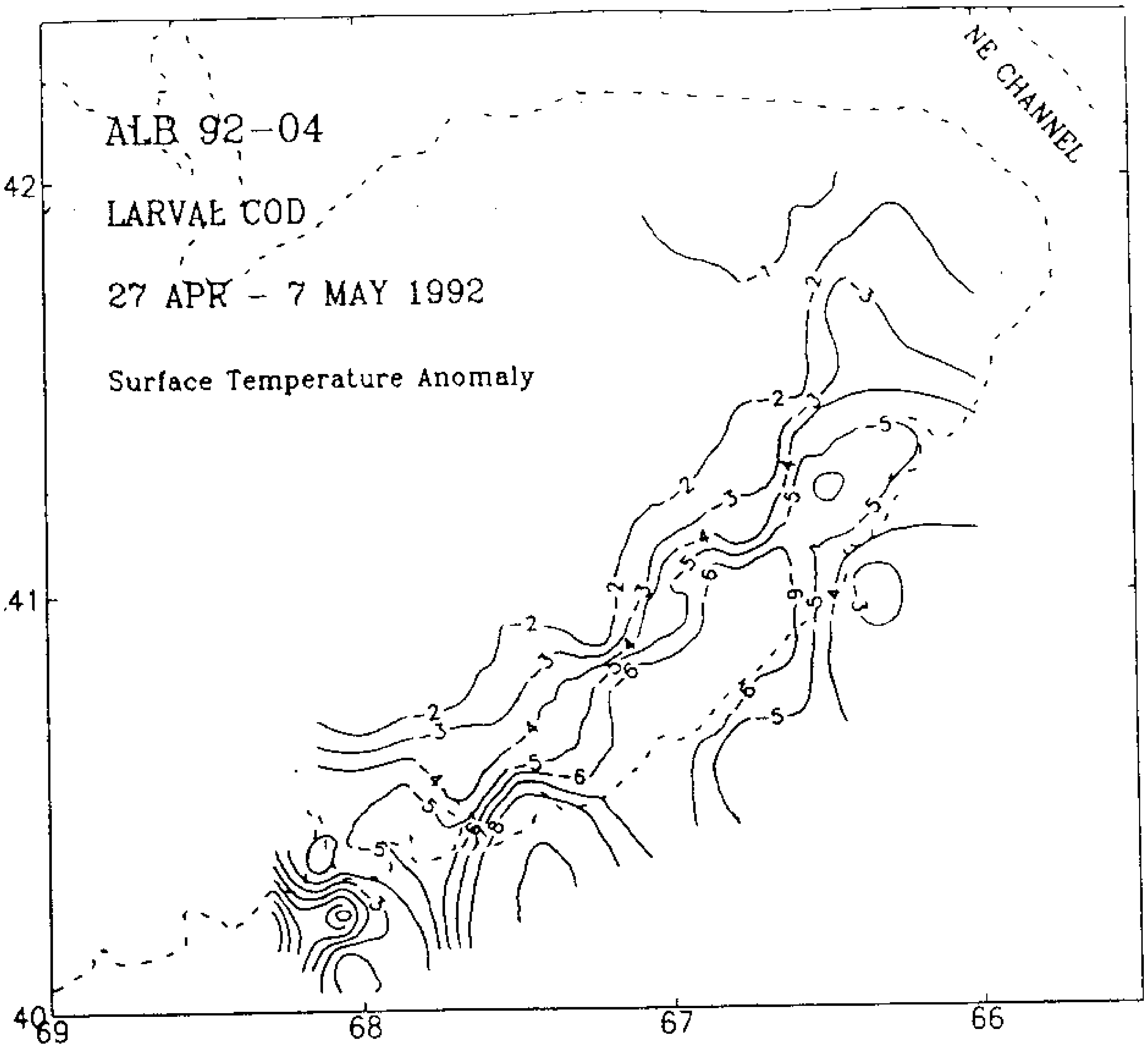


Figure 12. Surface (top) and bottom (bottom) salinity measured on AL9204. Dashed line represents the 200m isobath.



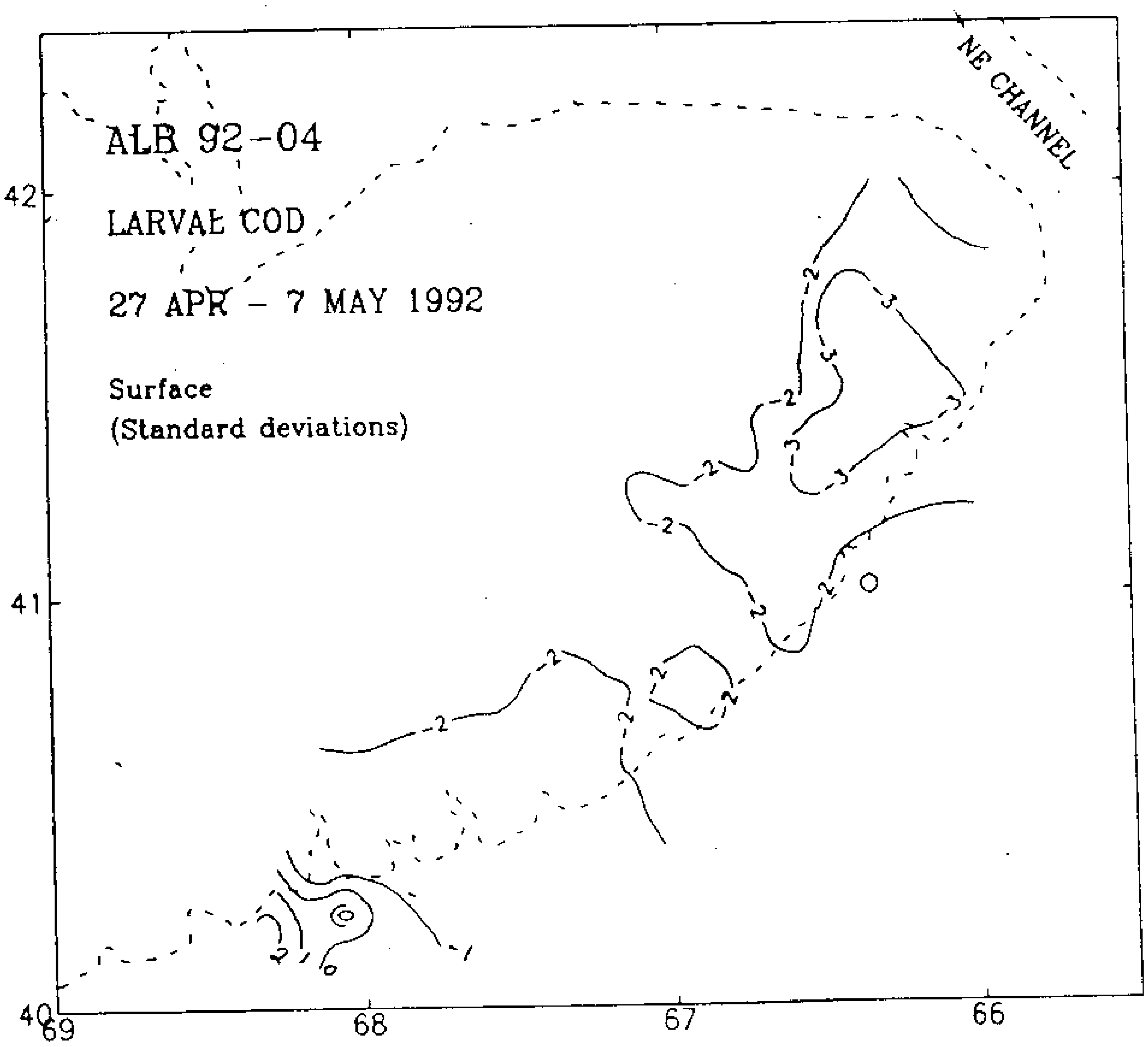


Figure 13. Surface temperature anomaly (top) and anomaly normalized by standard deviations (bottom) relative to 10-year MARMAP annual cycle (Mountain and Holzwarth, 1989).

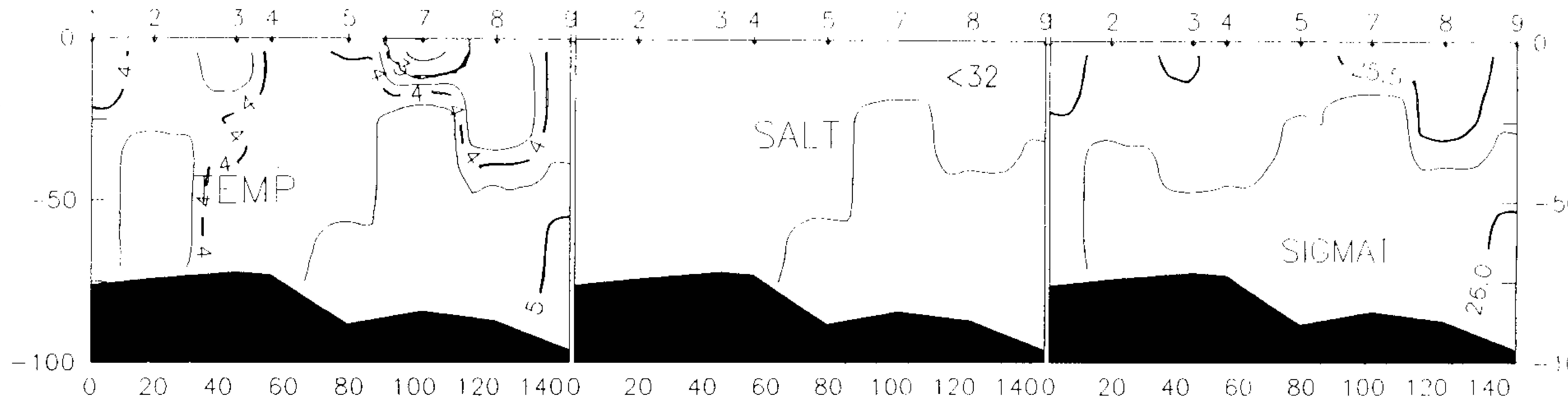


Figure 14. Alongbank section #1 on AL9204 (April 27, 1992).

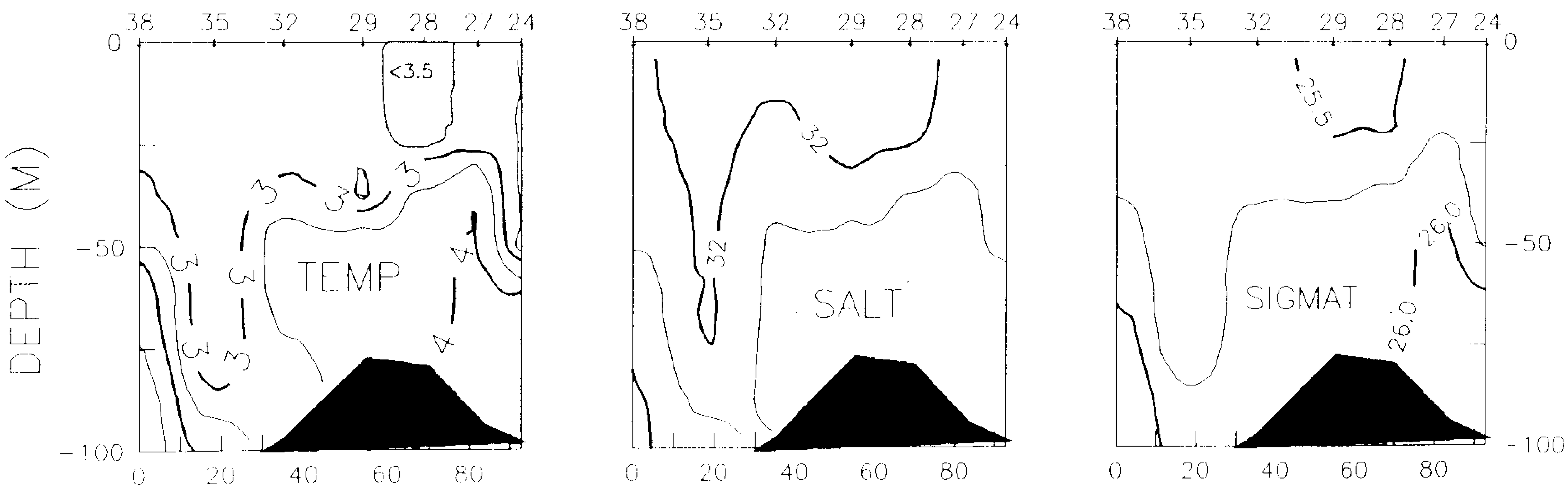


Figure 15. Along-bank section #2 on AL9204 (May 6,1992).

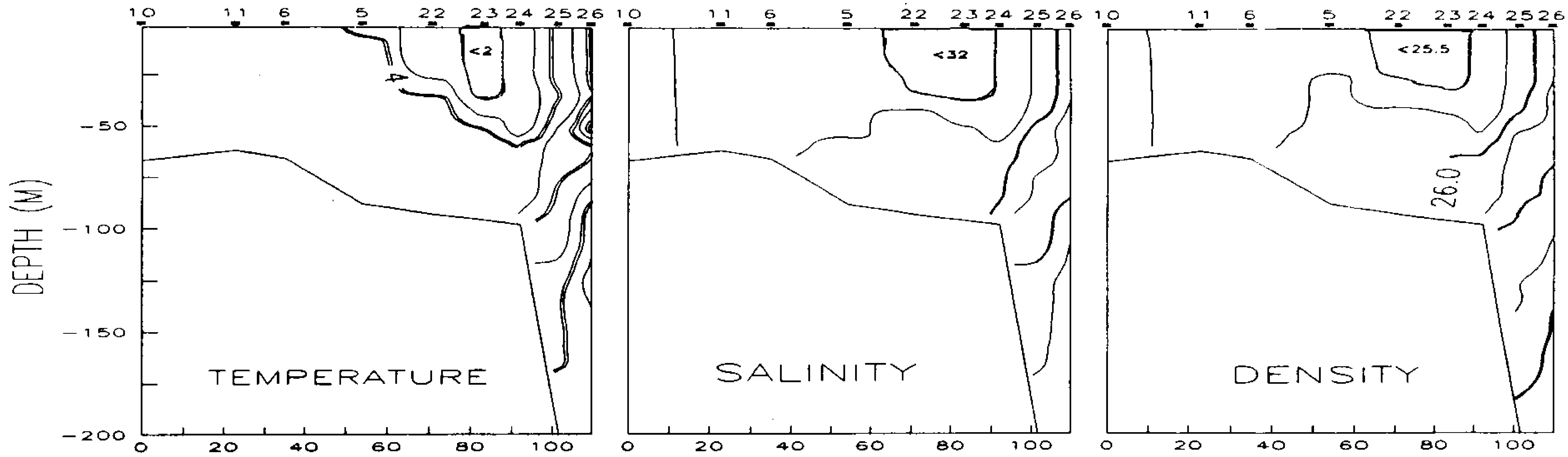


Figure 16. Cross–bank section #1 on AL9204 (4/28/1992–5/6/1992).

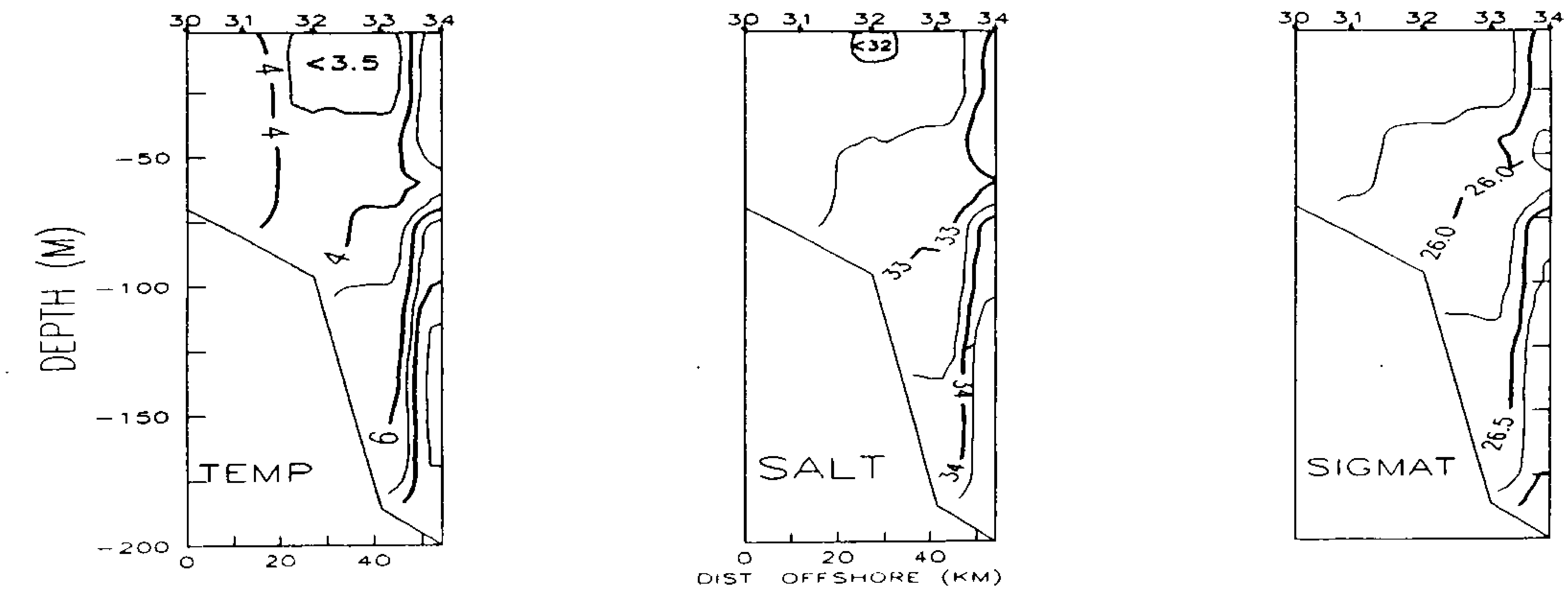


Figure 17. Cross-bank section #2 on AL9204 (May 6,1992) Contour intervals are .5, .5, and .25 for temperature, salinity, and sigmat, respectively.

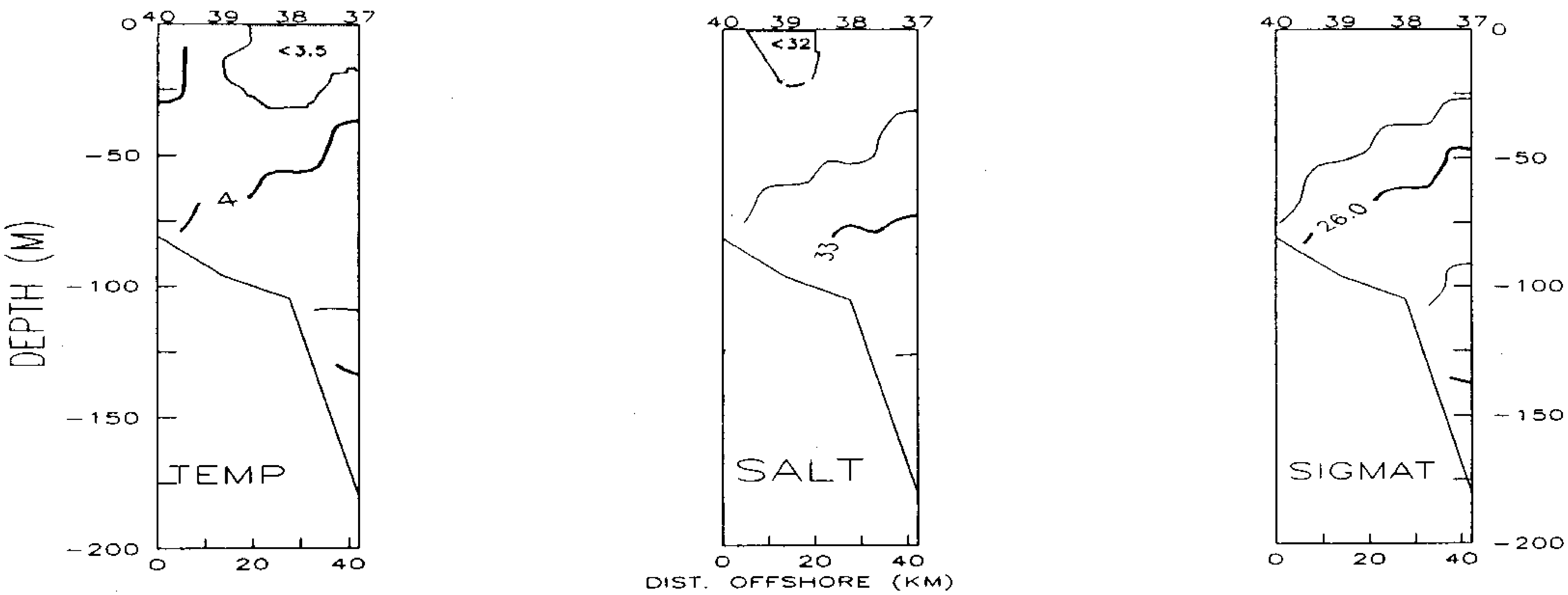


Figure 18. Cross–bank section # 3 on AL9204 (May 6,1992). Contour intervals are .5, .5, and .25 for temperature, salinity, and sigmat, respectively

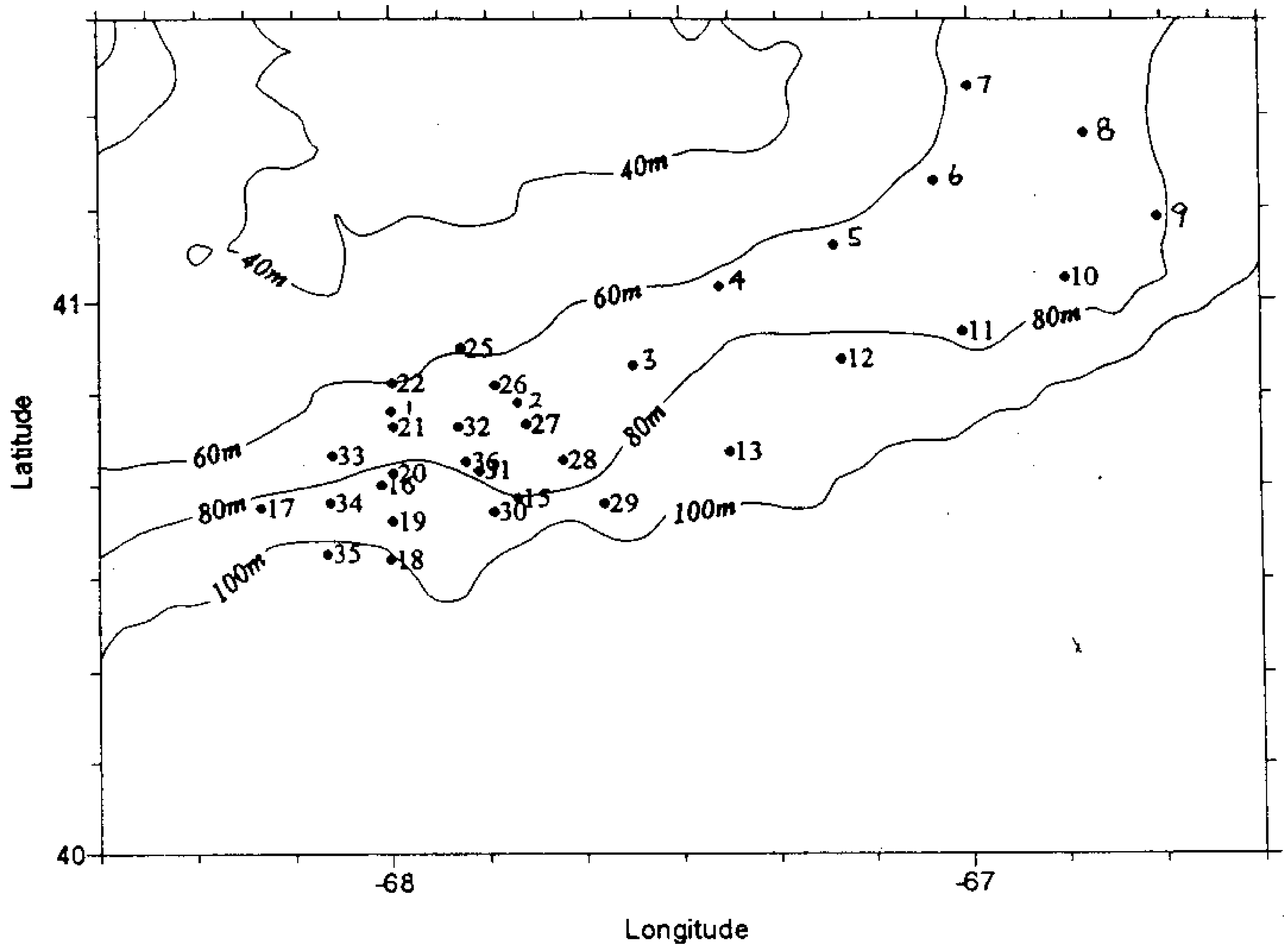


Figure 19. Station Positions on cruise AL9205. Depth contours greater than 100m are not drawn.

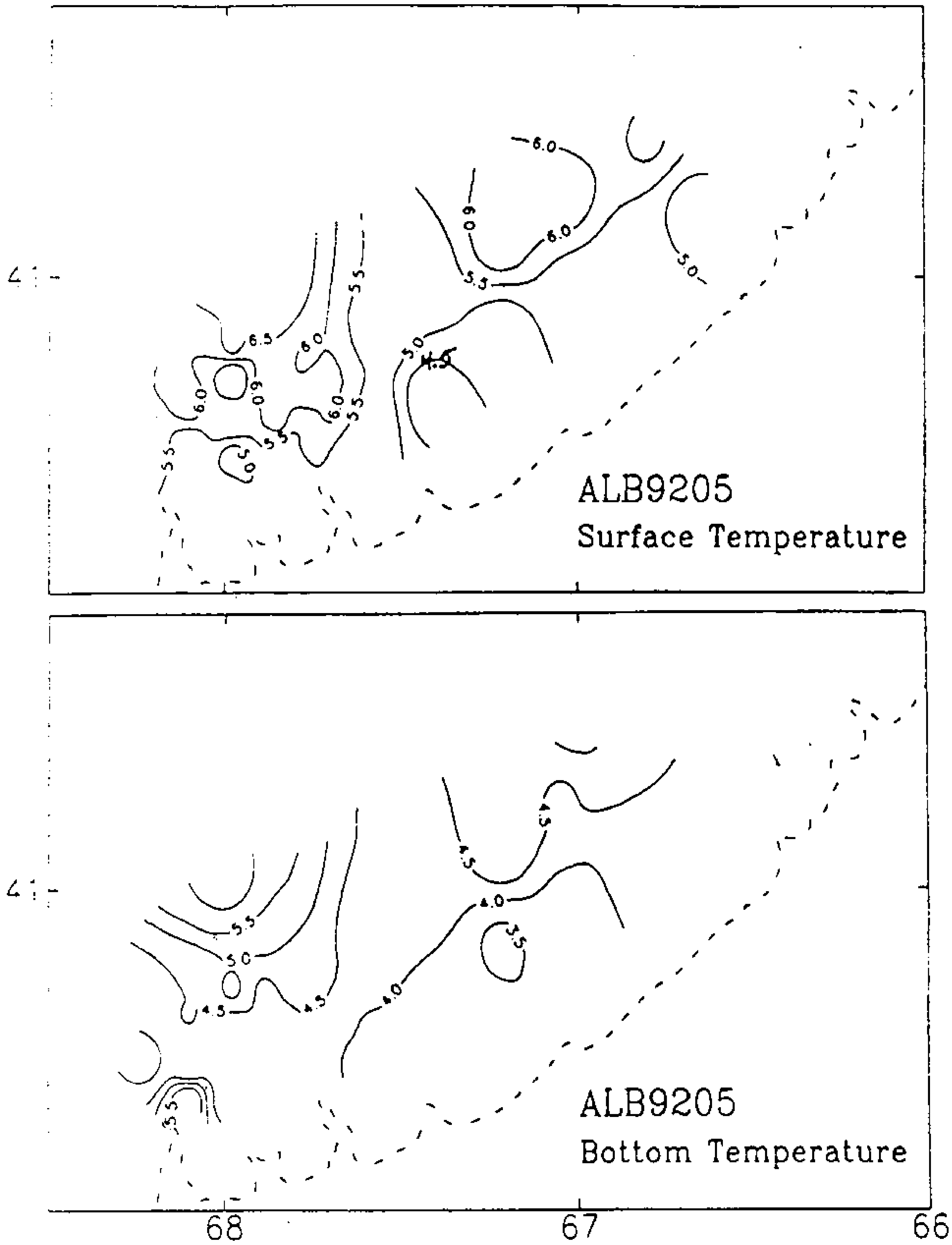
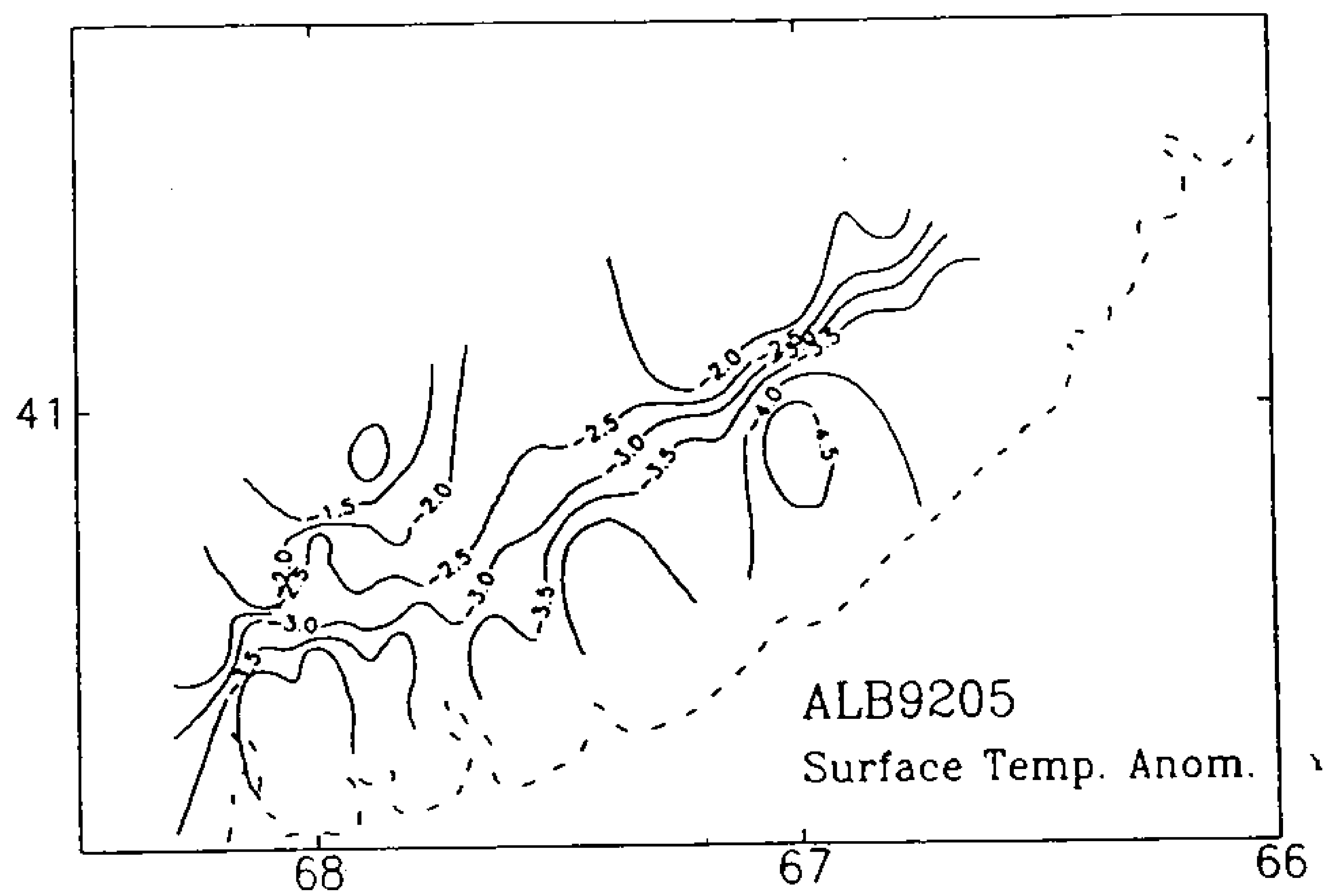


Figure 20. Surface (top) and bottom (bottom) temperature measured o[n] AL9205. Dashed line represents the 200m isobath.



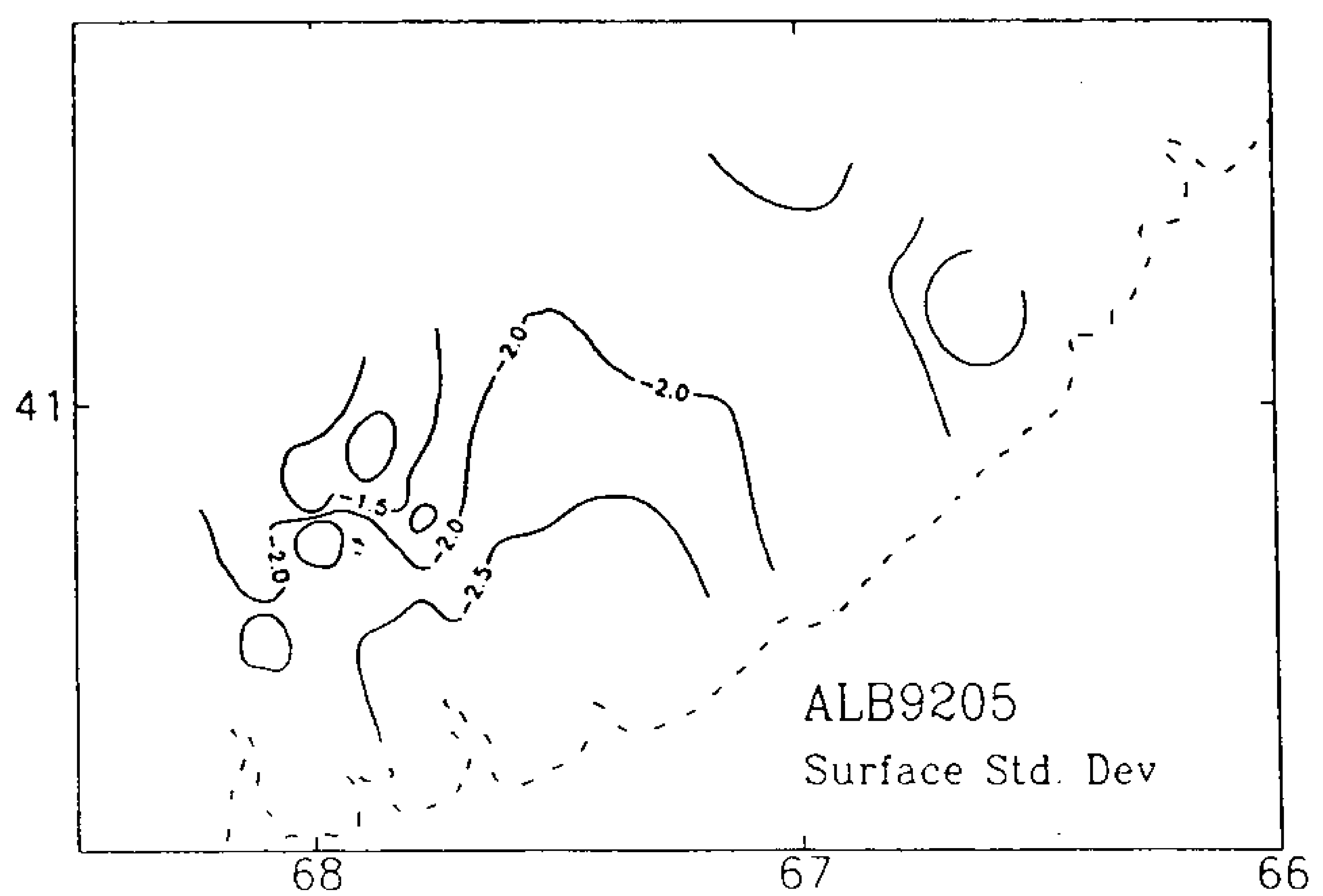
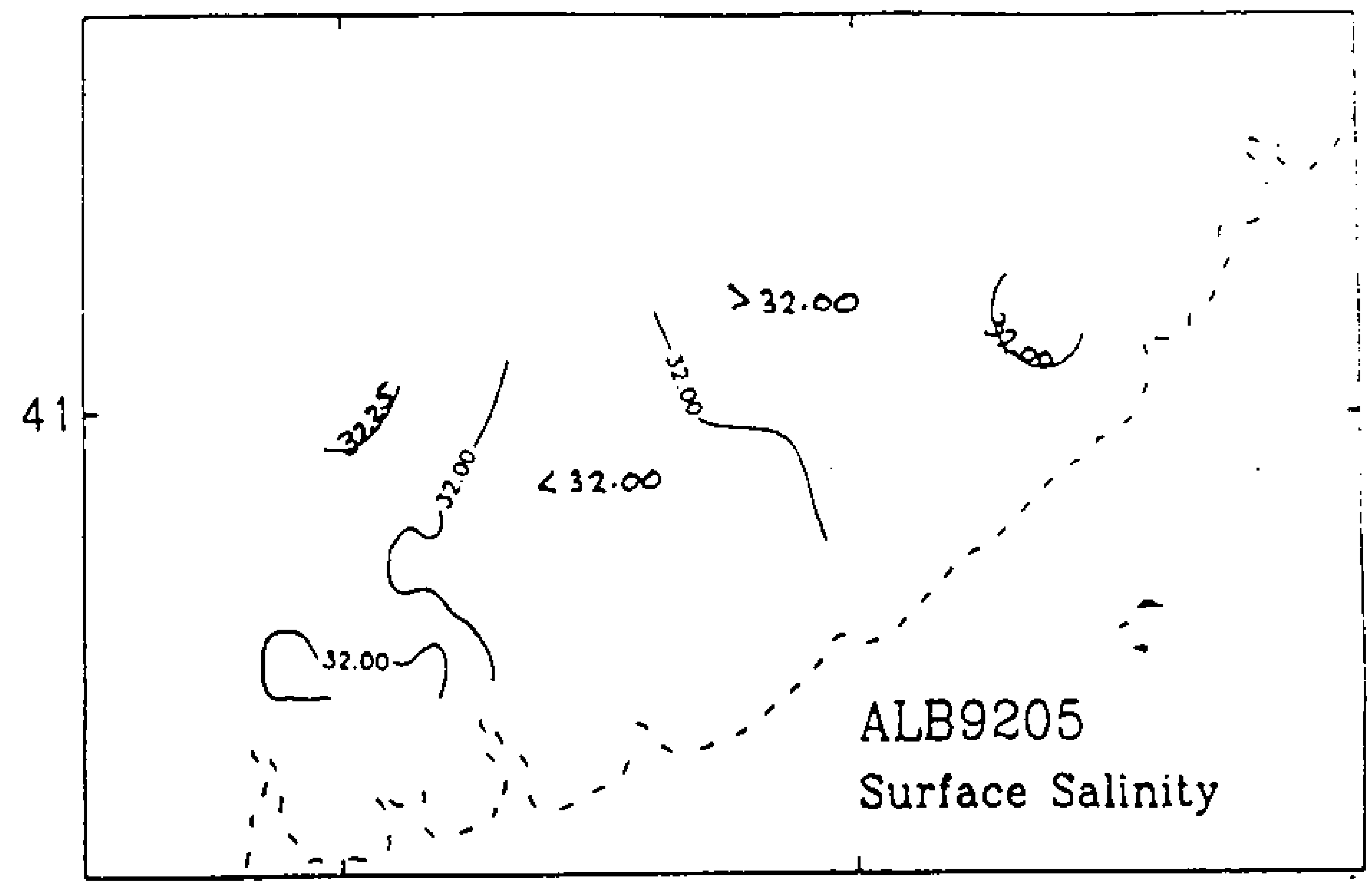


Figure 21. Surface temperature anomaly (top) and surface temperature anomaly normalized by standard deviations (bottom) on AL9205.



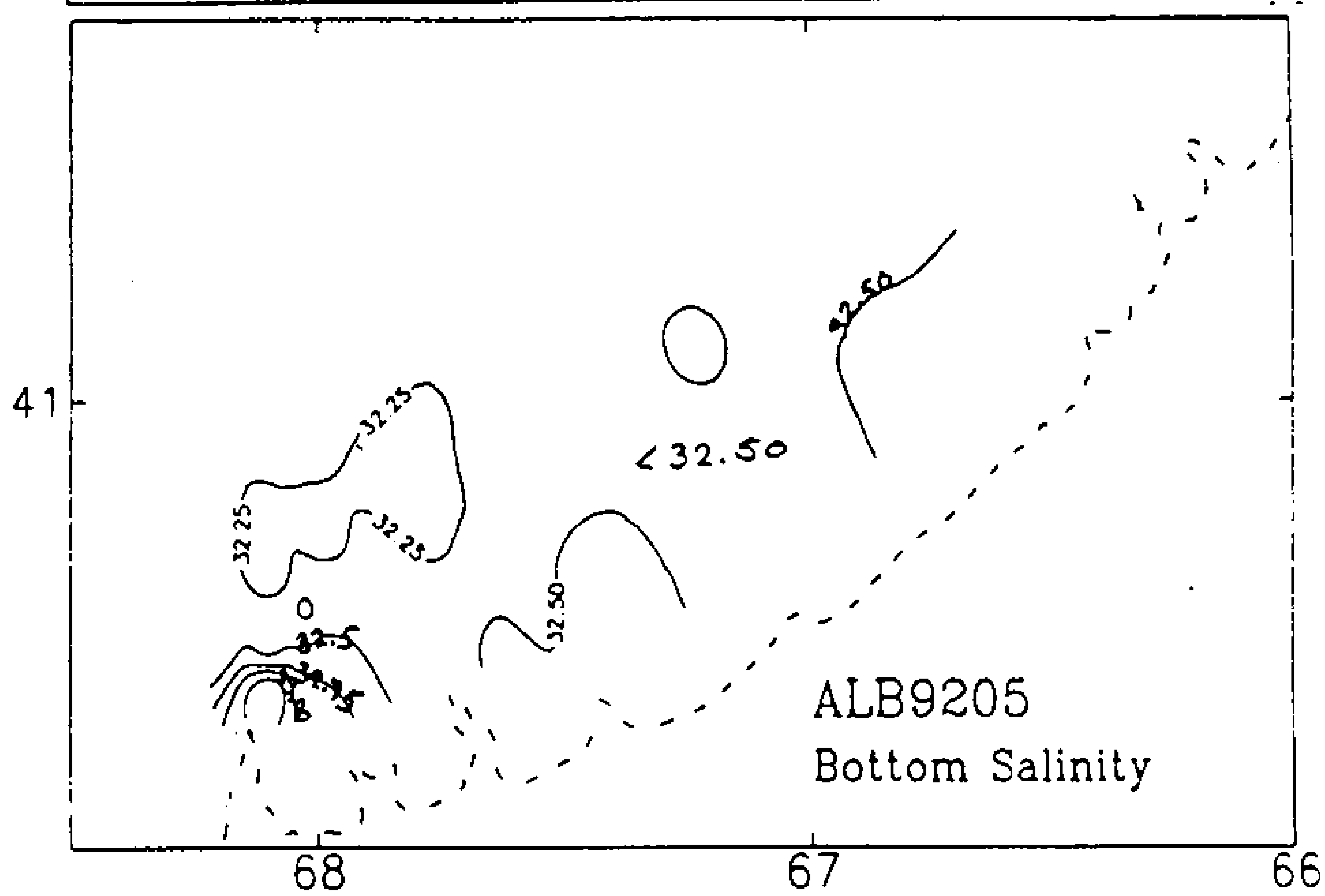


Figure 22. Surface (top) and bottom (bottom) salinity measured on AL9205 Dashed line represents the 200m isobath.

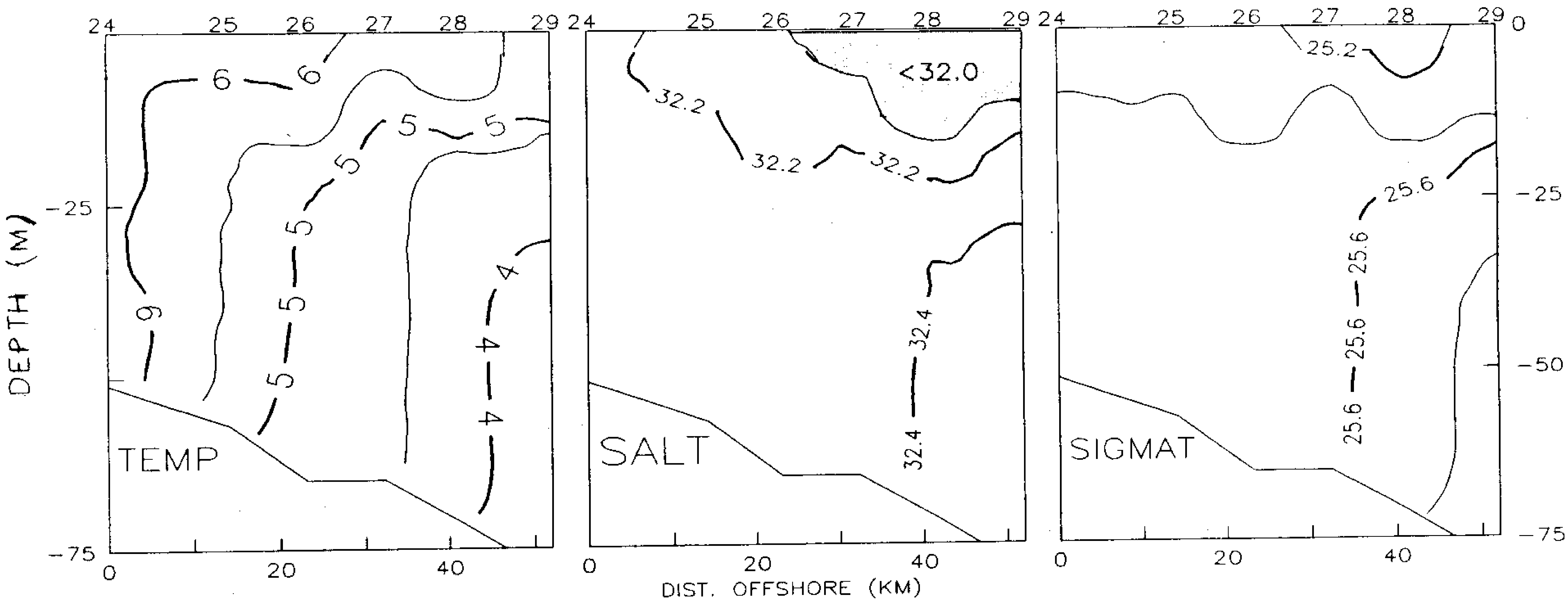


Figure 23. Cross-bank section #1 on AL9205 (May 20,1992). Contour intervals are .5, .2, and .2 for temperature, salinity, and sigmat, respectively.

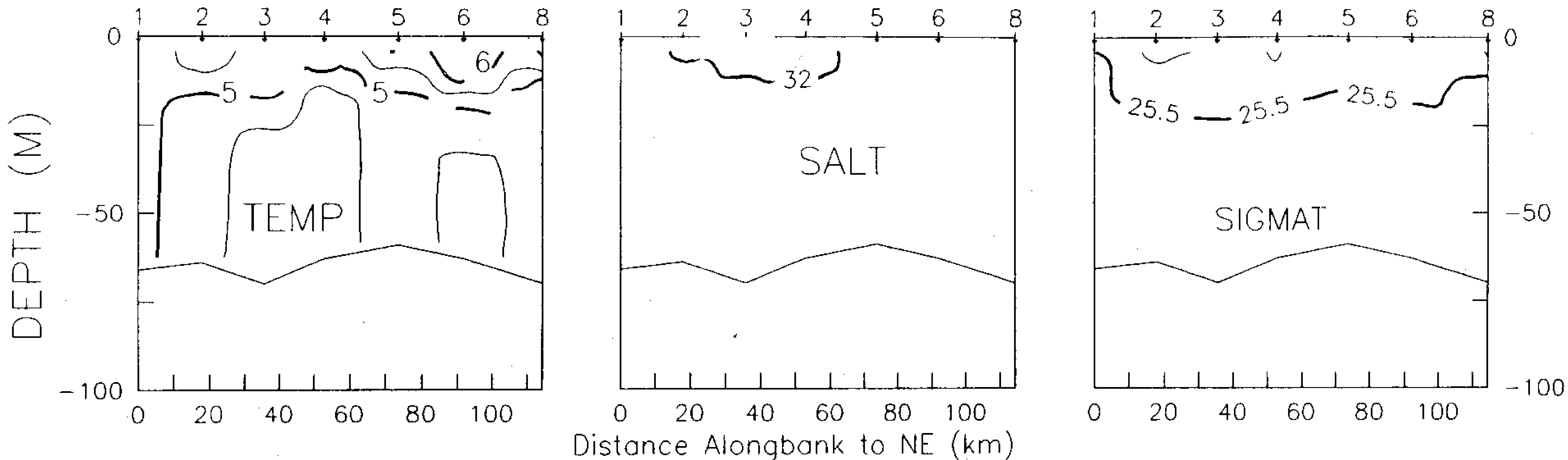


Figure 24. Alongbank section #1 on AL9205 (May 19, 1992).

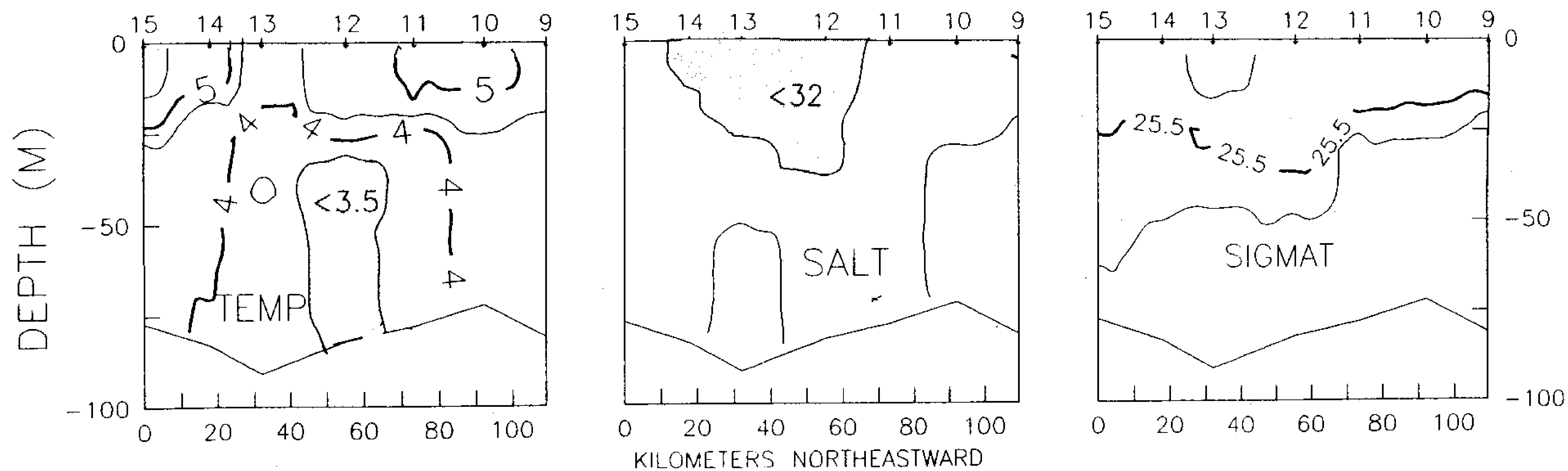


Figure 25. Alongbank section #2 on AL9205 (May 20, 1992).

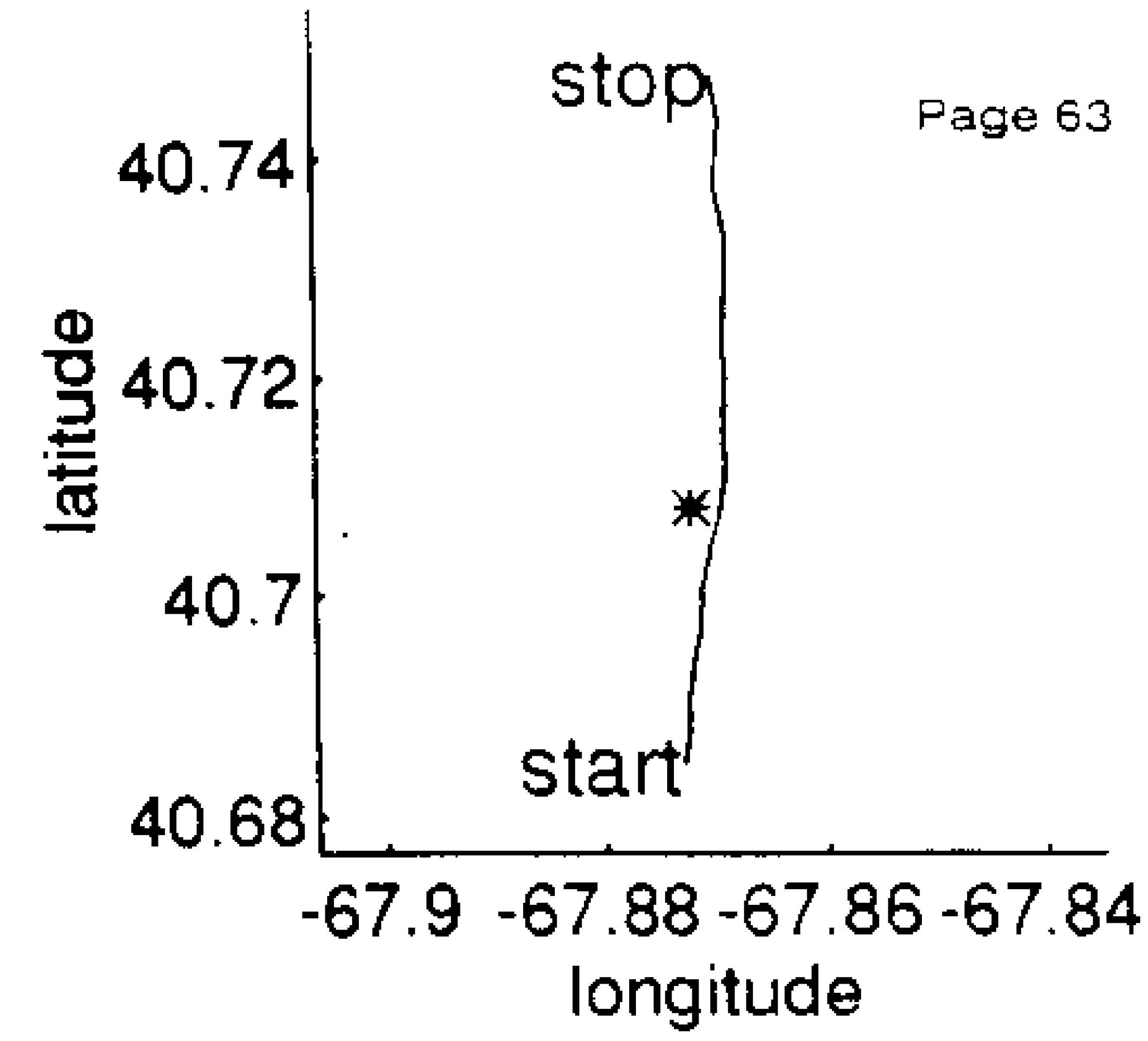
Transecte# 5

Drifter Site w/Endeavor

Albatross IV

start time:	5/21	2250	xint:	0.8271
stop time:	5/22	15	yint:	2

variable	mean	min	max	stderr
temp	4.643	4.06	7.1	0.0701
salt	32.24	31.76	32.39	0.019
density	25.55	24.88	25.73	0.0213
flur	0.578	0.25	0.92	0.0389



From: 40 41.08 N -67 52.37 W
To: 40 44.87N -67 52.18 W

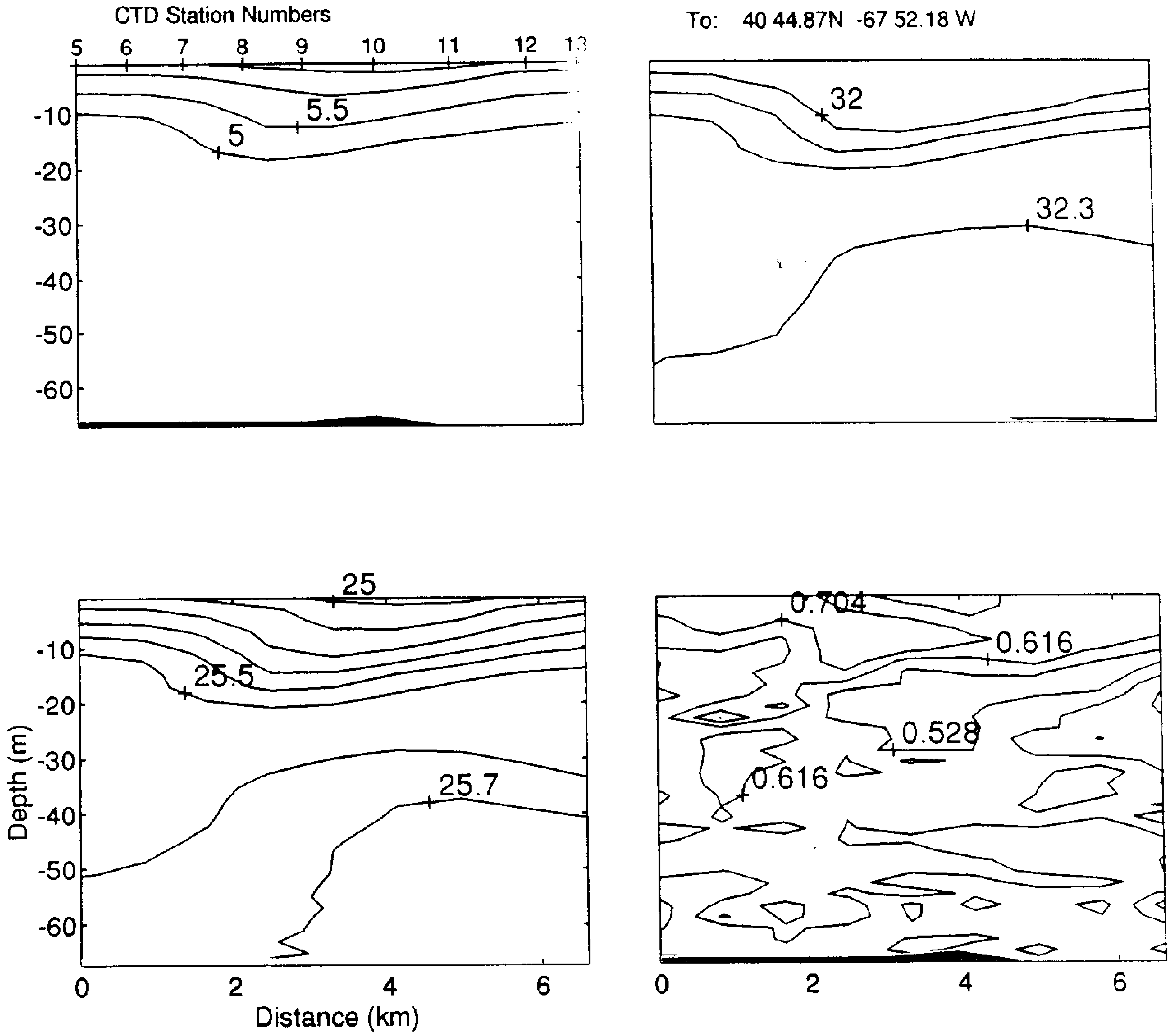


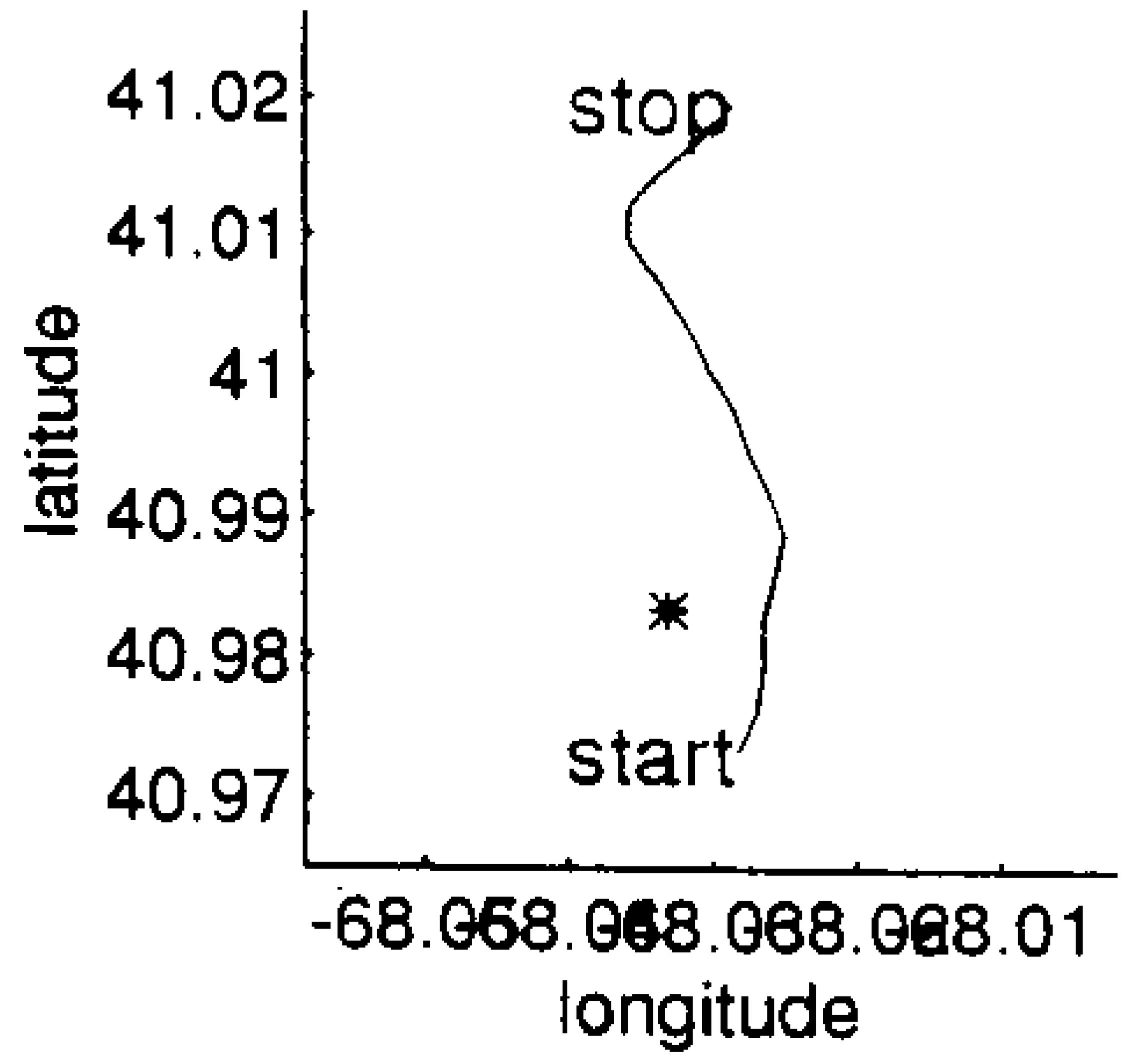
Figure 26. AL9205 MarkV CTD transect. See position, time (local), and statistics above. Note units for temperature, salinity, density, and fluorescence are degC, psu, sigmat, adn volts, respectively.

Transect# 6

Mixed Site w/GB #15

start time:	5/22	518	xint:	0.6106
stop time:	5/22	645	yint:	2

variable	mean	min	max	stderr
temp	6.276	6.14	6.44	0.01
salt	32.29	32.26	32.3	0.0027
density	25.4	25.37	25.41	0.0019
flur	1.135	0.88	1.76	0.0592



From: 40 58.39 N68 1.692 W

To: 41 1.188N68 1.71 W

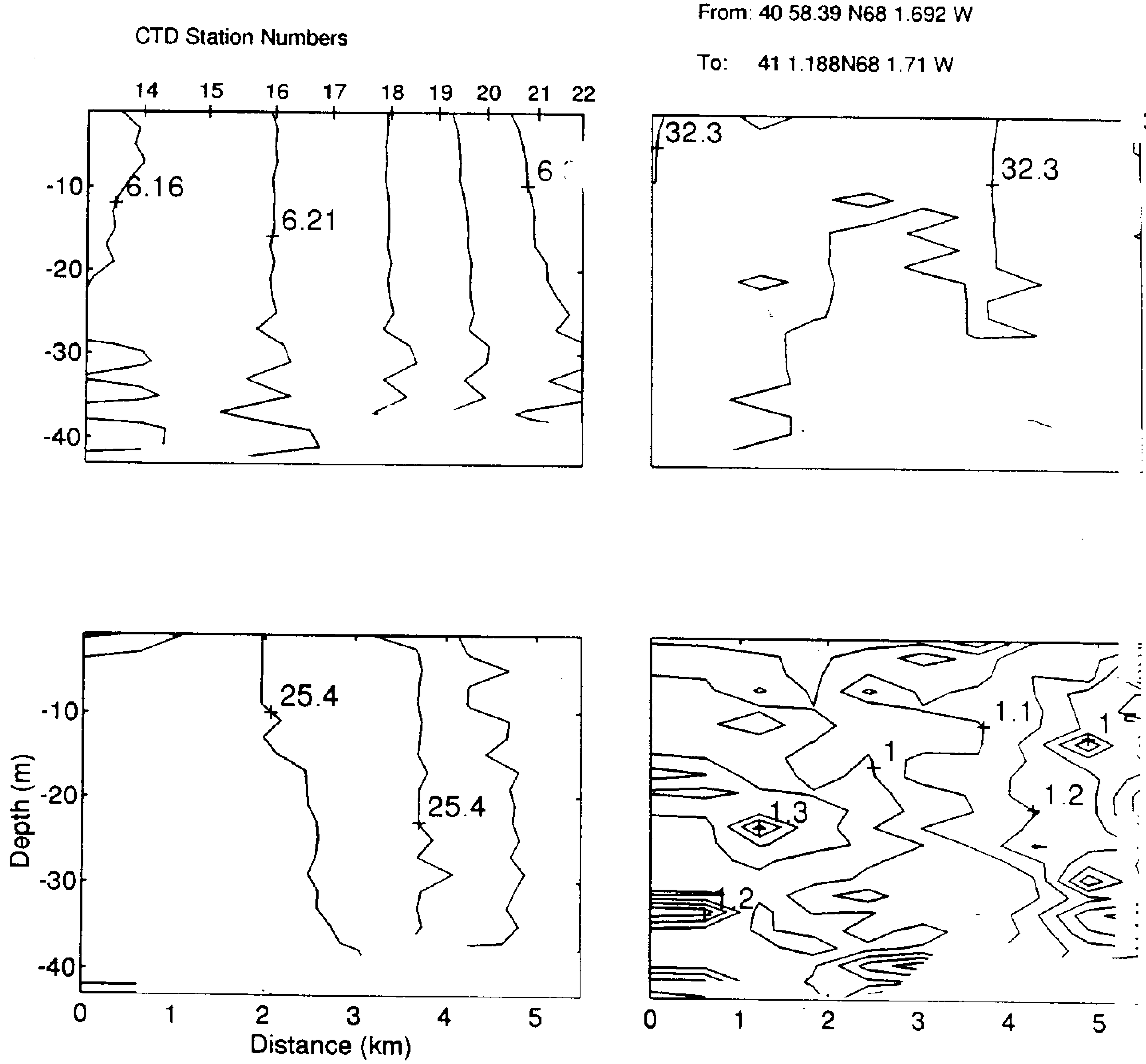
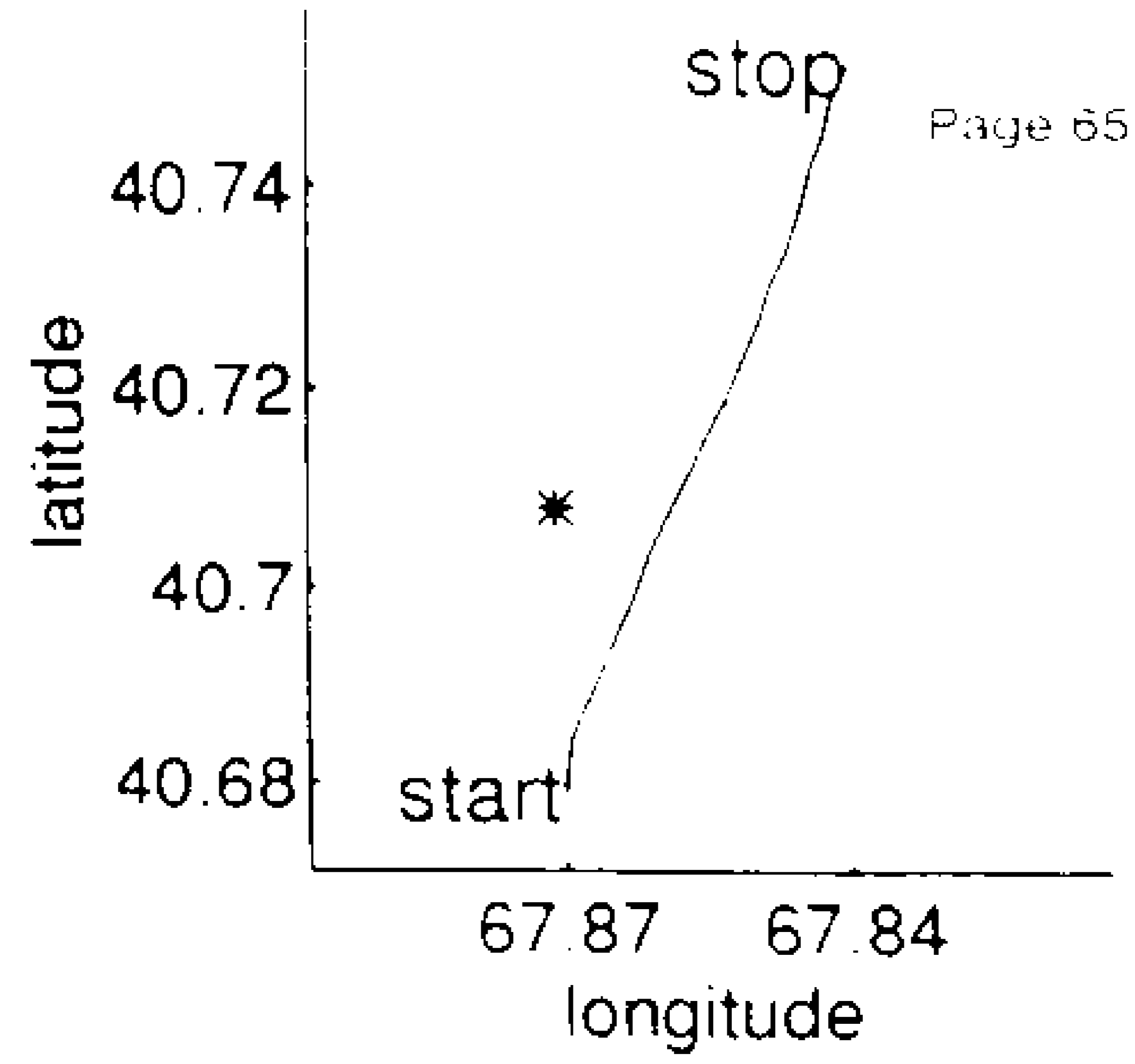


Figure 27. AL9205 MarkV CTD transect. See position, time (local), a statistics above. Note units for temperature, salinity, density, a fluorescence are degC, psu, sigmat, adn volts, respectively.

Transect# 7

Stratified Site w/GB#17



start time:	5/22 1510		xint:	0.9941
stop time:	5/22 1645		yint:	2

variable	mean	min	max	stderr
temp	4.846	4.05	7.9	0.1384
salt	32.21	31.8	32.42	0.0223
density	25.5	24.87	25.75	0.0288
flur	0.6009	0.22	1.91	0.1128

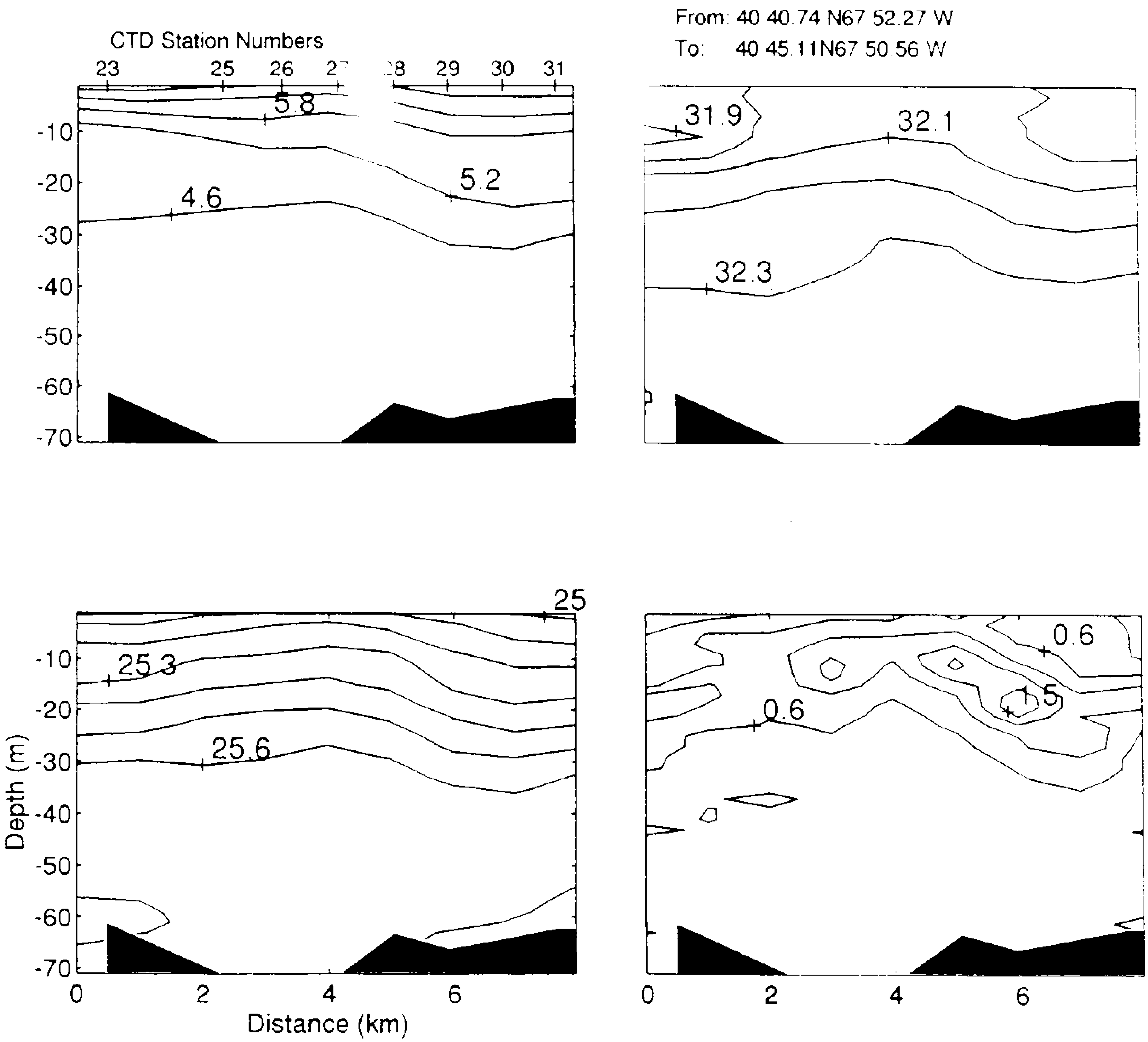
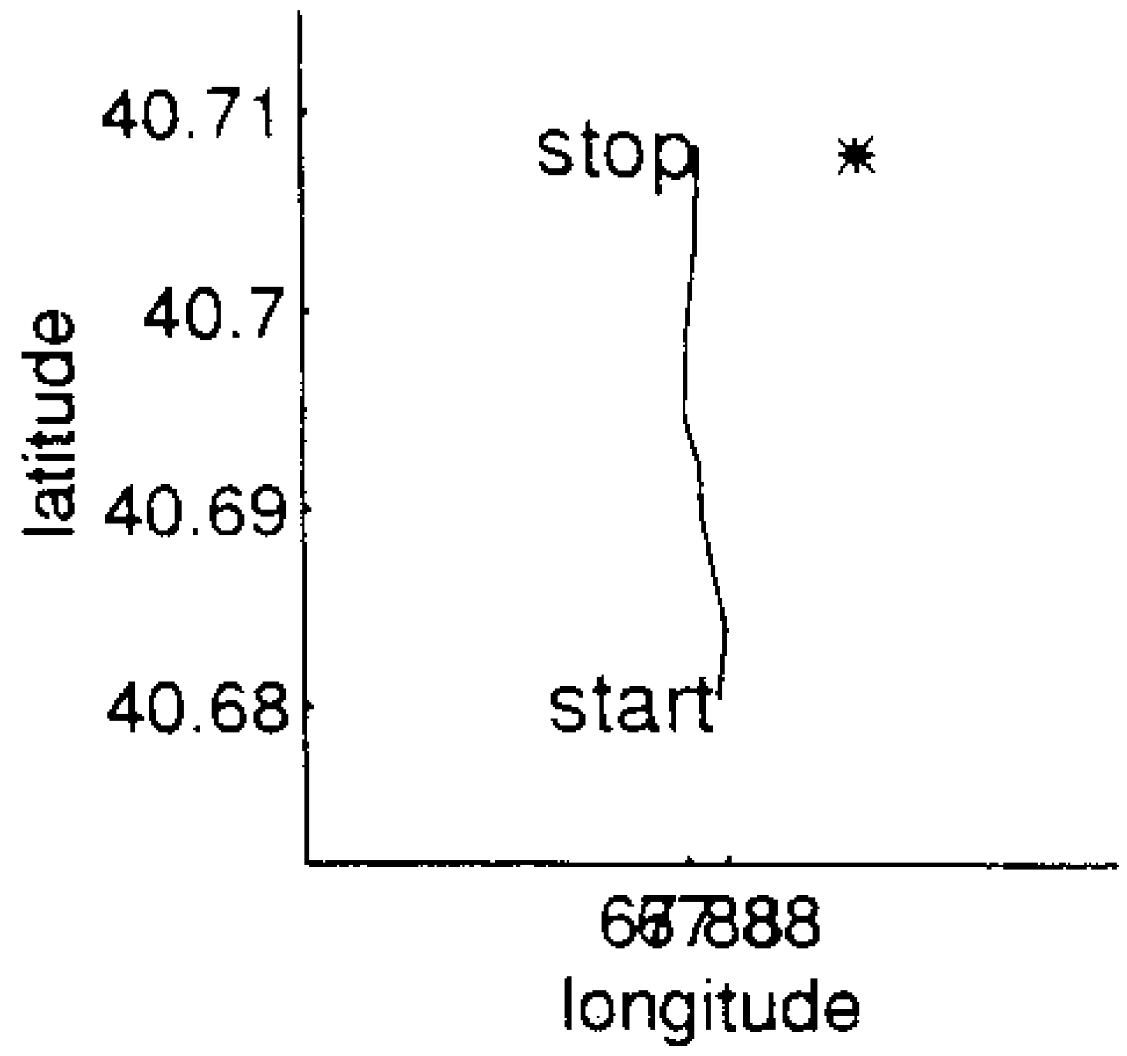


Figure 28. AL9205 MarkV CTD transect. See position, time (local), and statistics above. Note units for temperature, salinity, density, and fluorescence are degC, psu, sigmat, adn volts, respectively.

Transect# 8

Stratified Site w/GB#19



start time:	5/22 2319	xint:	0.855
stop time:	5/22 2359	yint:	2

variable	mean	min	max	stderr
temp	4.655	3.92	7.91	0.1582
salt	32.2	31.81	32.37	0.0245
density	25.52	24.81	25.71	0.0327
flur	0.7173	0.19	2.03	0.1507

From: 40 40.82 N67 52.74 W
To: 40 42.5N67 52.79 W

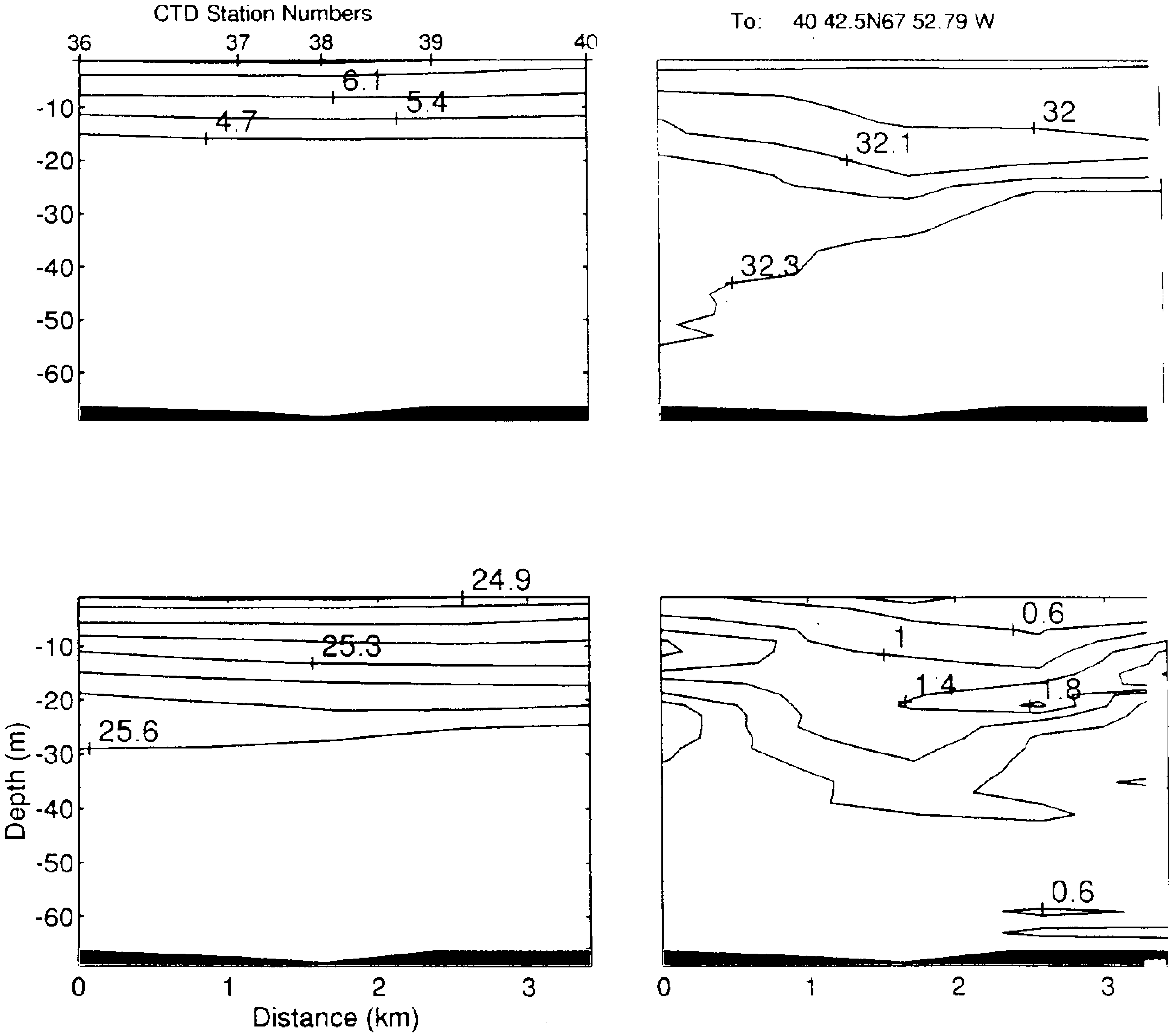
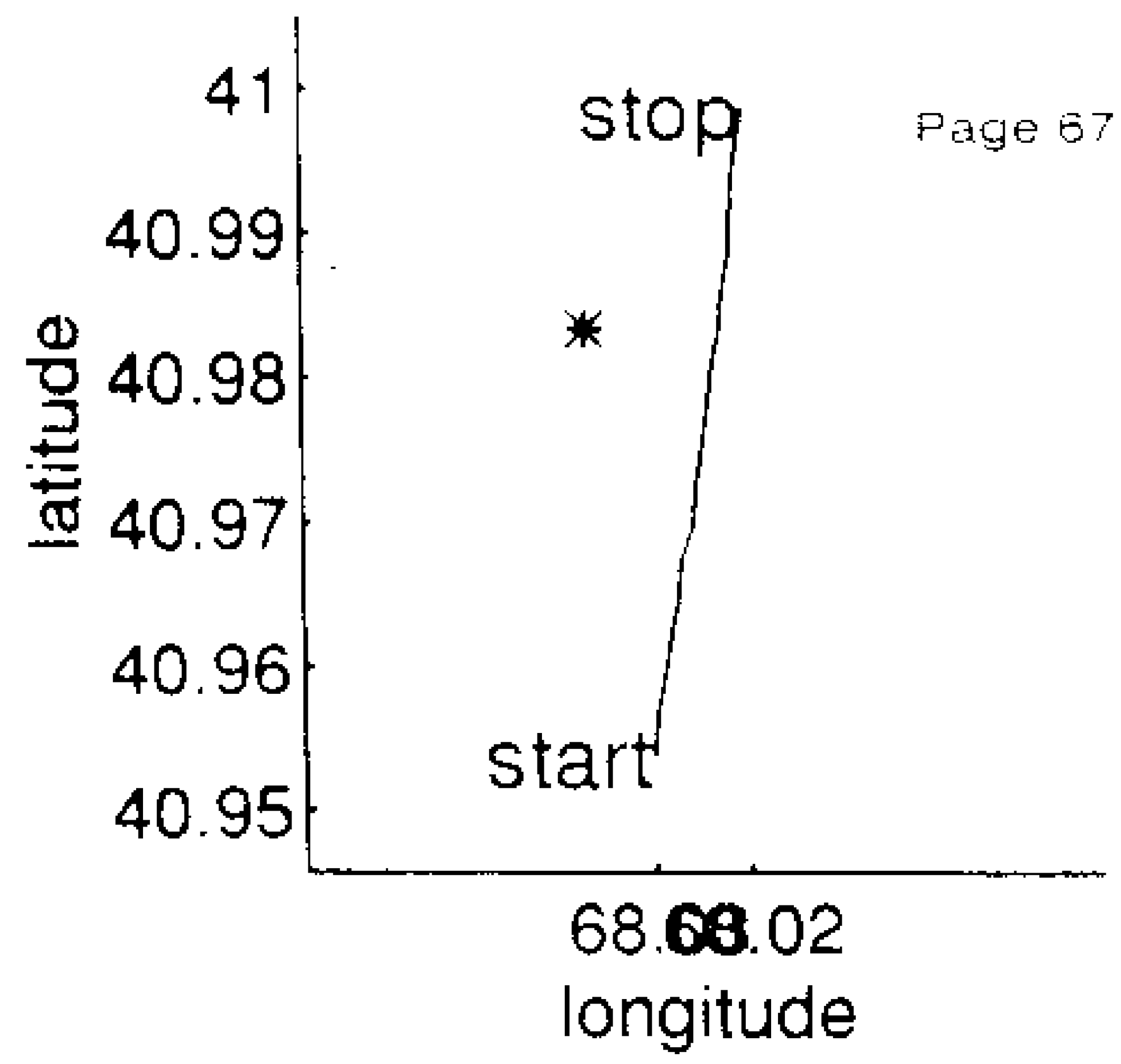


Figure 29. AL9205 MarkV CTD transect. See position, time (local), a statistics above. Note units for temperature, salinity, density, a fluorescence are degC, psu, sigmat, adn volts, respectively.

Transect# 9

Mixed Site w/GB#21



start time:	5/23	453	xint:	0.5918
stop time:	5/23	618	yint:	2

variable	mean	min	max	stderr
temp	6.331	6.18	6.45	0.0088
salt	32.29	32.27	32.3	0.0019
density	25.39	25.38	25.4	0.0023
flur	1.173	0.75	1.6	0.0666

From: 40 57.22 N68 1.71 W

To: 40 59.93N68 1.32 W

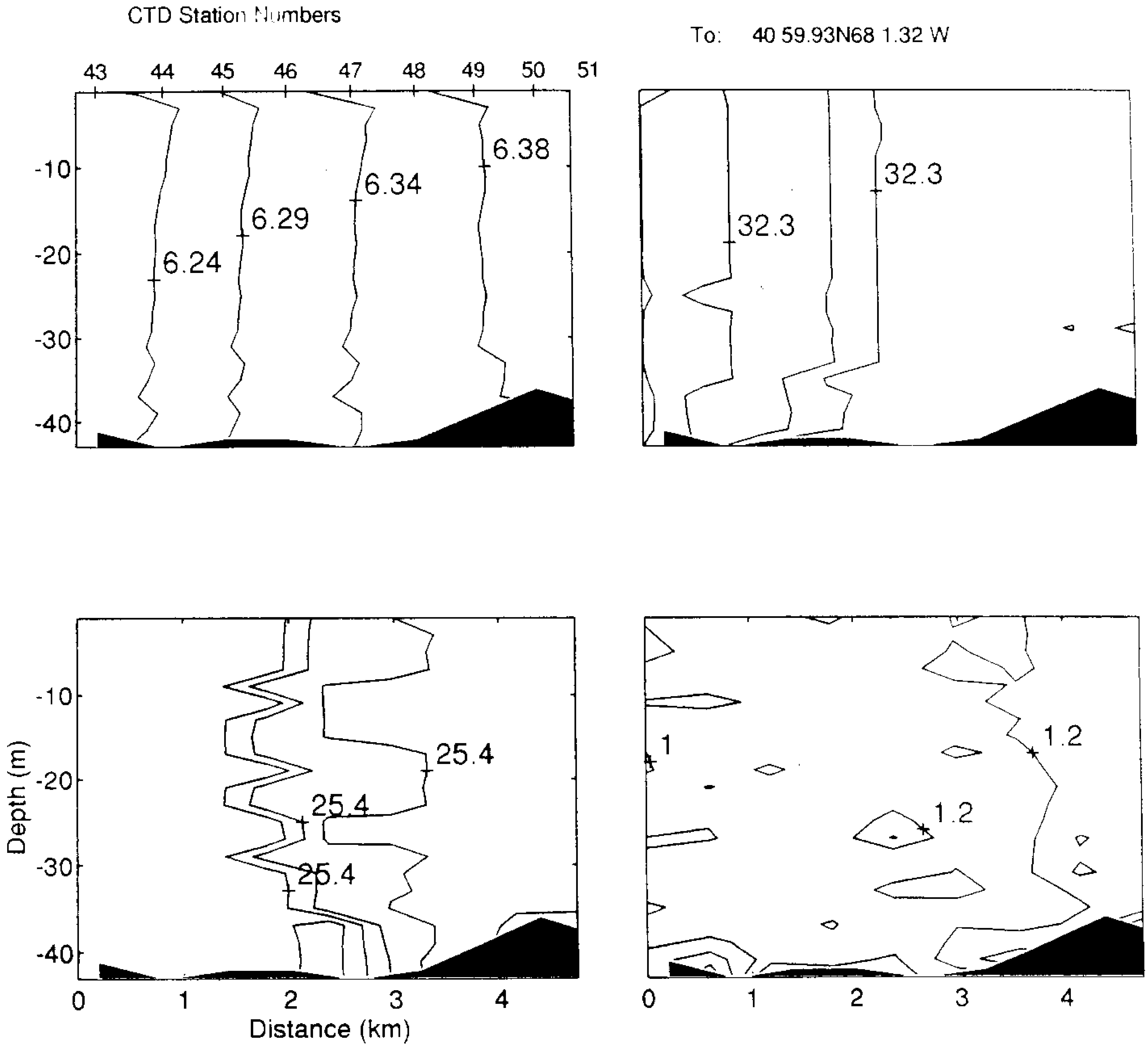
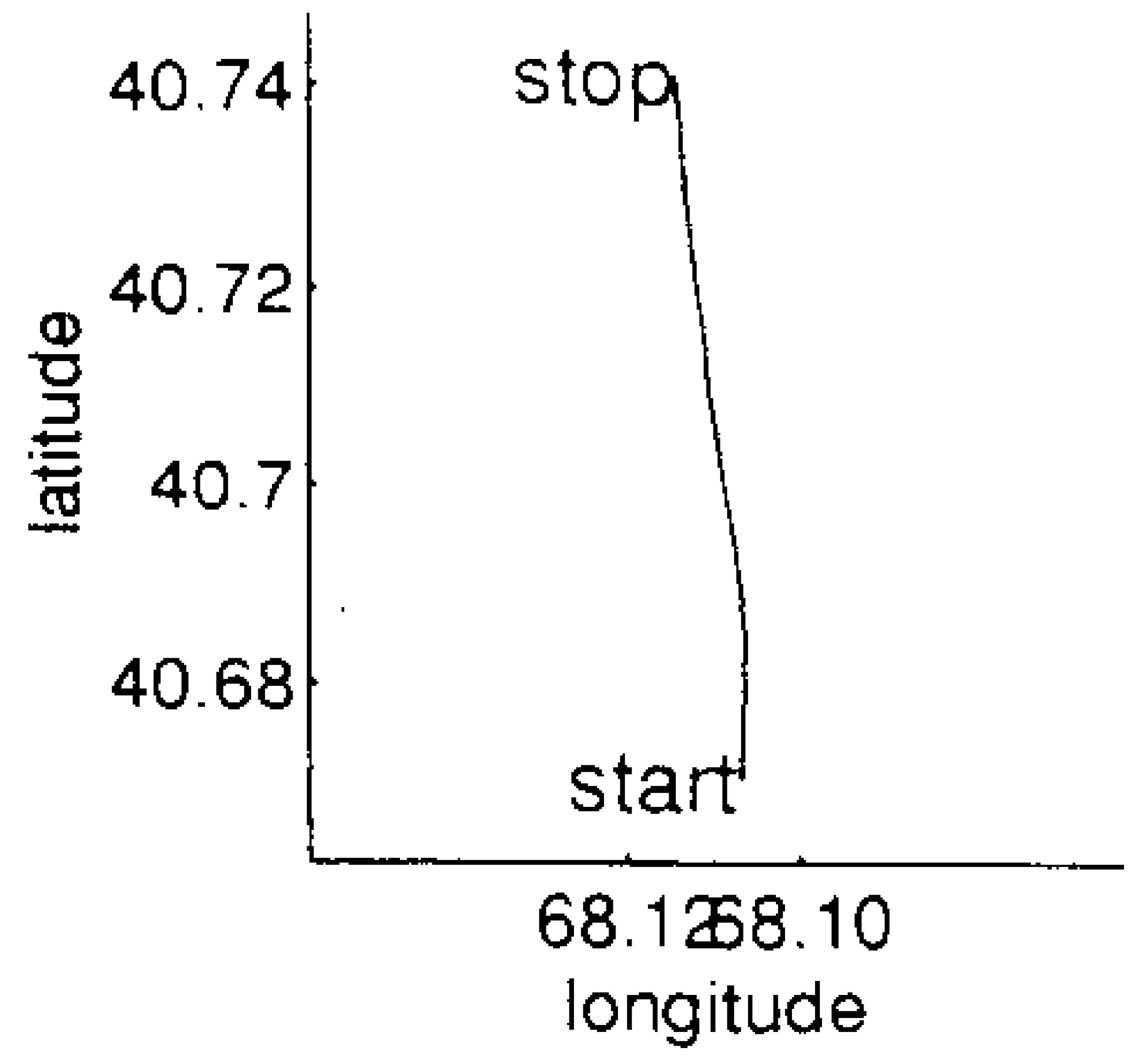


Figure 30. AL9205 MarkV CTD transect. See position, time (local), an statistics above. Note units for temperature, salinity, density, an fluorescence are degC, psu, sigmat, adn volts, respectively.

Transect# 10

Drifter Site   w/GB#23



start time:	5/23 1348	xint:	1.313
stop time:	5/23 1458	yint:	2

variable	mean	min	max	stderr
temp	4.866	4.23	9.3	0.1215
salt	32.21	31.94	32.32	0.0173
density	25.5	24.82	25.65	0.0241
flur	0.5061	0.21	2.96	0.1065

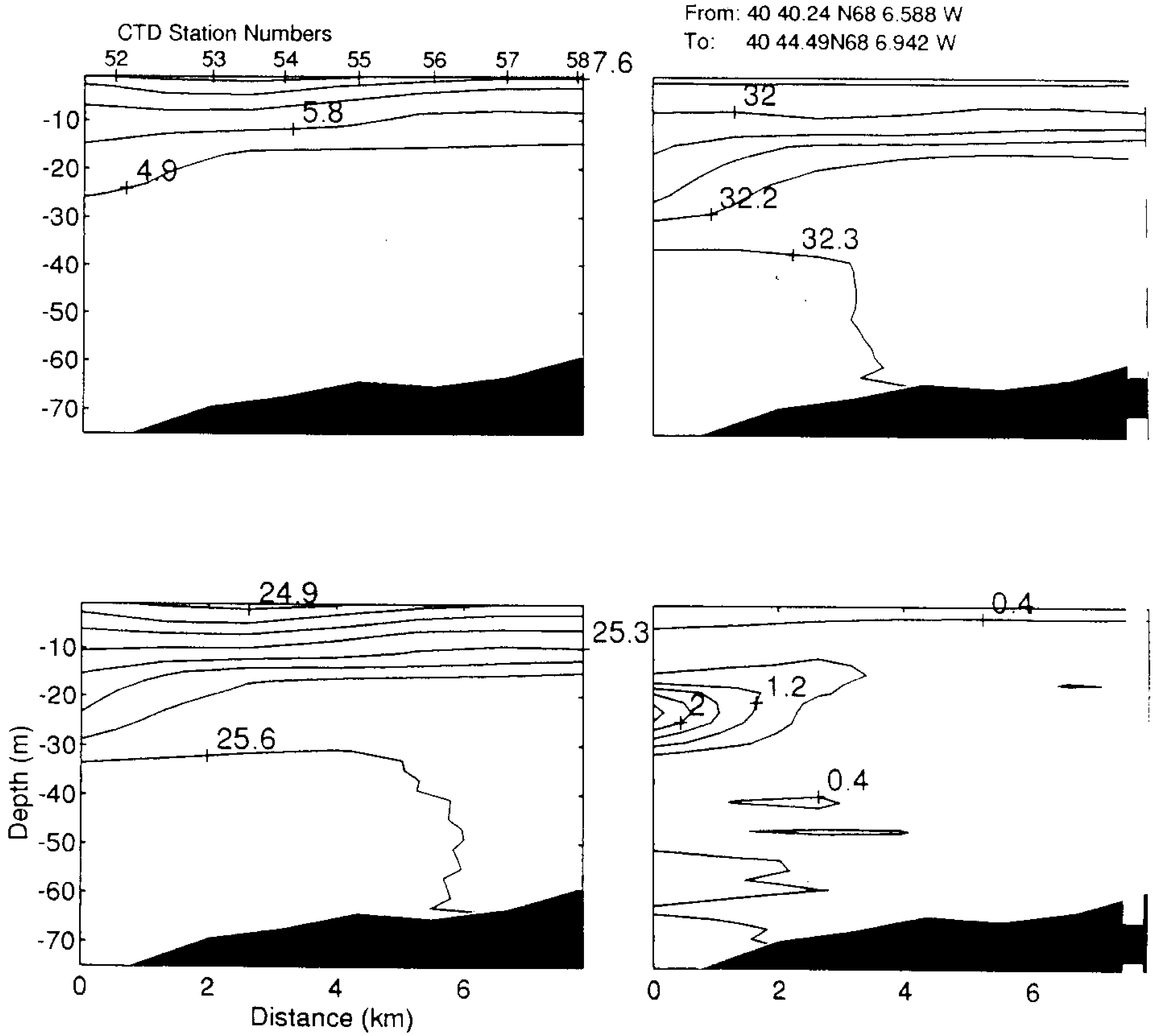
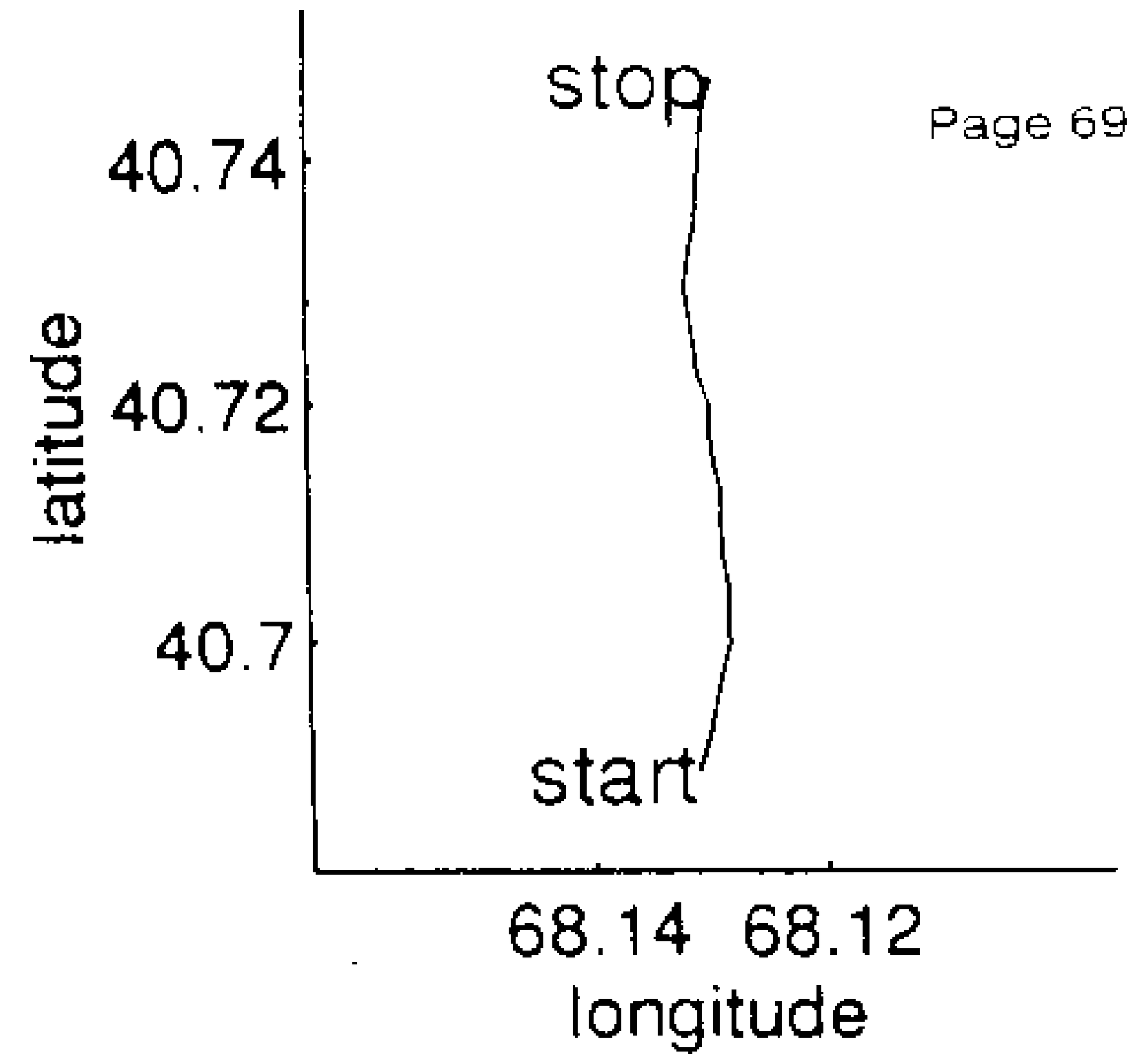


Figure 31. AL9205 MarkV CTD transect. See position, time (local), an statistics above. Note units for temperature, salinity, density, ·ı fluorescence are degC, psu, sigmat, adn volts, respectively.

Transect# 11

Drifter Site w/GB#25



start time:	5/23 1842		xint:	0.5565
stop time:	5/23 2037		yint:	2

variable	mean	min	max	stderr
temp	5.032	4.25	9.81	0.1717
salt	32.2	31.7	32.31	0.0205
density	25.47	24.43	25.65	0.033
flur	0.6861	0.32	2.82	0.1462

From: 40 41.35 N68 7.674 W
To: 40 44.81N68 7.578 W

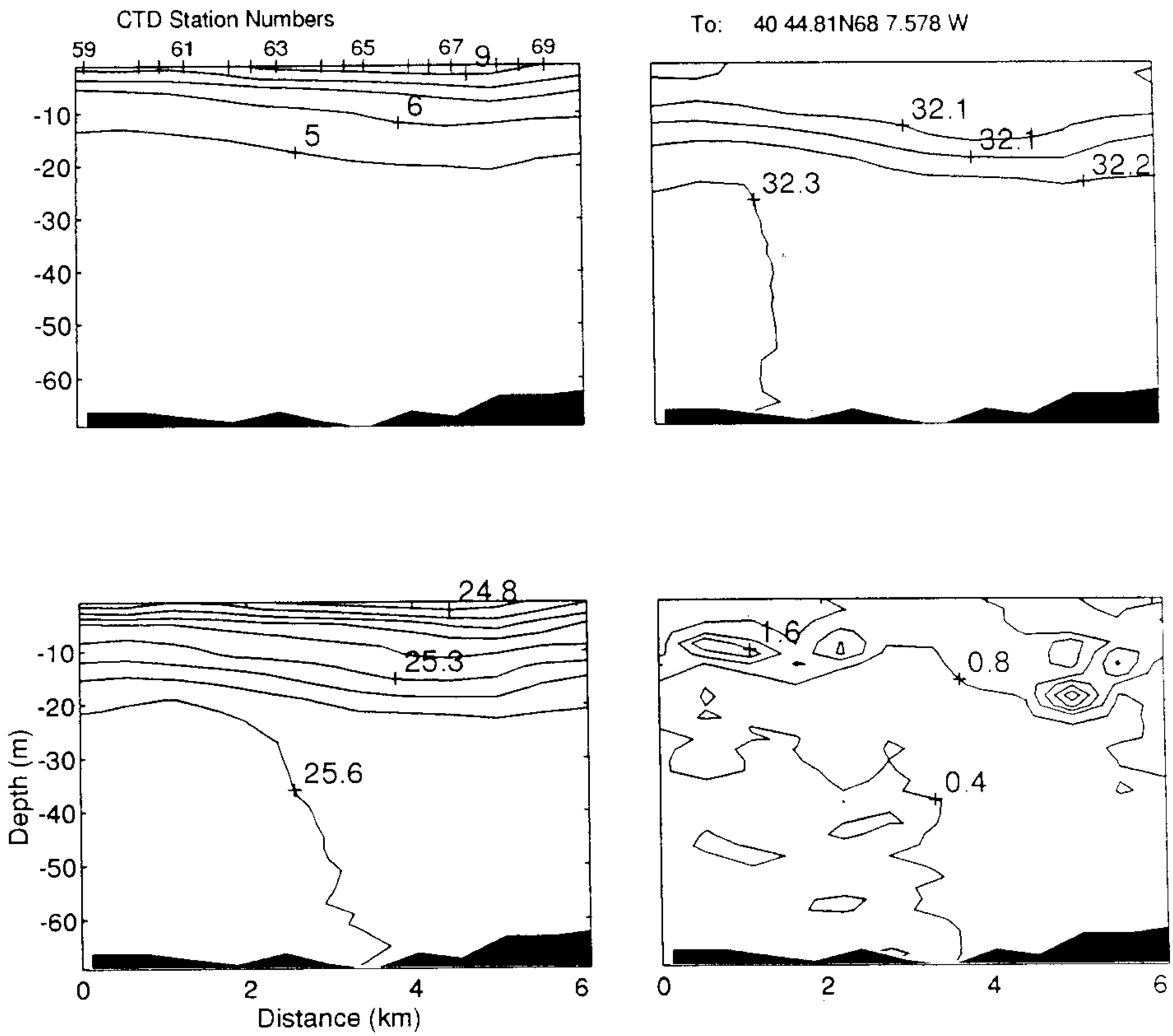


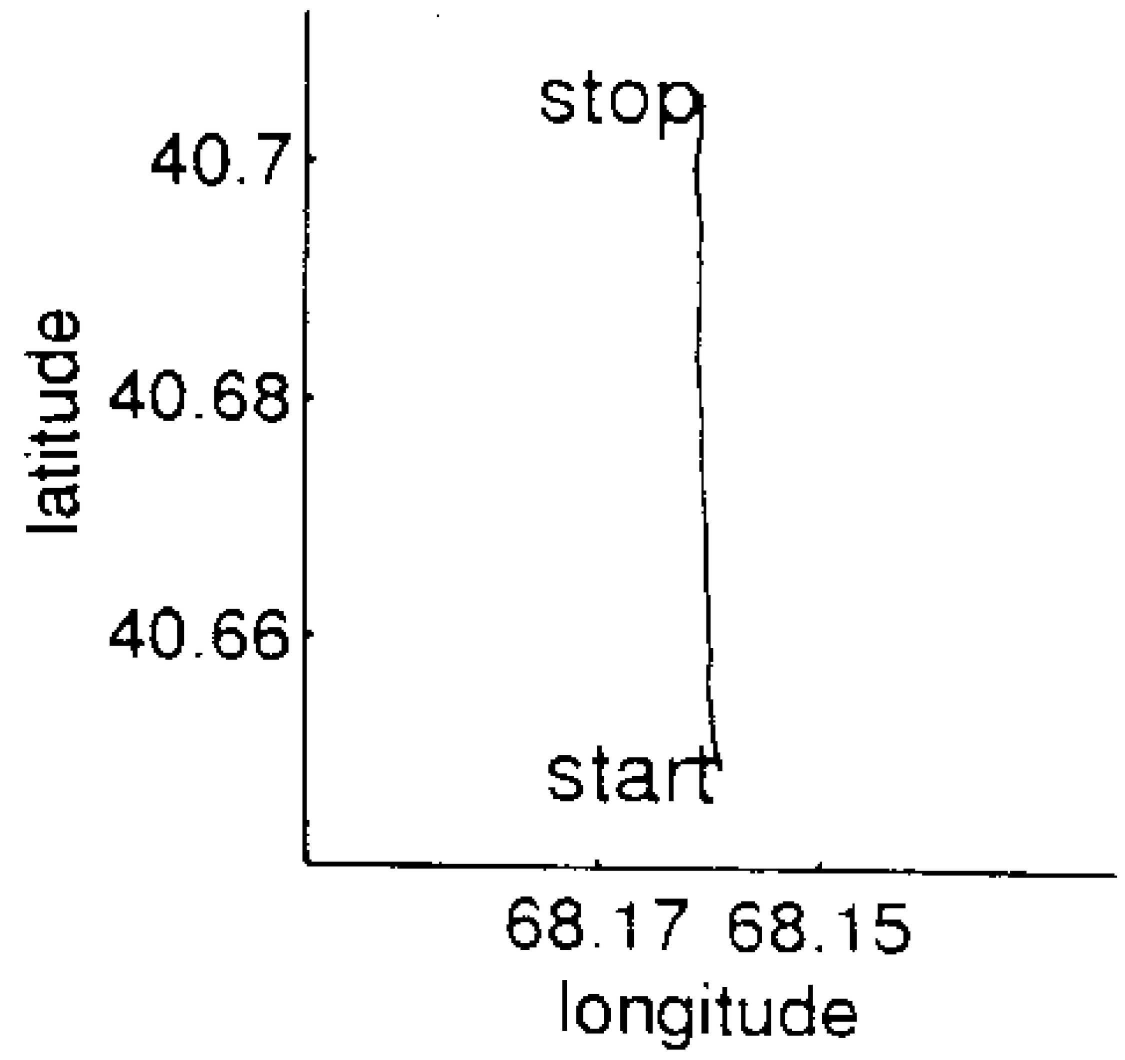
Figure 32. AL9205 MarkV CTD transect. See position, time (local), an statistics above. Note units for temperature, salinity, density, an fluorescence are degC, psu, sigmat, adn volts, respectively.

Transect# 12

Drifter Site w/GB#28

start time:	5/24	403	xint:	0.8453
stop time:	5/24	518	yint:	2

variable	mean	min	max	stderr
temp	4.695	4.09	8.86	0.1835
salt	32.23	31.88	32.49	0.0165
density	25.53	24.81	25.81	0.0292
flur	0.633	0.34	3.42	0.1787



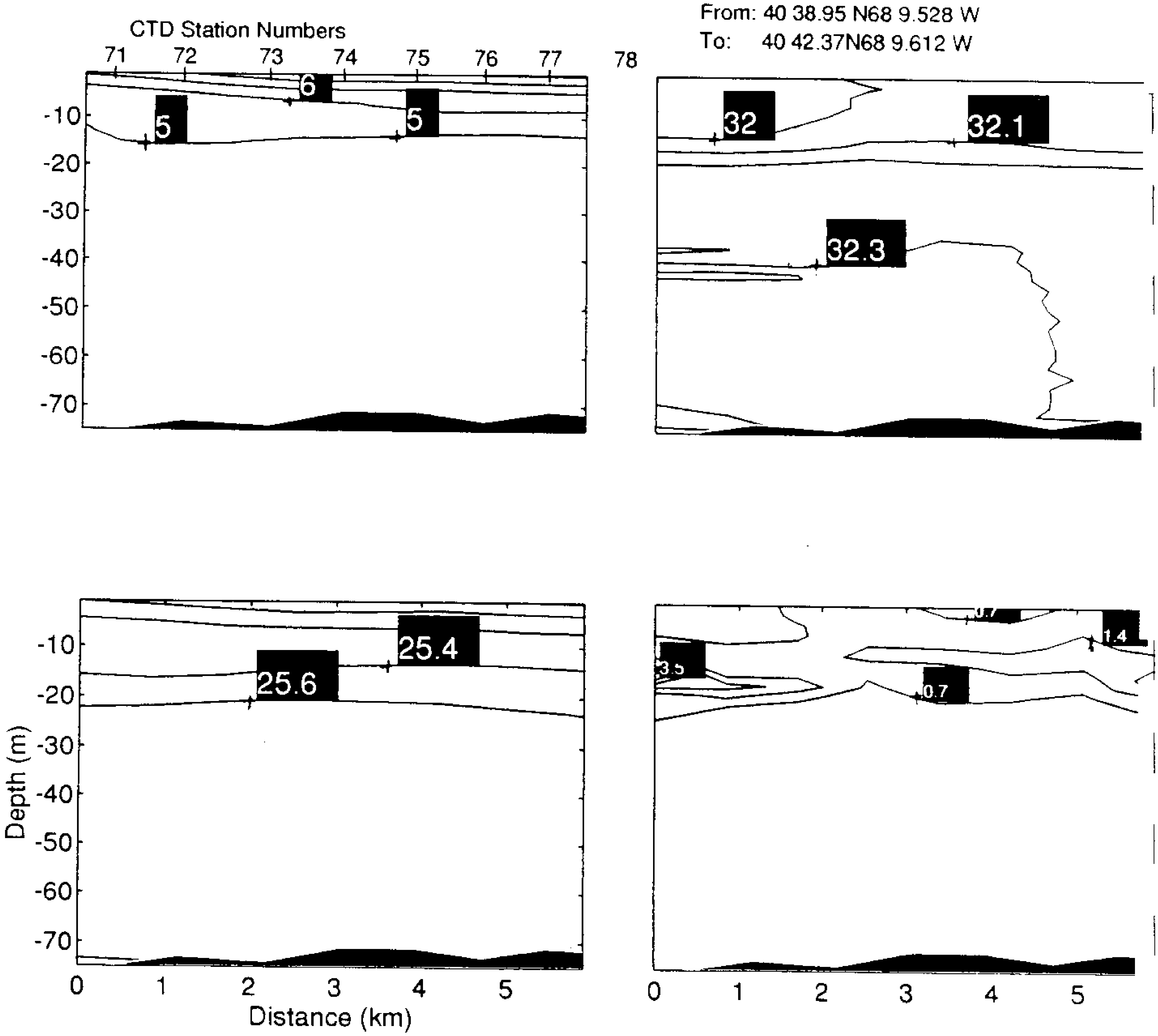


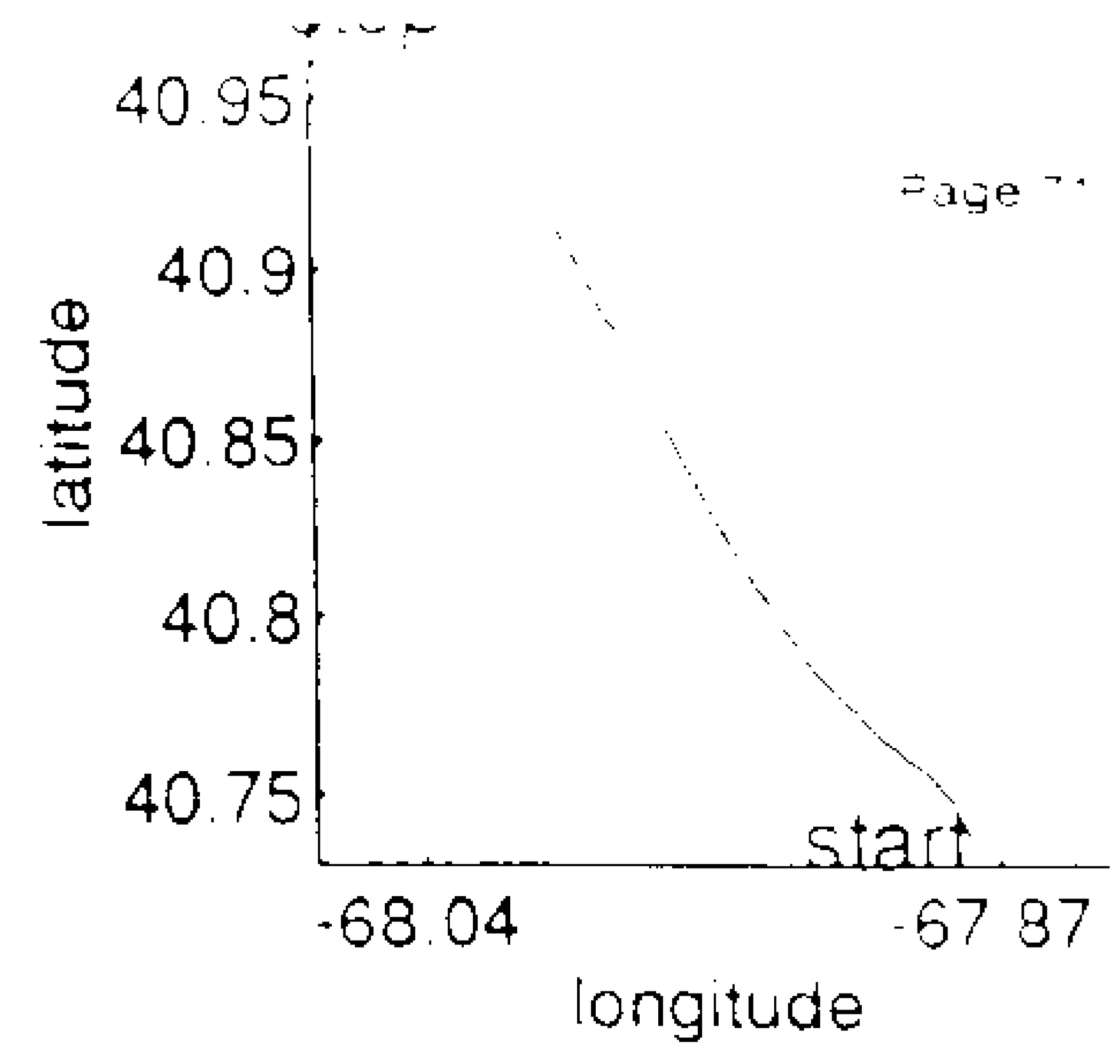
Figure 33. AL9205 MarkV CTD transect. See position, time (local), a statistics above. Note units for temperature, salinity, density, a fluorescence are degC, psu, sigmat, adn volts, respectively.

Transect# 13

Site S to M w/GB#31

start time:	5/24 2320		xint:	1.25
stop time:	5/25 410		yint:	2

variable	mean	min	max	stderr
temp	5.648	4.15	7.87	0.1331
salt	32.21	31.77	32.32	0.0204
density	25.41	24.9	25.67	0.0248
flur	1.182	0.23	4.05	0.1488



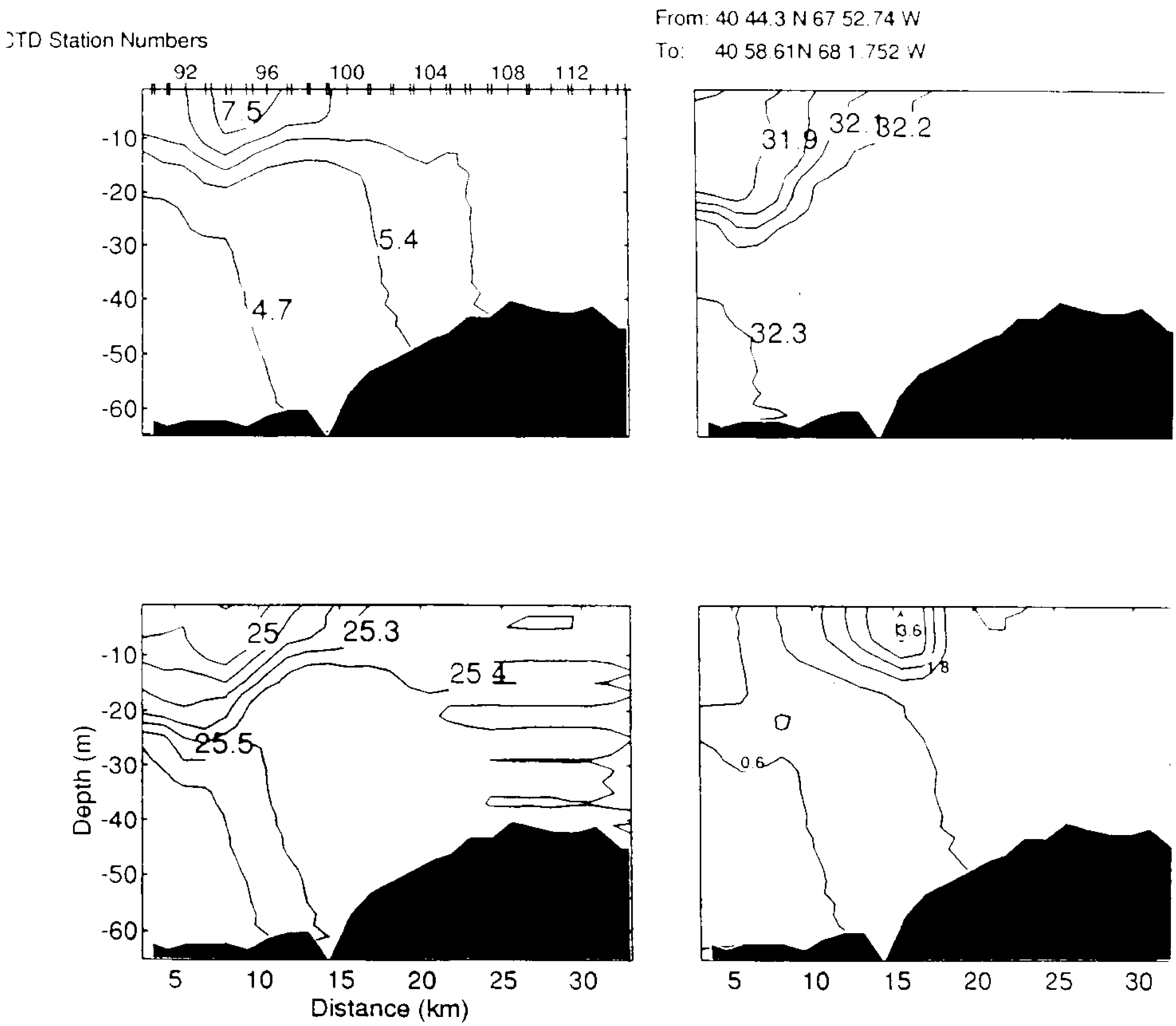


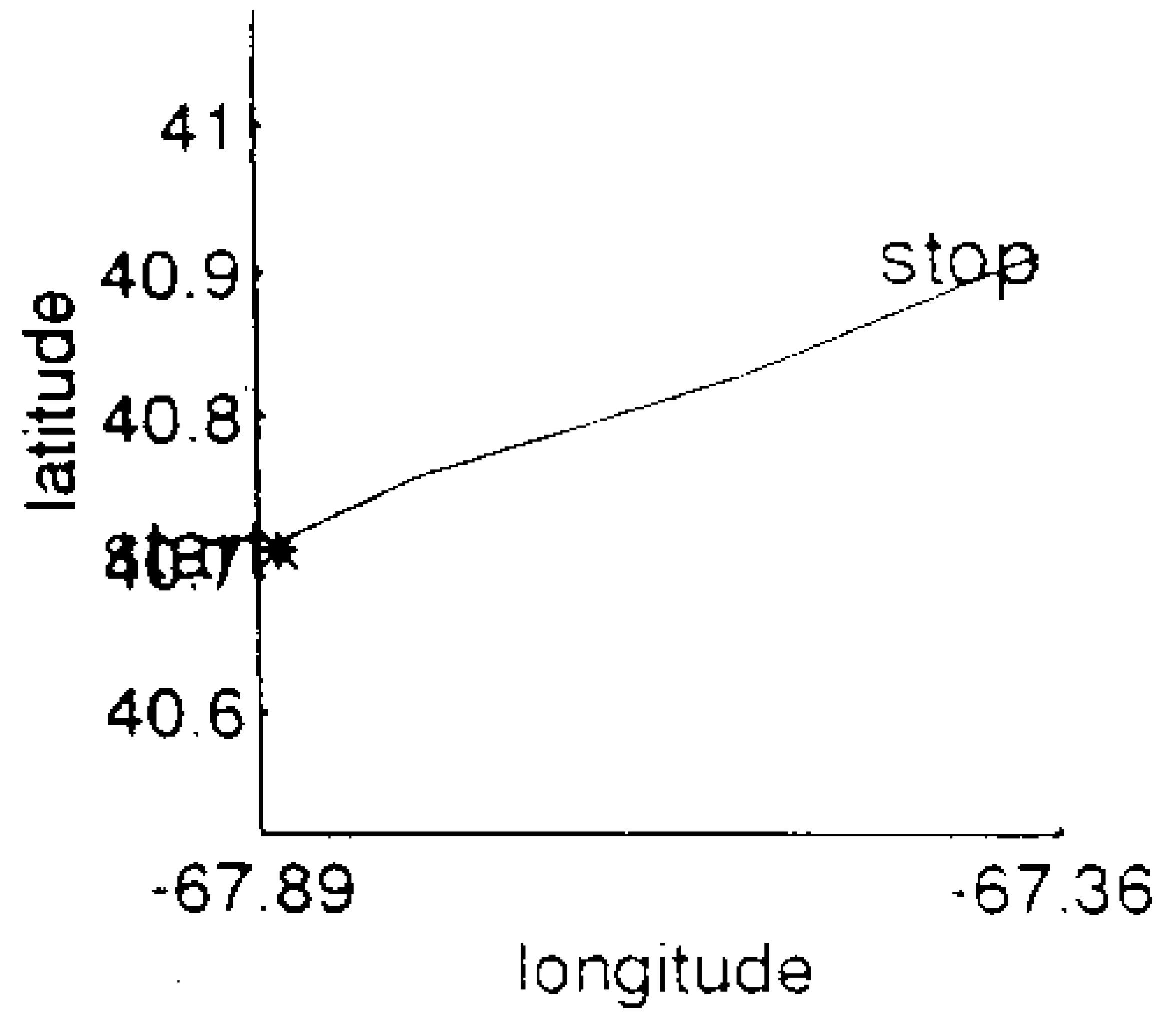
Figure 34. AL9205 MarkV CTD transect. See position, time (local), and statistics above. Note units for temperature, salinity, density, and fluorescence are degC, psu, sigmat, adn volts, respectively.

Transect# 14

Along Isobath 131-136

start time:	5/25 1818		xint:	10
stop time:	5/26 10		yint:	2

variable	mean	min	max	stderr
temp	4.487	2.83	6.48	0.0494
salt	32.2	31.79	32.41	0.0639
density	25.53	25.06	25.75	0.0476
flur	0.6413	0.24	1.66	0.0764



From: 40 42.65 N 67 52.66 W
To: 40 54.82N 67 21.97 W

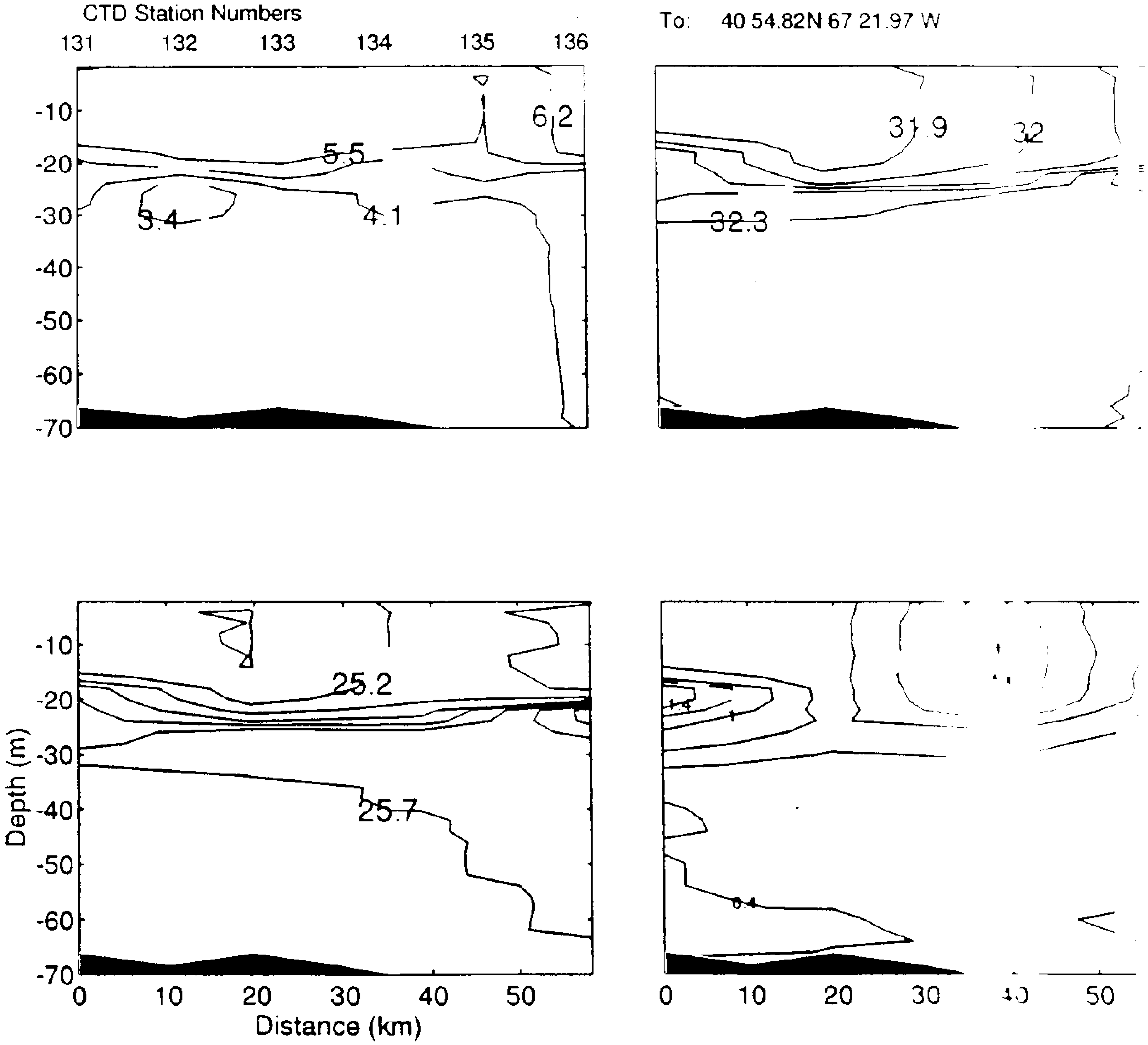


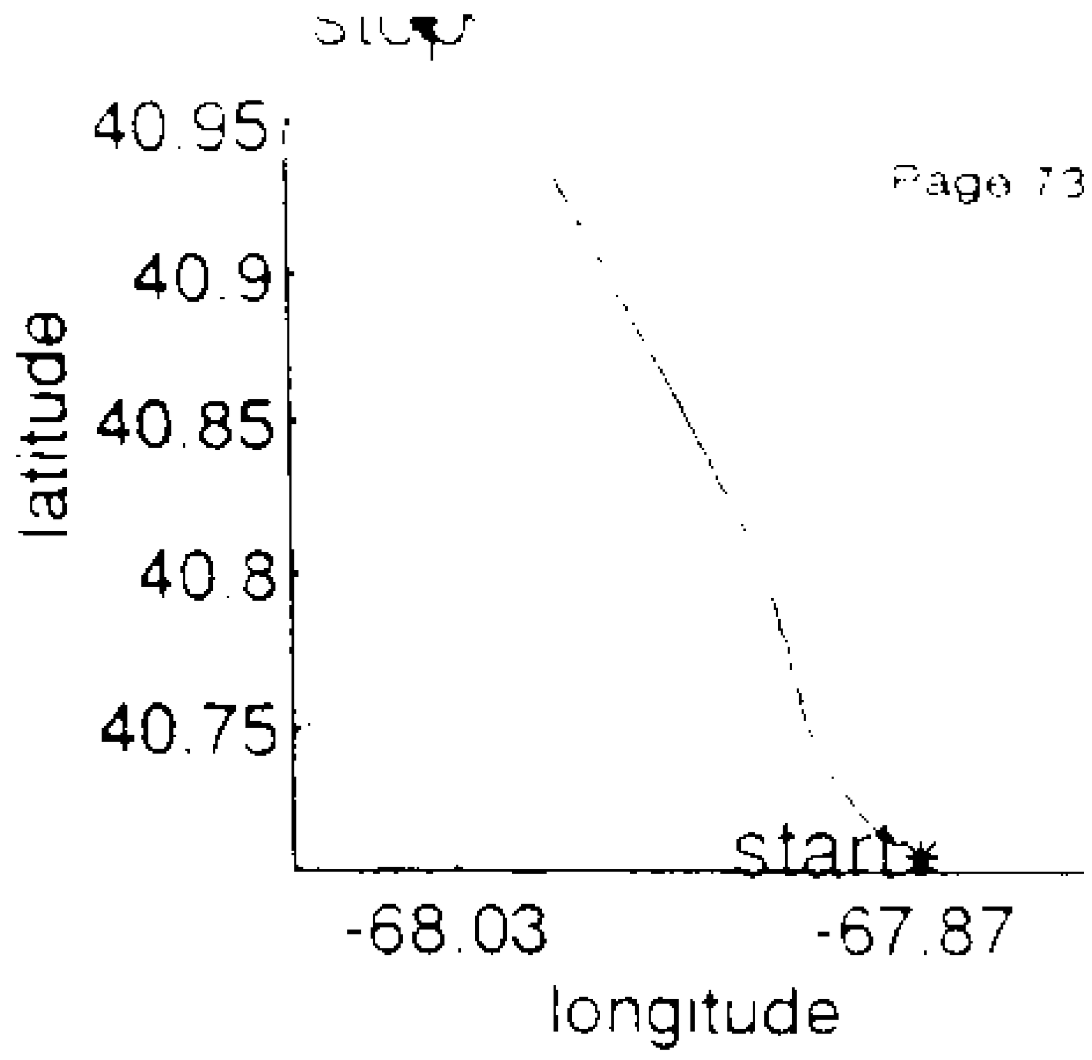
Figure 35. AL9205 MarkV CTD transect. See position, time (local), a statistics above. Note units for temperature, salinity, density, an fluorescence are degC, psu, sigmat, adn volts, respectively.

Transect# 15

Site S to M w/no GB

start time:	5/26	242	xint:	1 283
stop time:	5/26	743	yint:	2

variable	mean	min	max	stderr
temp	5.364	4 06	6 9	0.1217
salt	32.16	31.75	32.34	0 0288
density	25.4	25.05	25.69	0 0264
flur	0.7989	0.33	2.73	0.1018



From: 40 42.69 N 67 52.72 W
To: 40 59.18N 68 1.05 W

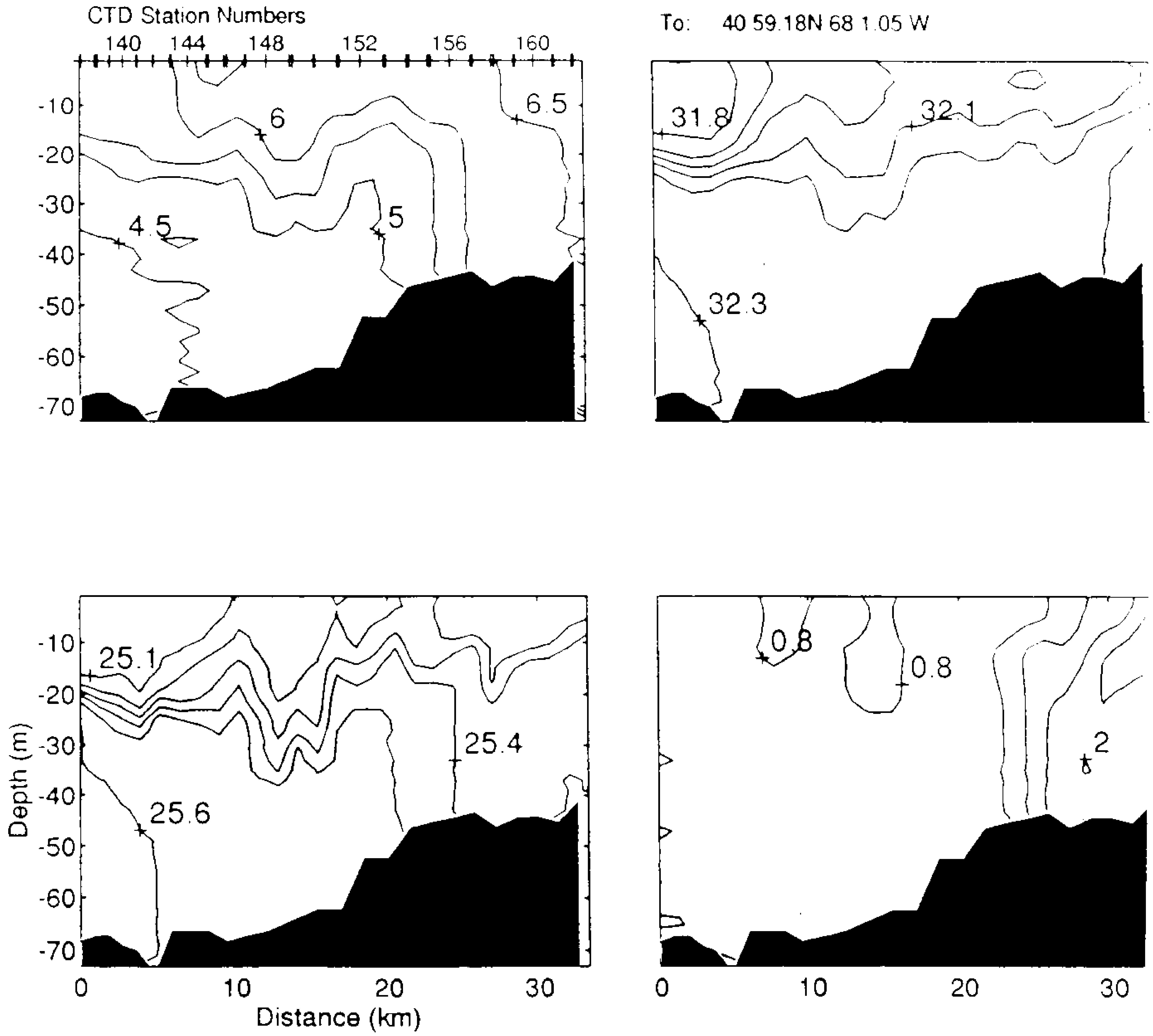


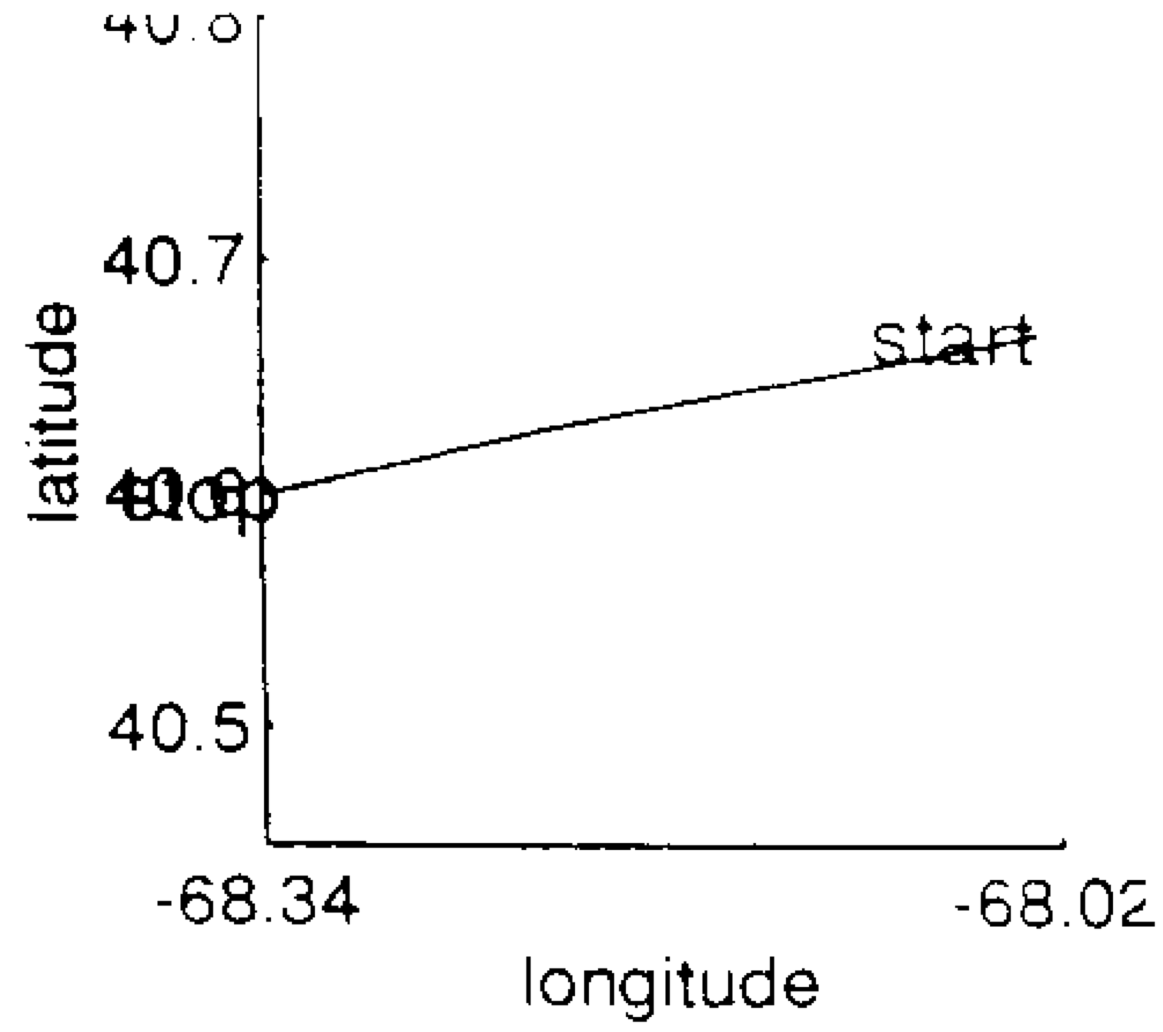
Figure 36. AL9205 MarkV CTD transect. See position, time (local), and statistics above. Note units for temperature, salinity, density, and fluorescence are degC, psu, sigmat, adn volts, respectively.

Transect# 16

SW along-isobath

start time:	5/27 1443		xint:	18.19
stop time:	5/27 1624		yint:	2

variable	mean	min	max	stderr
temp	4.729	4.03	6.49	0.1134
salt	32.23	31.82	32.45	0.0305
density	25.53	25.06	25.77	0.033
flur	0.6281	0.28	1.6	0.1032



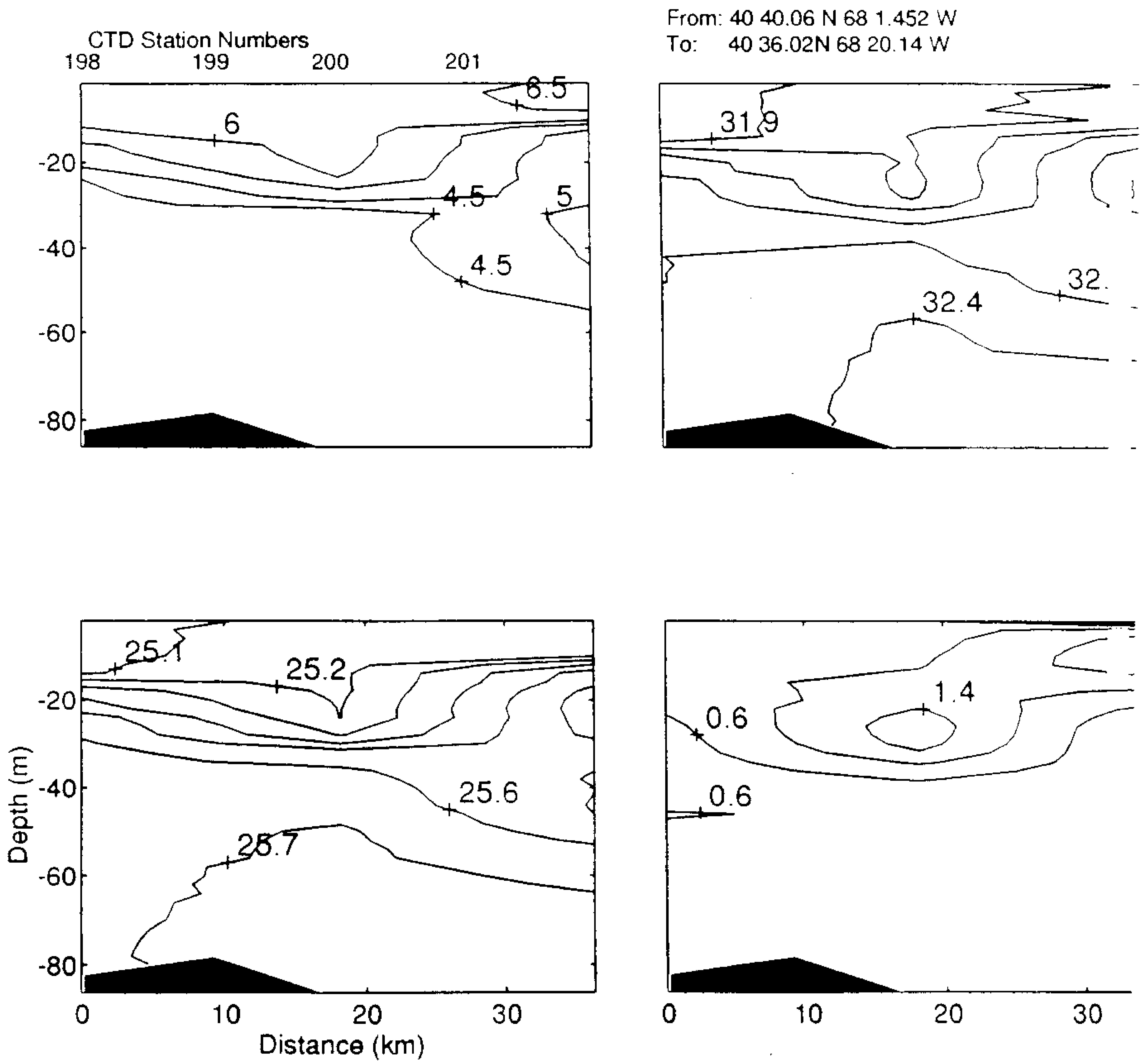


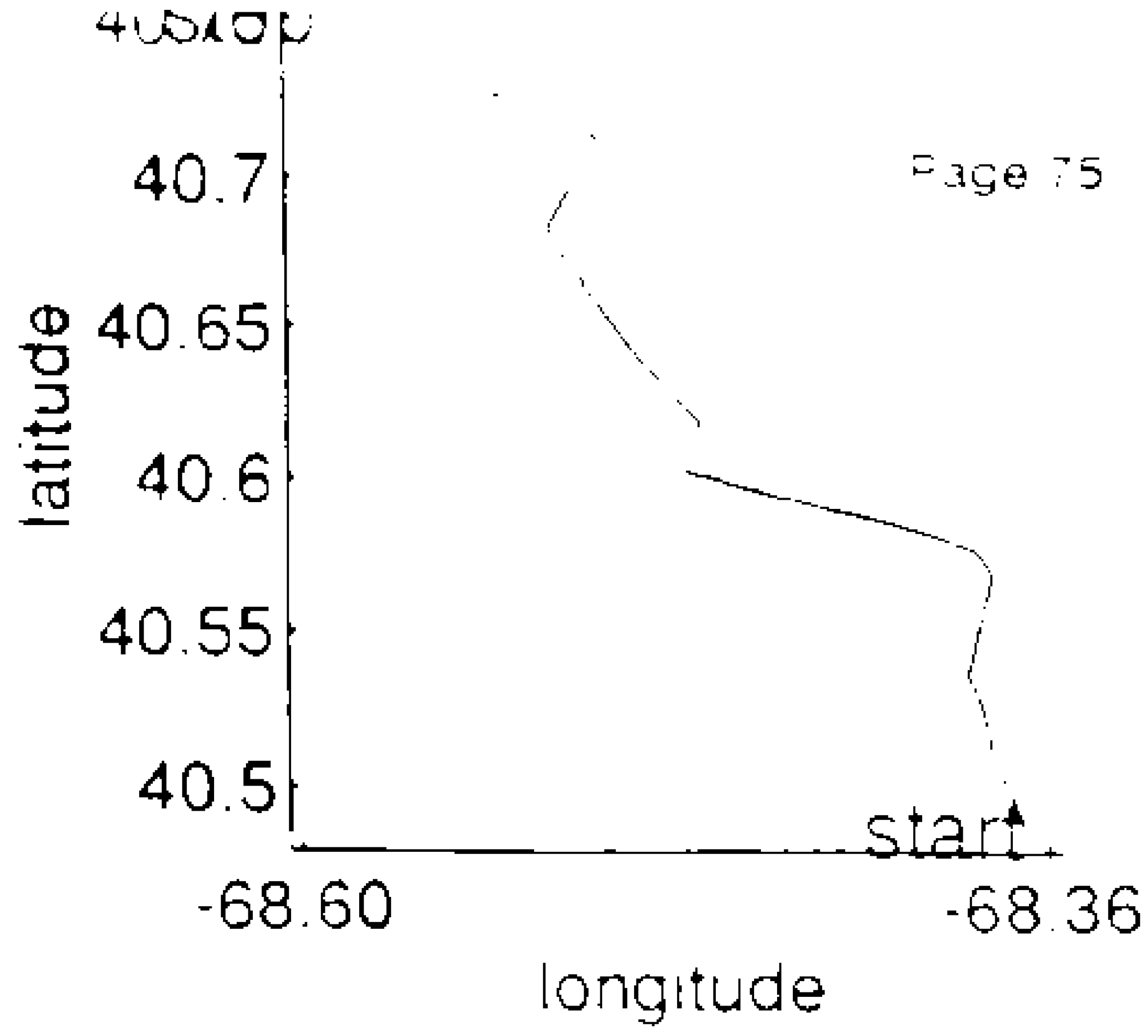
Figure 37. AL9205 MarkV CTD transect. See position, time (local), a statistics above. Note units for temperature, salinity, density, an fluorescence are degC, psu, sigmat, adn volts, respectively.

Transect# 17

Cross-bank w/GB#36

start time:	5/27 1945		xint:	1.15
stop time:	5/28 505		yint:	2

variable	mean	min	max	stderr
temp	5.585	3.91	7.39	0.1379
salt	32.29	31.82	32.99	0.0252
density	25.48	25.04	26.11	0.0263
flur	1.155	0.2	3.03	0.1338



From: 40 29.25 N 68 21.82 W
To: 40 45.13N 68 35.54 W

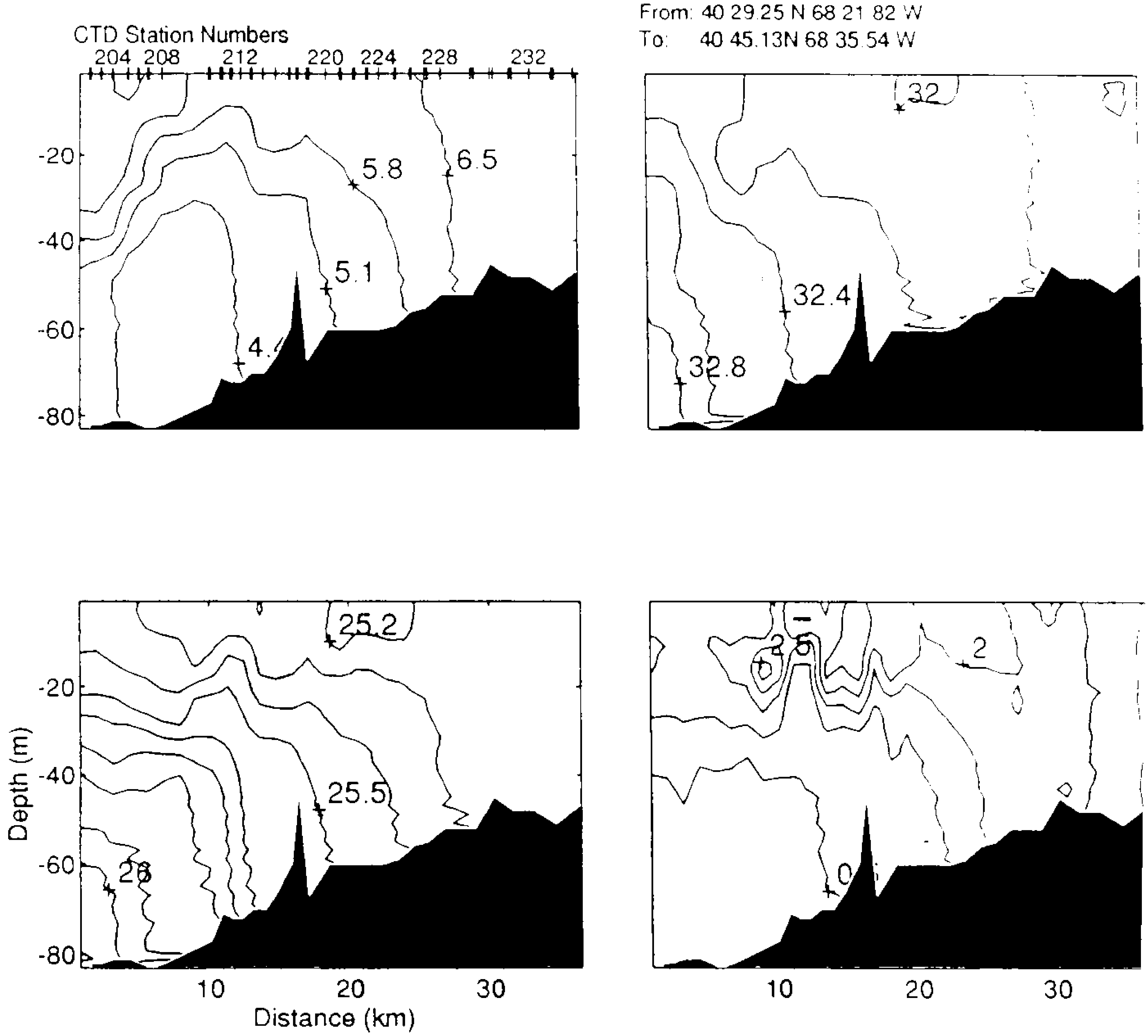


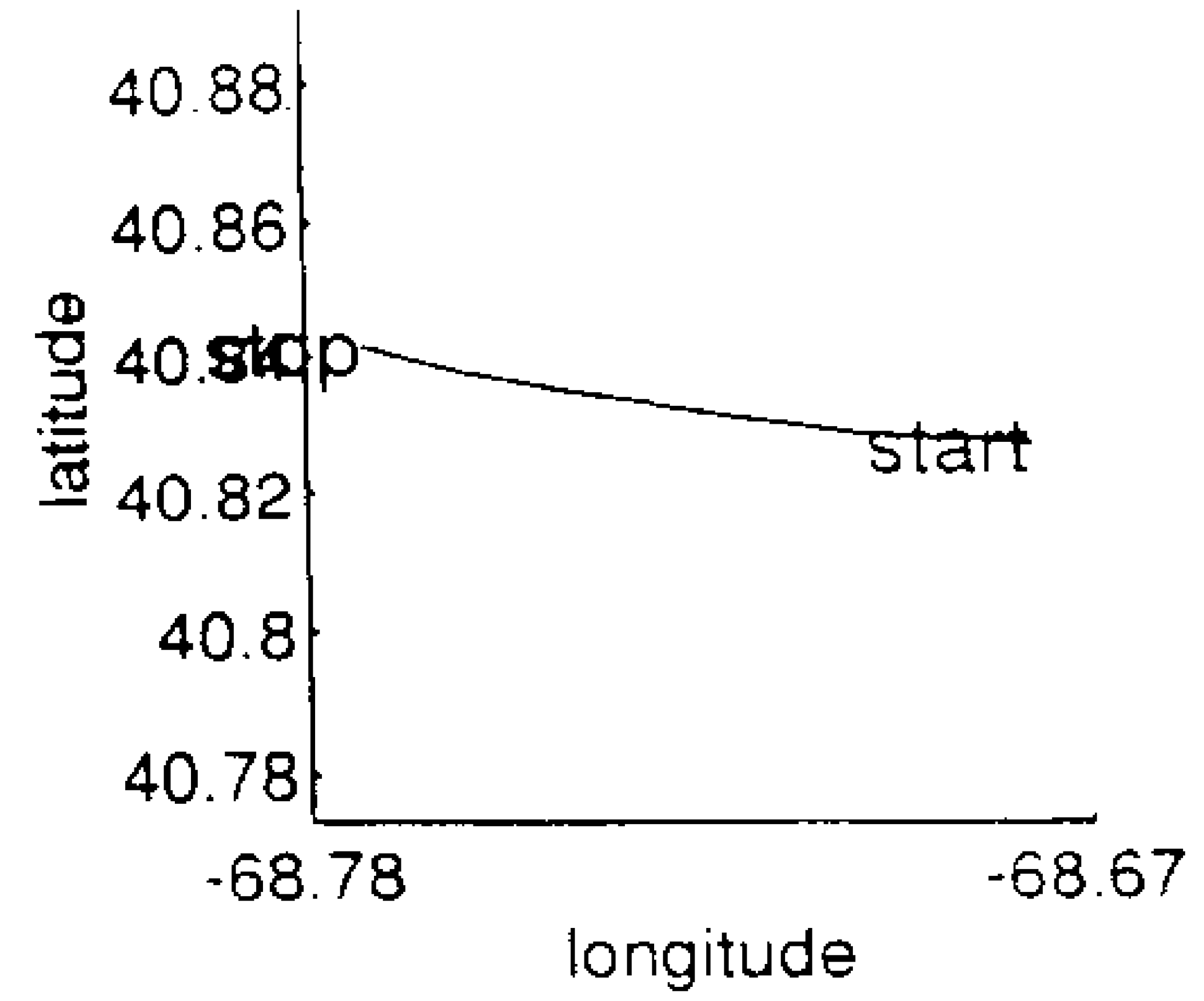
Figure 38. AL9205 MarkV CTD transect. See position, time (local), and statistics above. Note units for temperature, salinity, density, and fluorescence are degC, psu, sigmat, adn volts, respectively.

Transect# 18

Cross-GSC w/GB#37

start time:	5/28	1406	xint:	1.053
stop time:	5/28	1531	yint:	2

variable	mean	min	max	stderr
temp	7.043	6.96	7.92	0.0291
salt	32.32	32.29	32.36	0.0047
density	25.32	25.22	25.34	0.005
flur	1.065	0.25	1.71	0.1236



From: 40 49.64 N 68 40.78 W
To: 40 50.49N 68 46.43 W

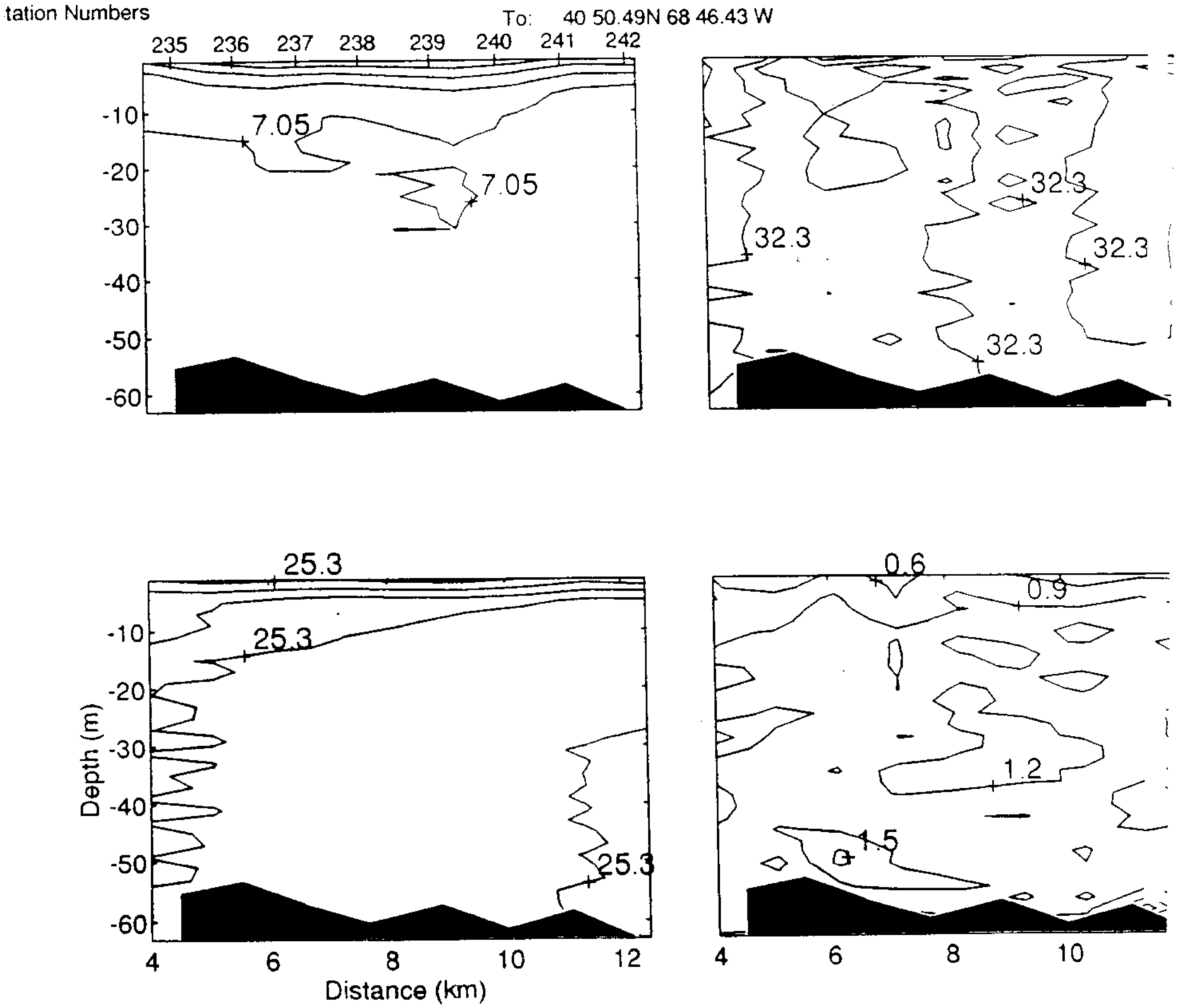


Figure 39. AL9205 MarkV CTD transect. See position, time (local), a statistics above. Note units for temperature, salinity, density, ar fluorescence are degC, psu, sigmat, adn volts, respectively.

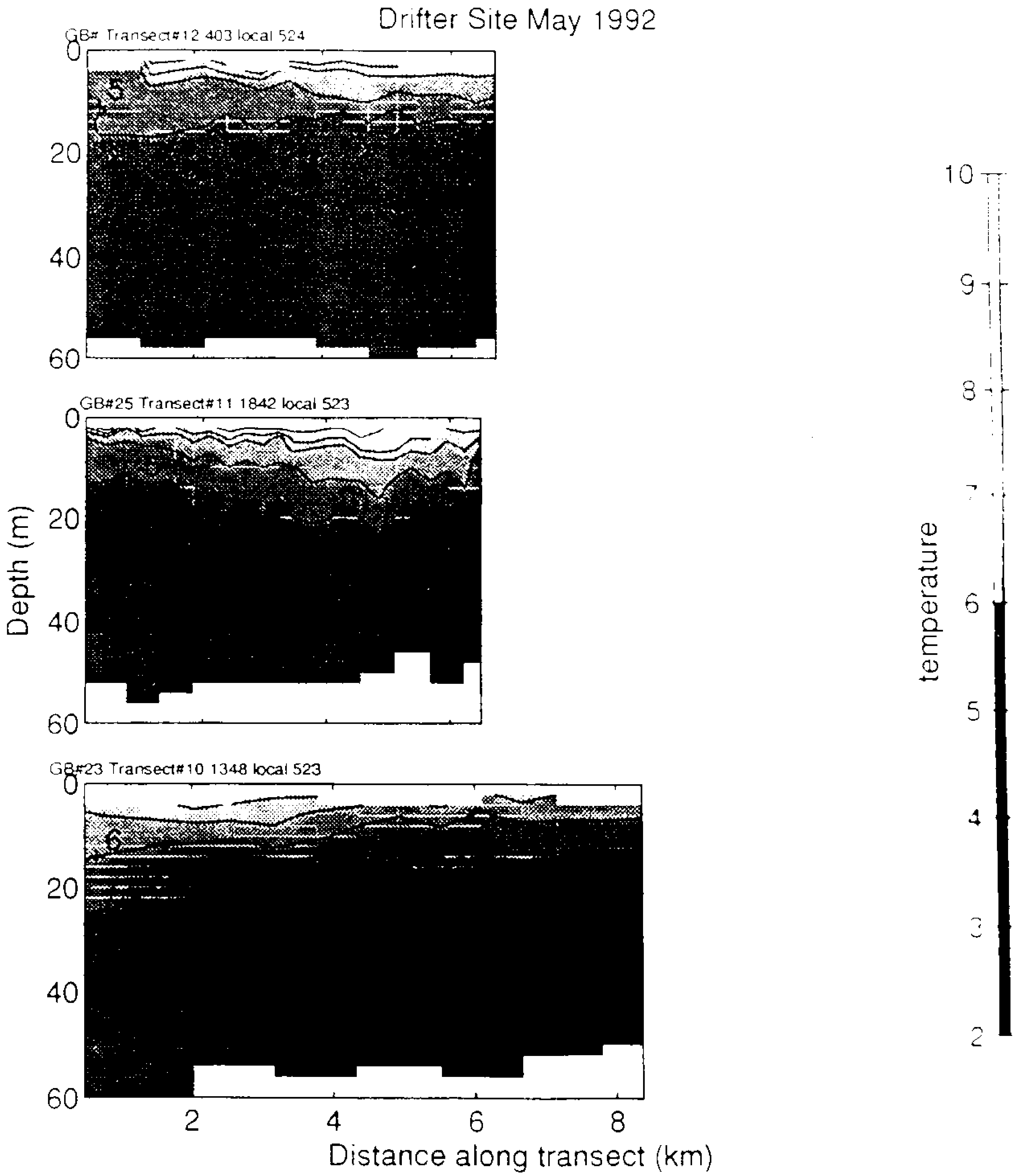


Figure 40. Cross-sections at the drifter site.

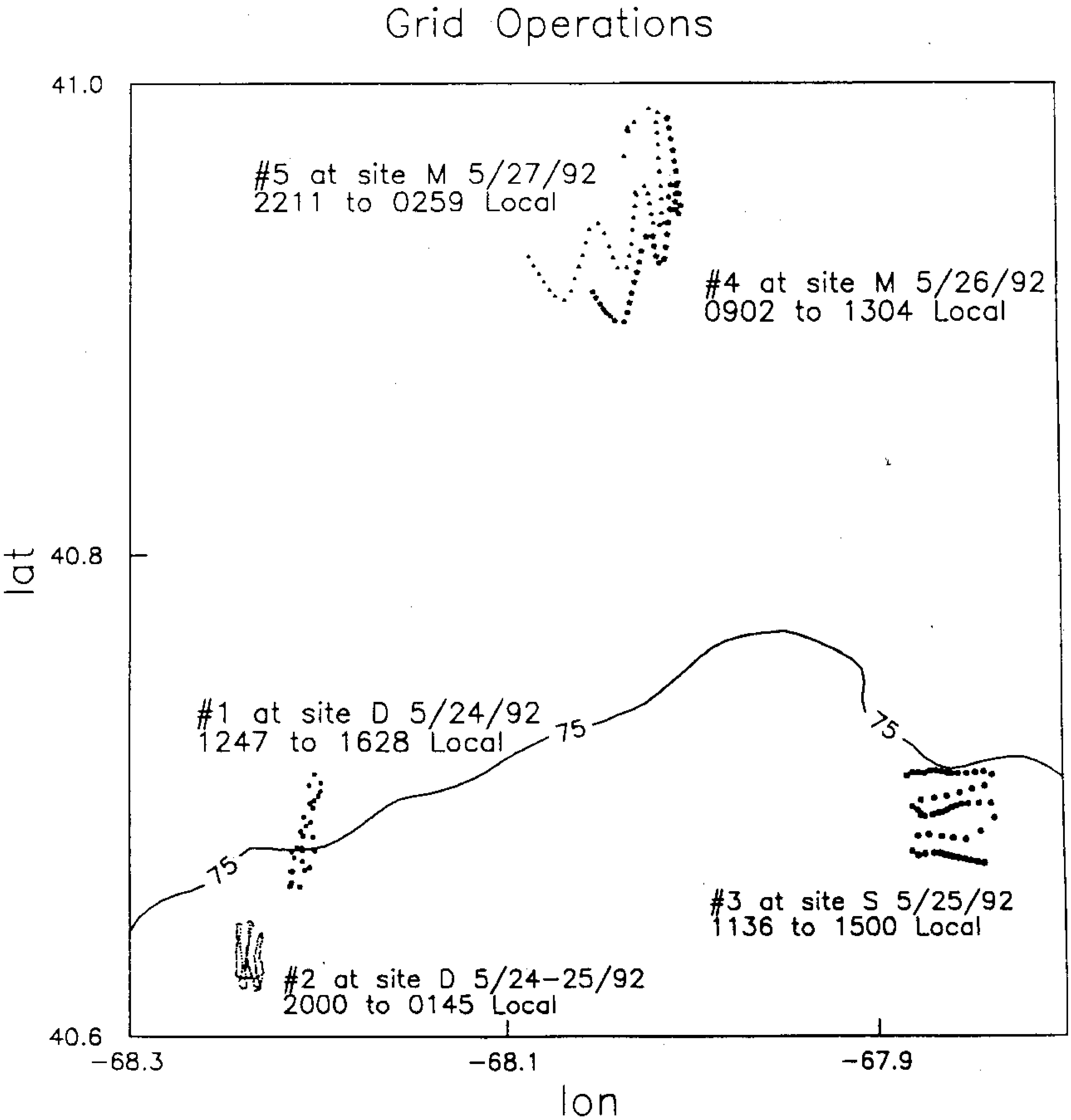


Figure 41. Summary of the grid operations.

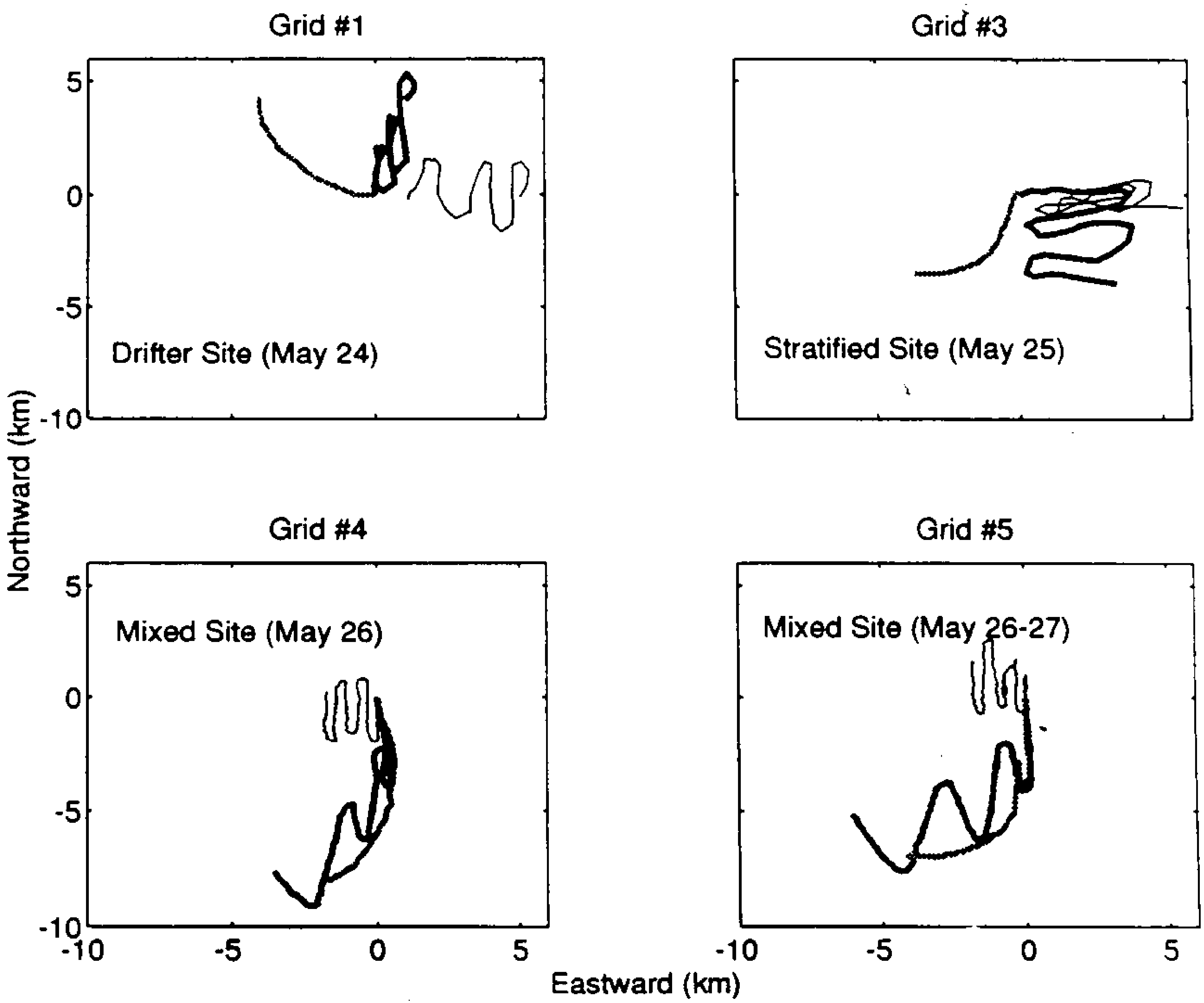


Figure 42. Grid paths in both geographic and Lagrangian coordinates.

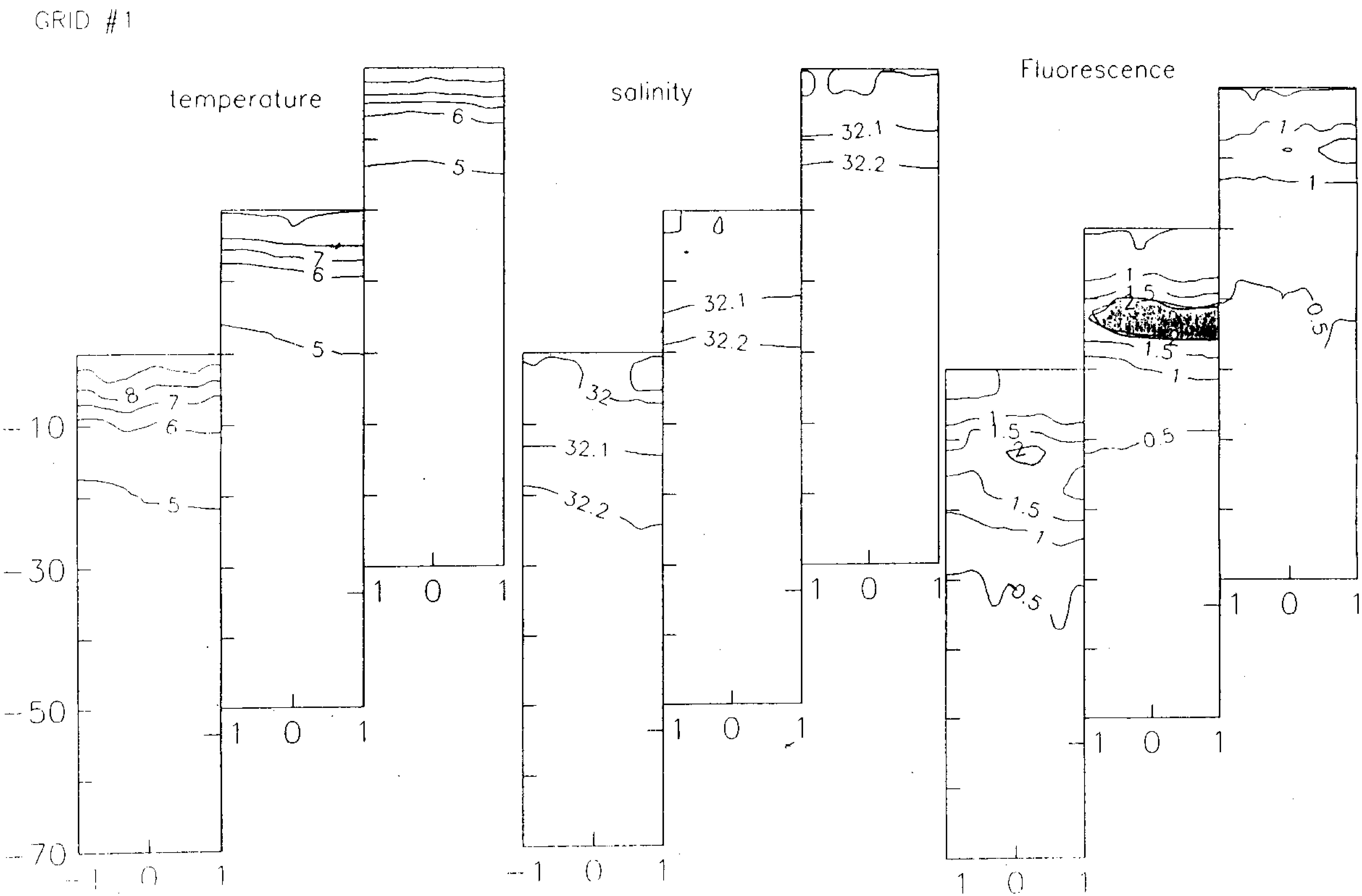


Figure 43. Vertical and horizontal stucture of "Grid #1" in Lagrangian reference frame. The x-axis is positive (kms) to the east, the y-axis is depth (m), and the third dimension is positive to the north.

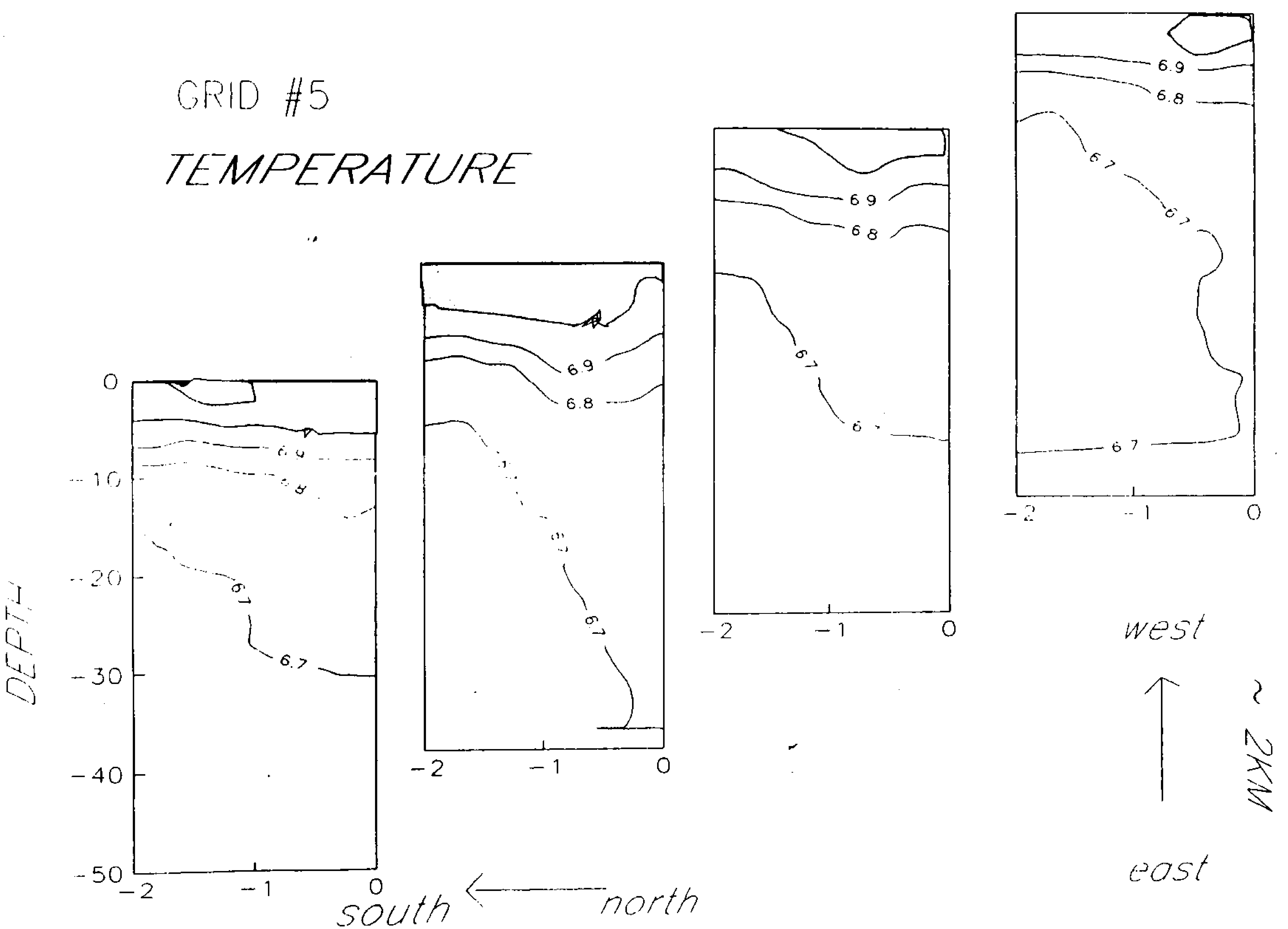


Figure 44. Four temperature transects of Grid #5 in Lagrangian coordinate space.

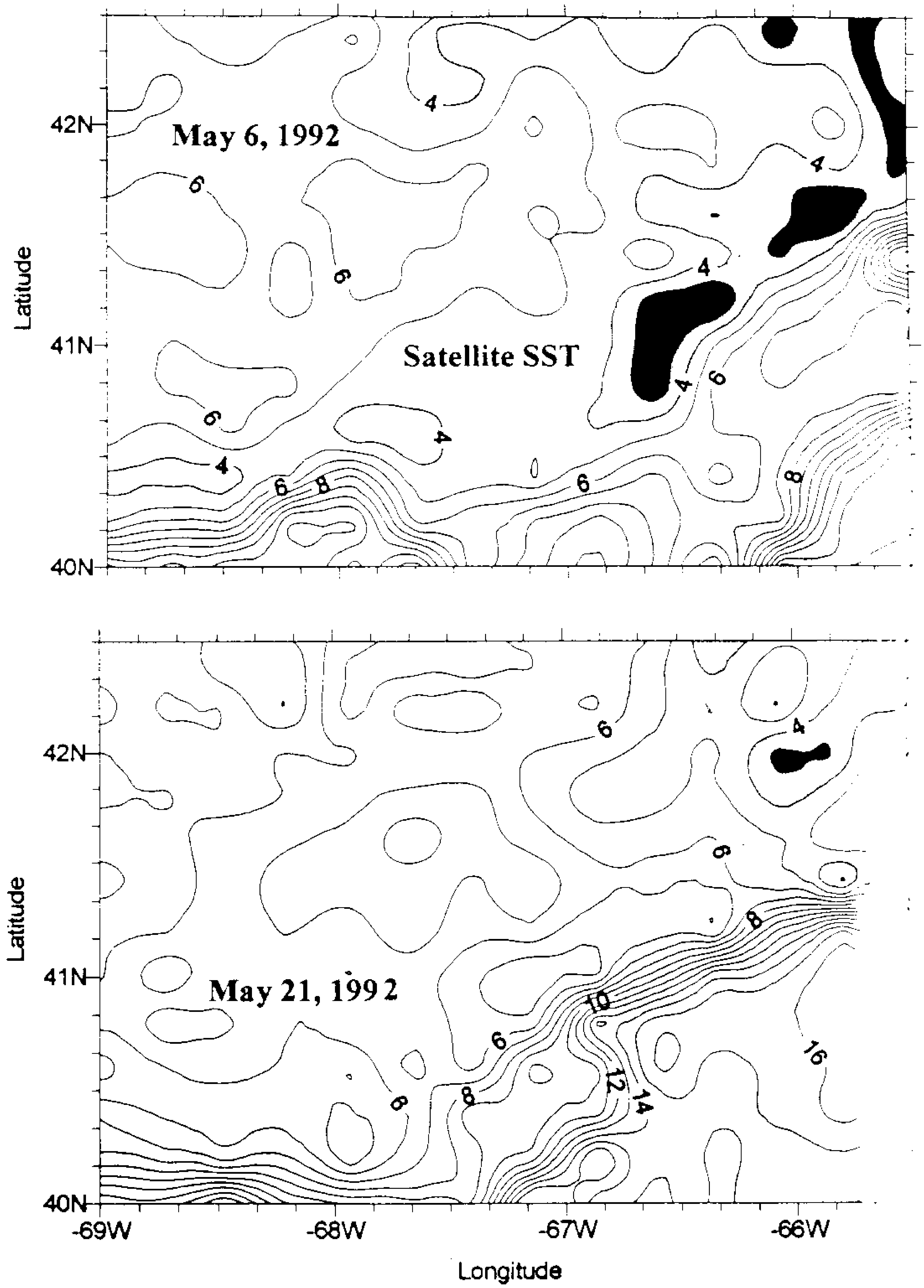


Figure 45. Satellite figures for May 6 and May 21, 1992.

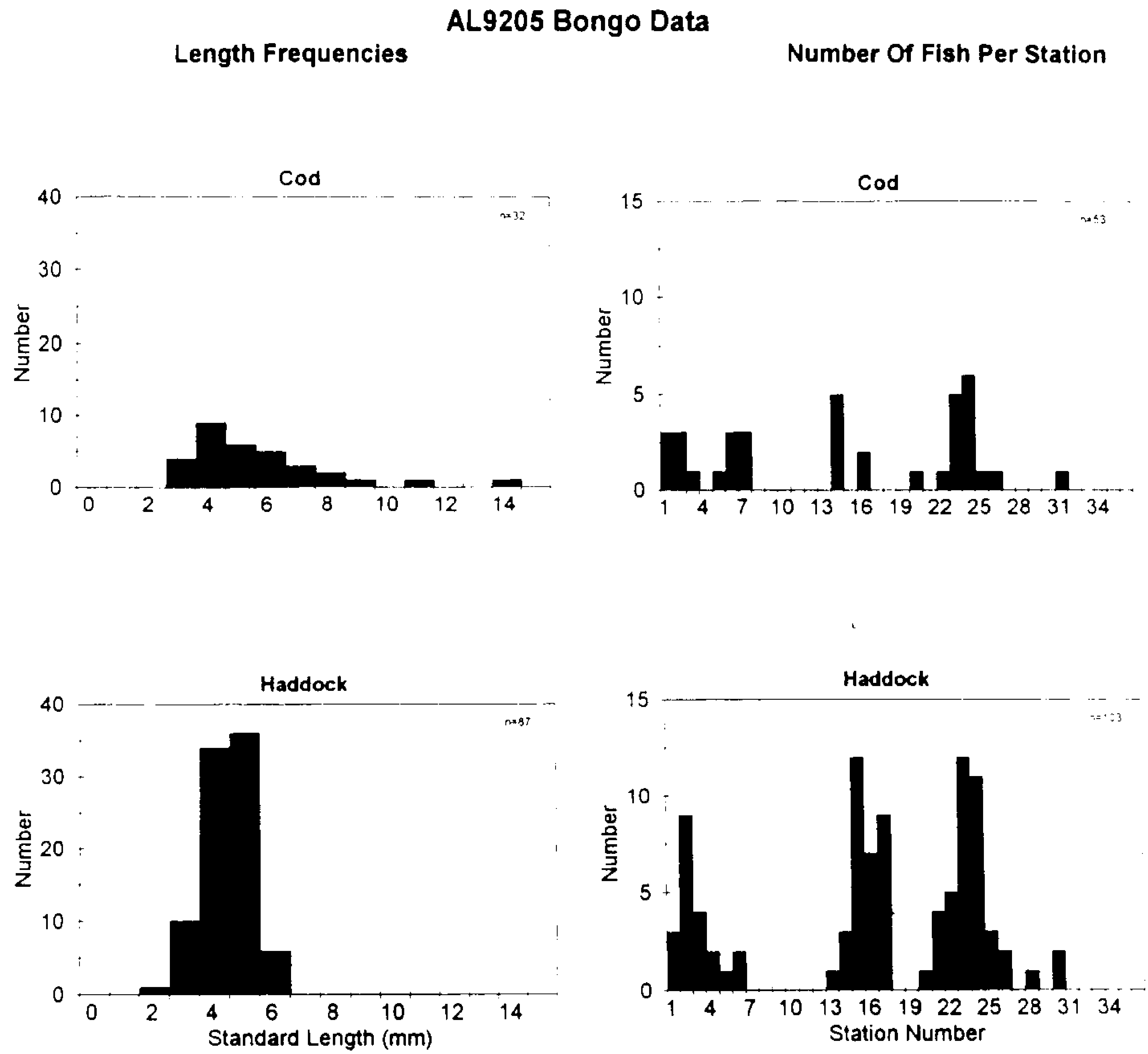
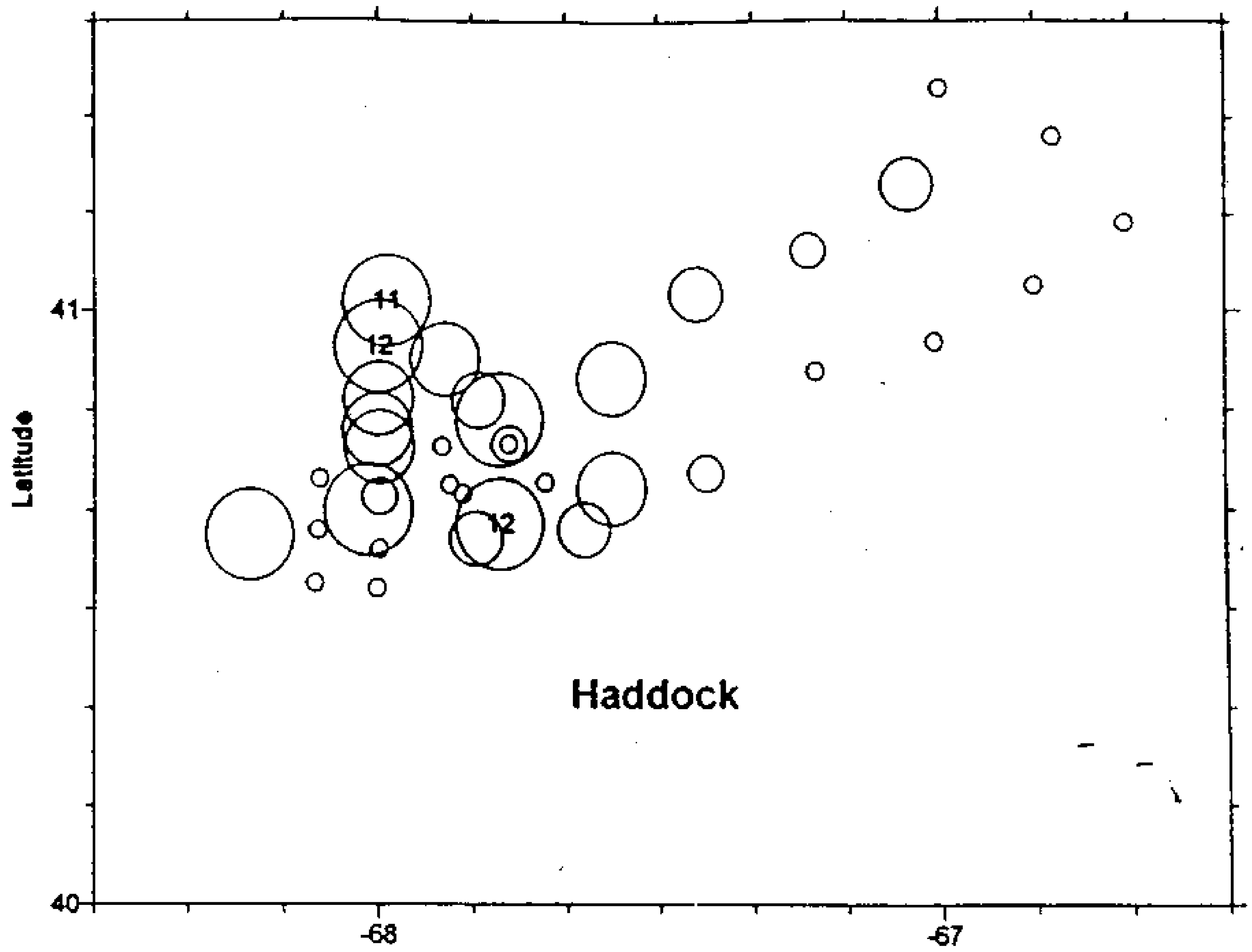


Figure 46. Length frequencies and #fish per haul



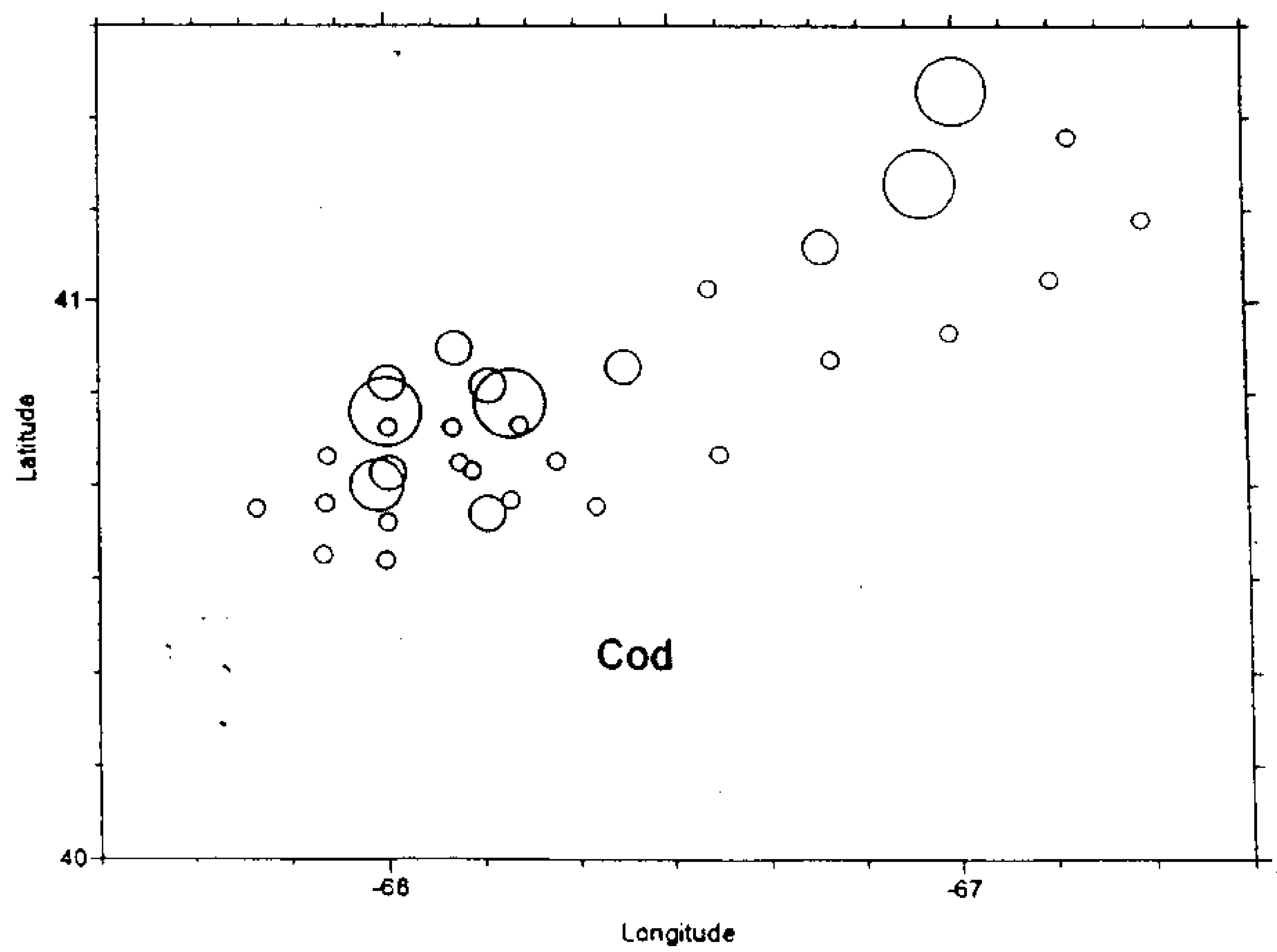


Figure 47. Relative catch per tow on AL9205 Bongo survey.

Data Report: AL9204 and AL9205

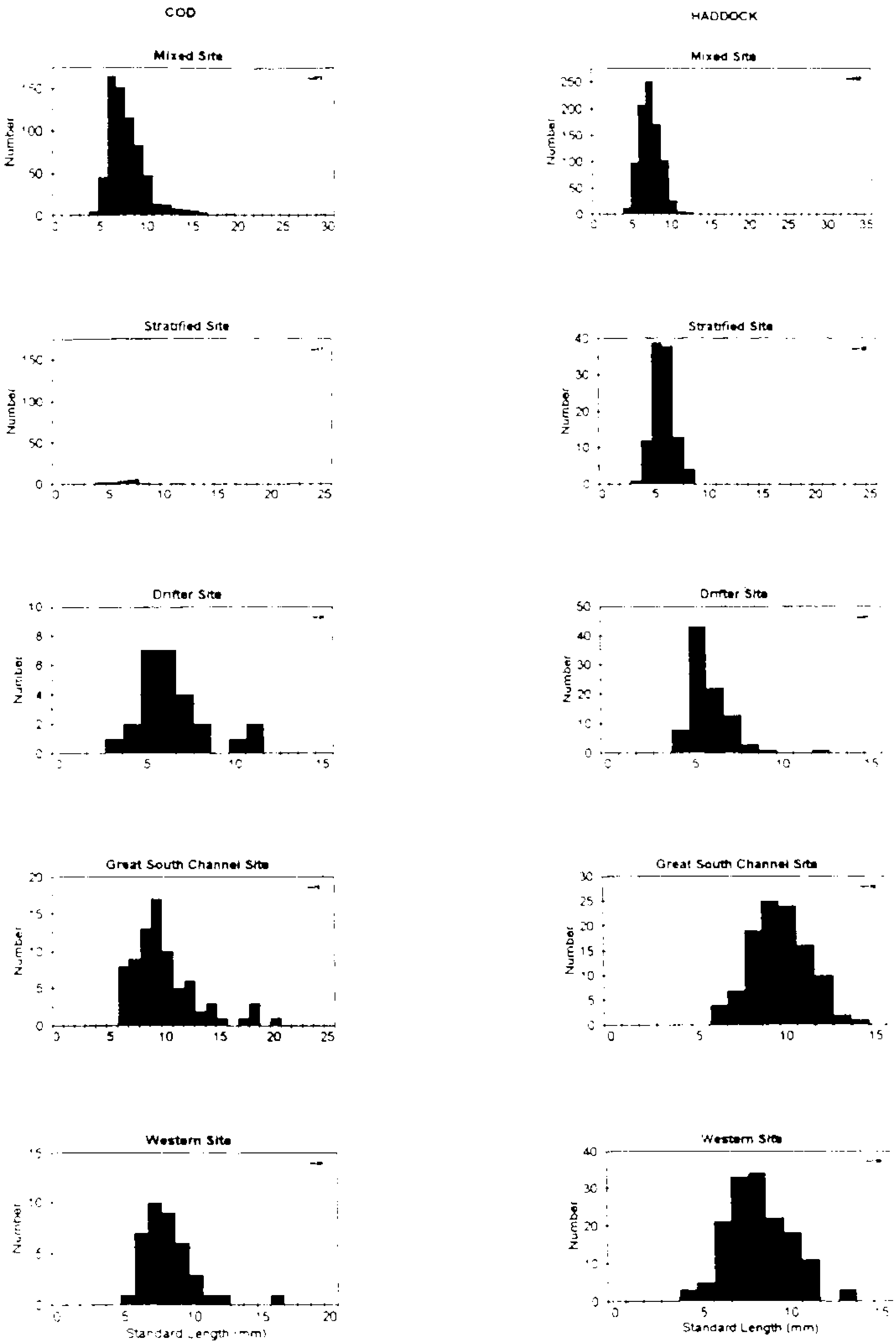


Figure 48. MOCNESS length frequency distributions for cod and haddock.

Data Report: AL9204 and AL9205

Up Hauls **Down Hauls**

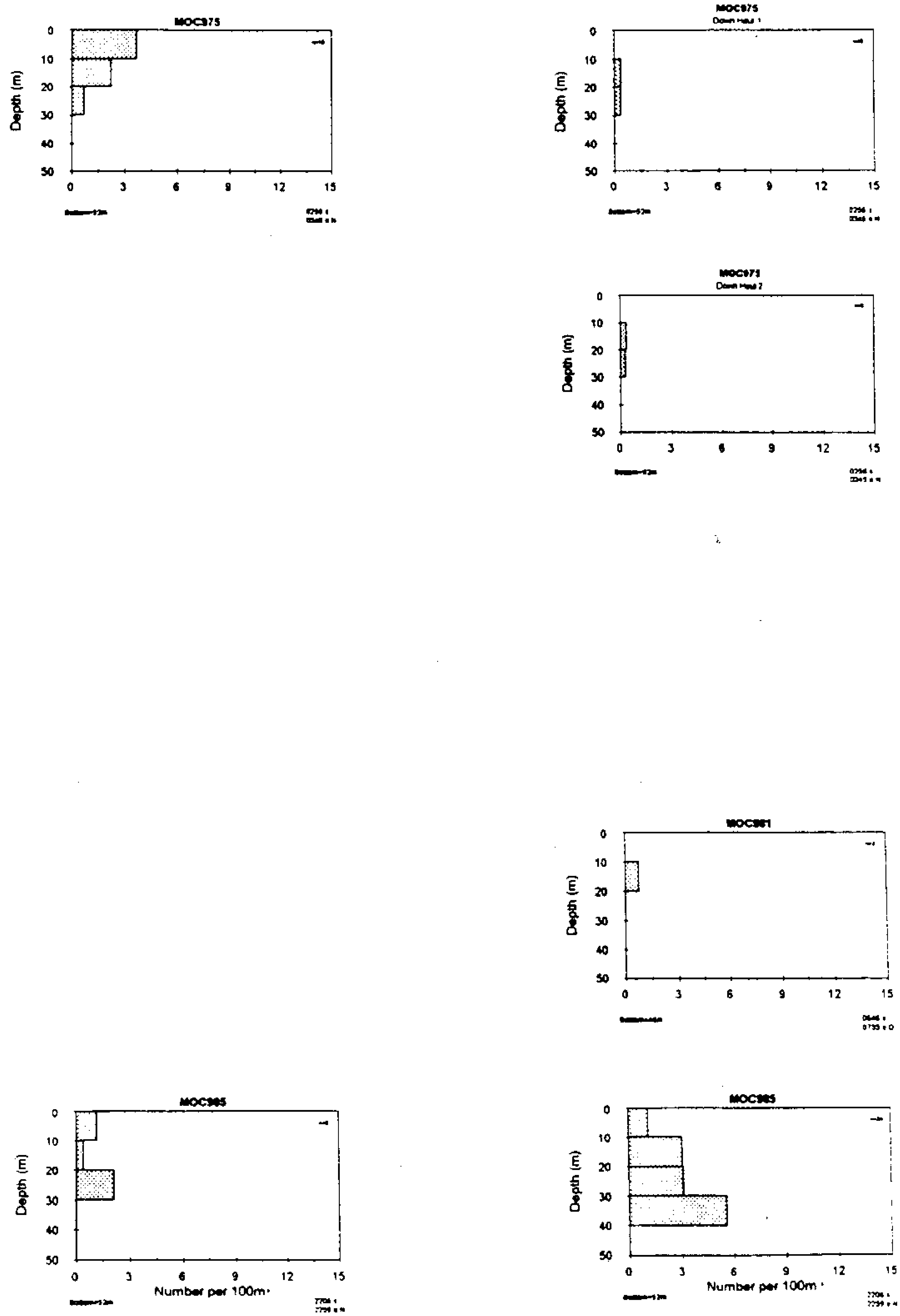


Figure 49. AL9205- egg distribution at the mixed site.

Data Report: AL9204 and AL9205

Up Hauls **Down Hauls**

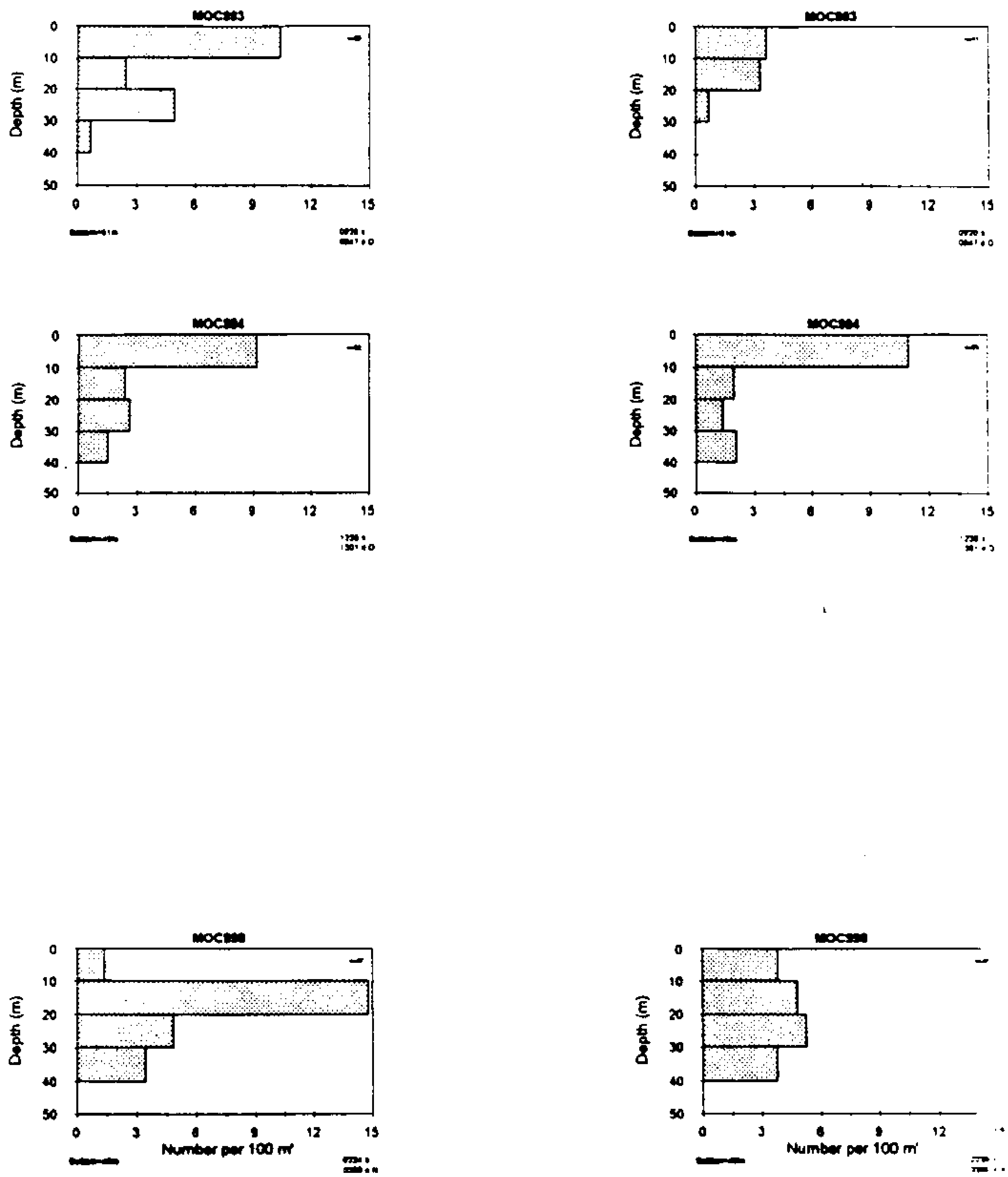


Figure 49b.AL9205- egg distribution at the mixed site.

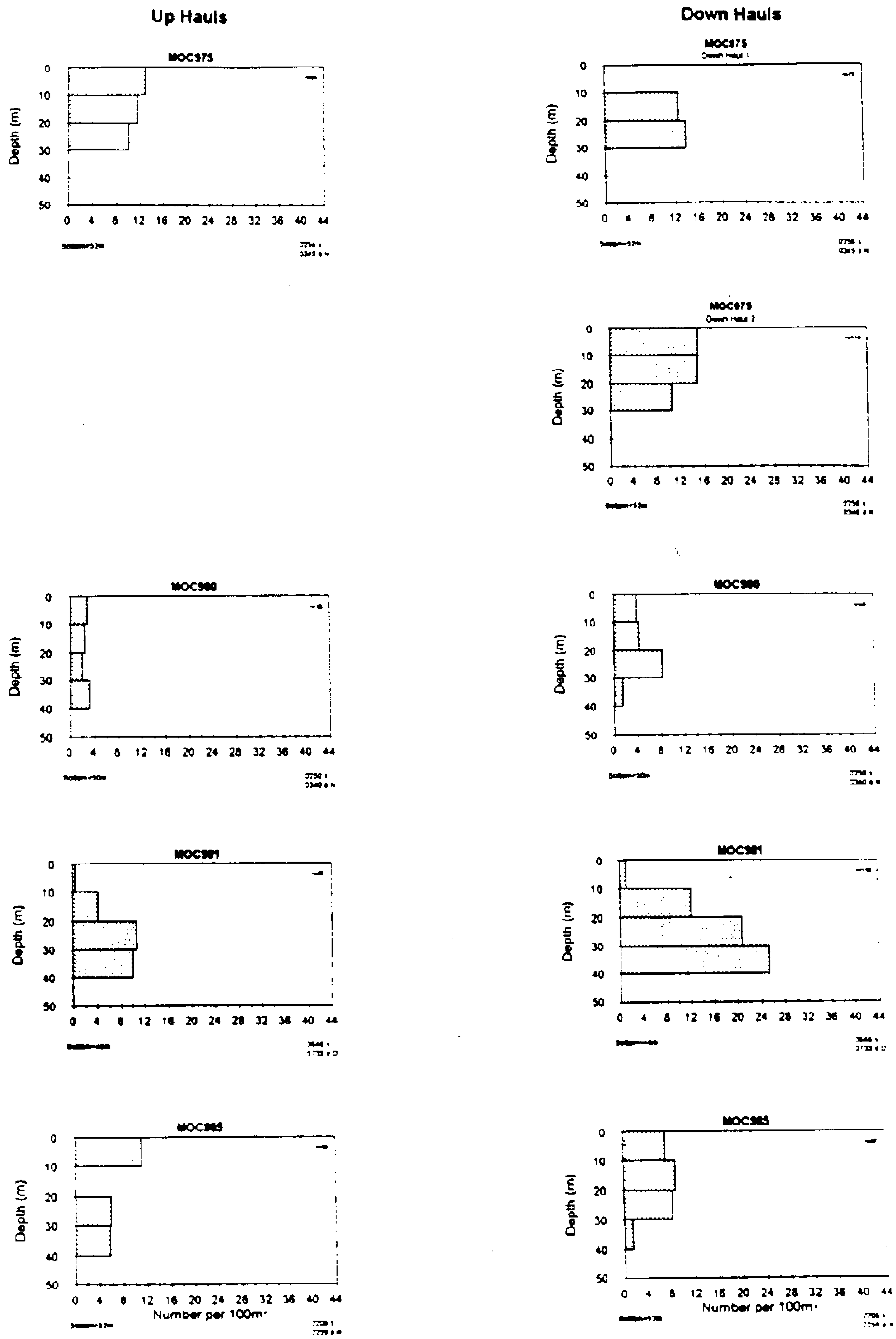


Figure 50a. AL9205- cod distribution at the mixed site.

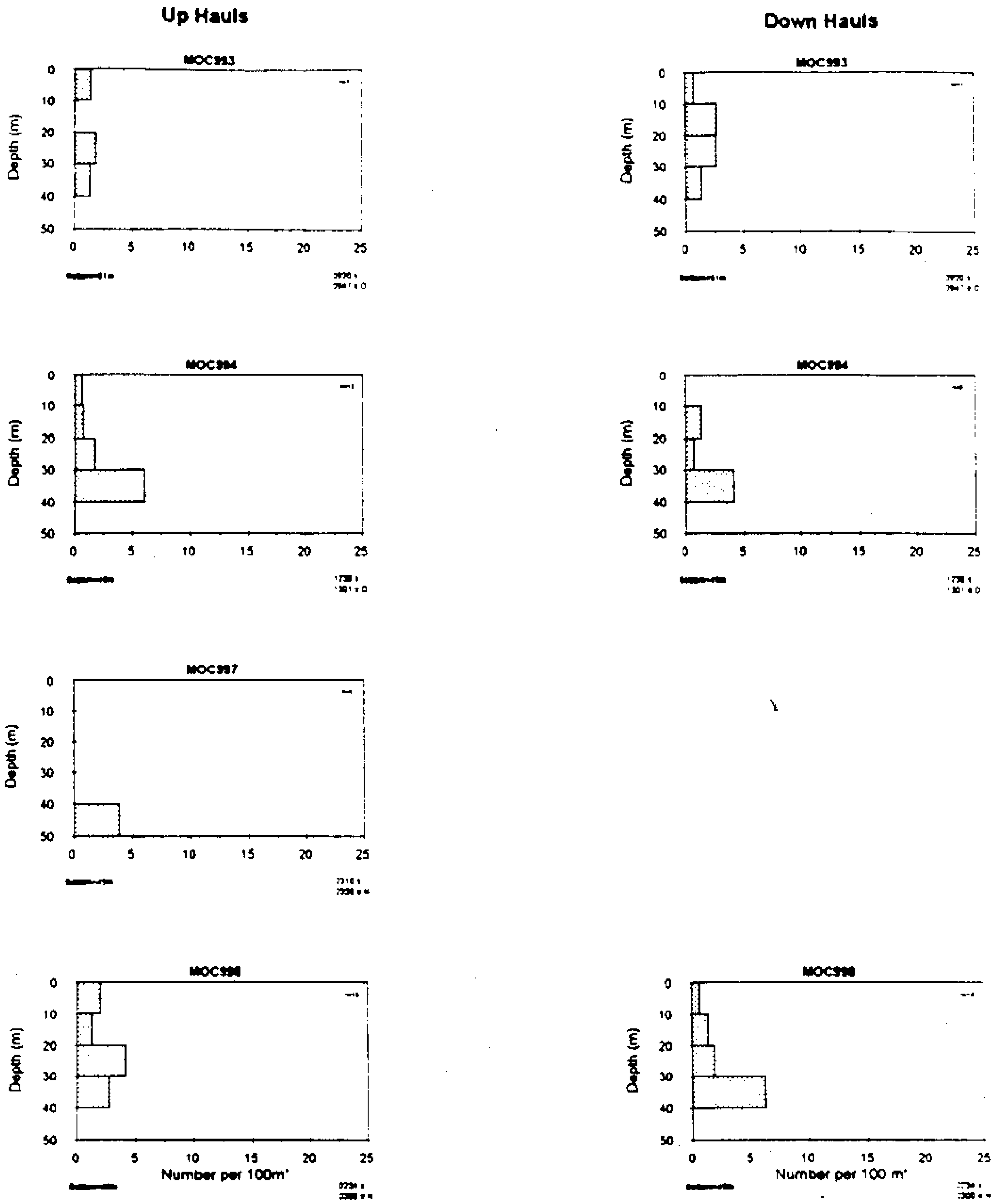


Figure 50b. AL9205- cod distribution at the mixed site.

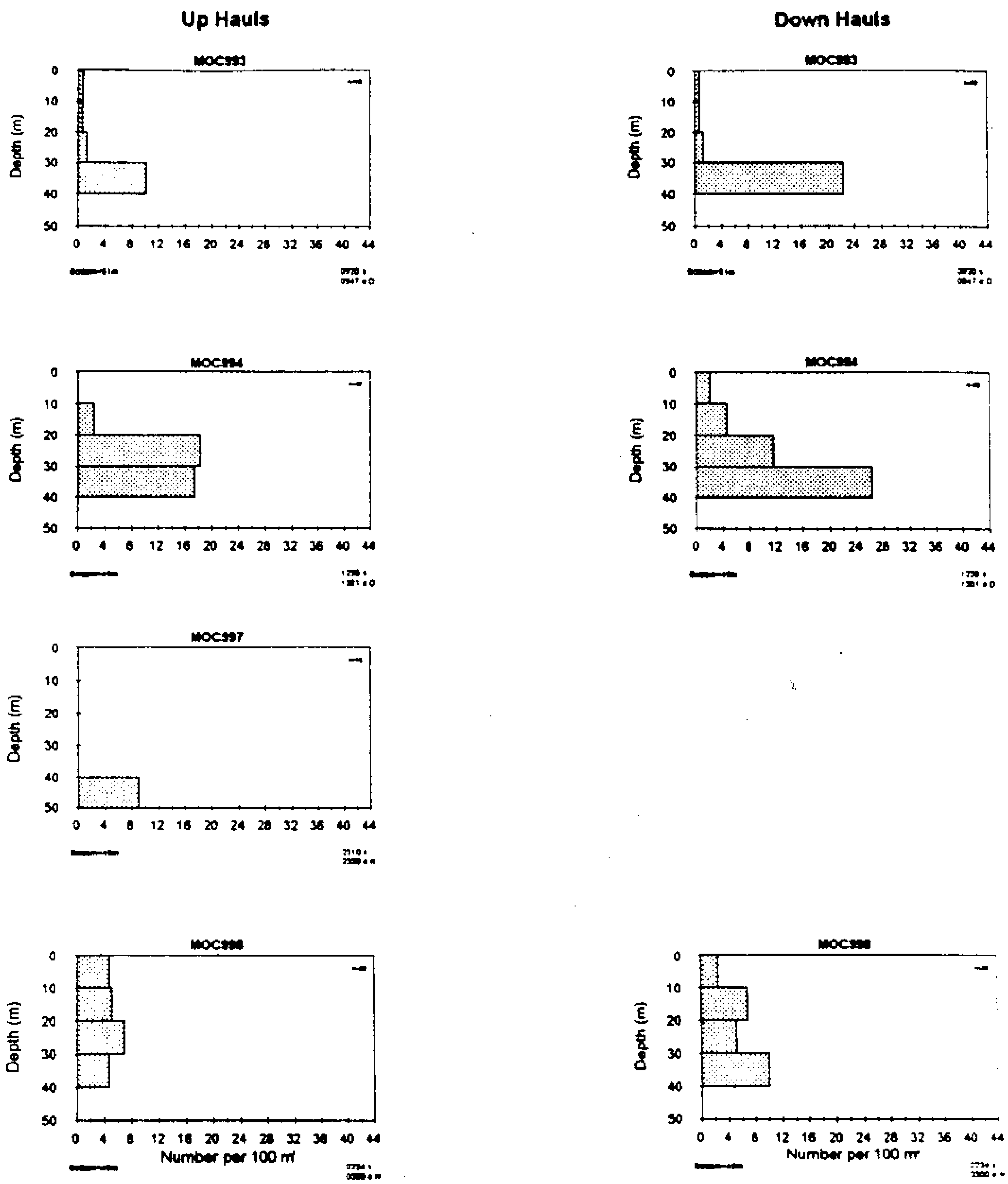


Figure 51a. AL9205- haddock distribution at the mixed site.

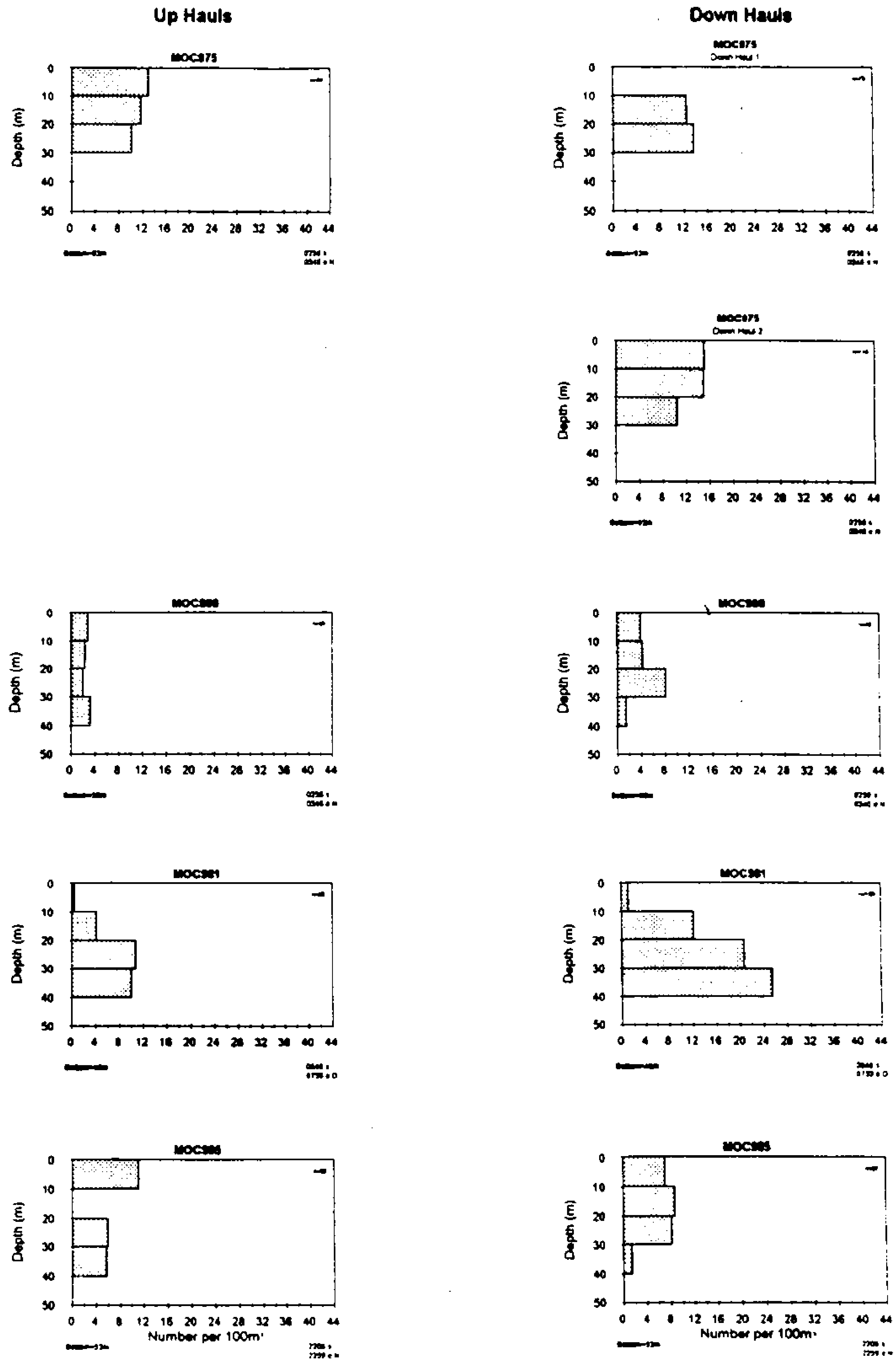


Figure 51b. AL9205- haddock distribution at the mixed site.

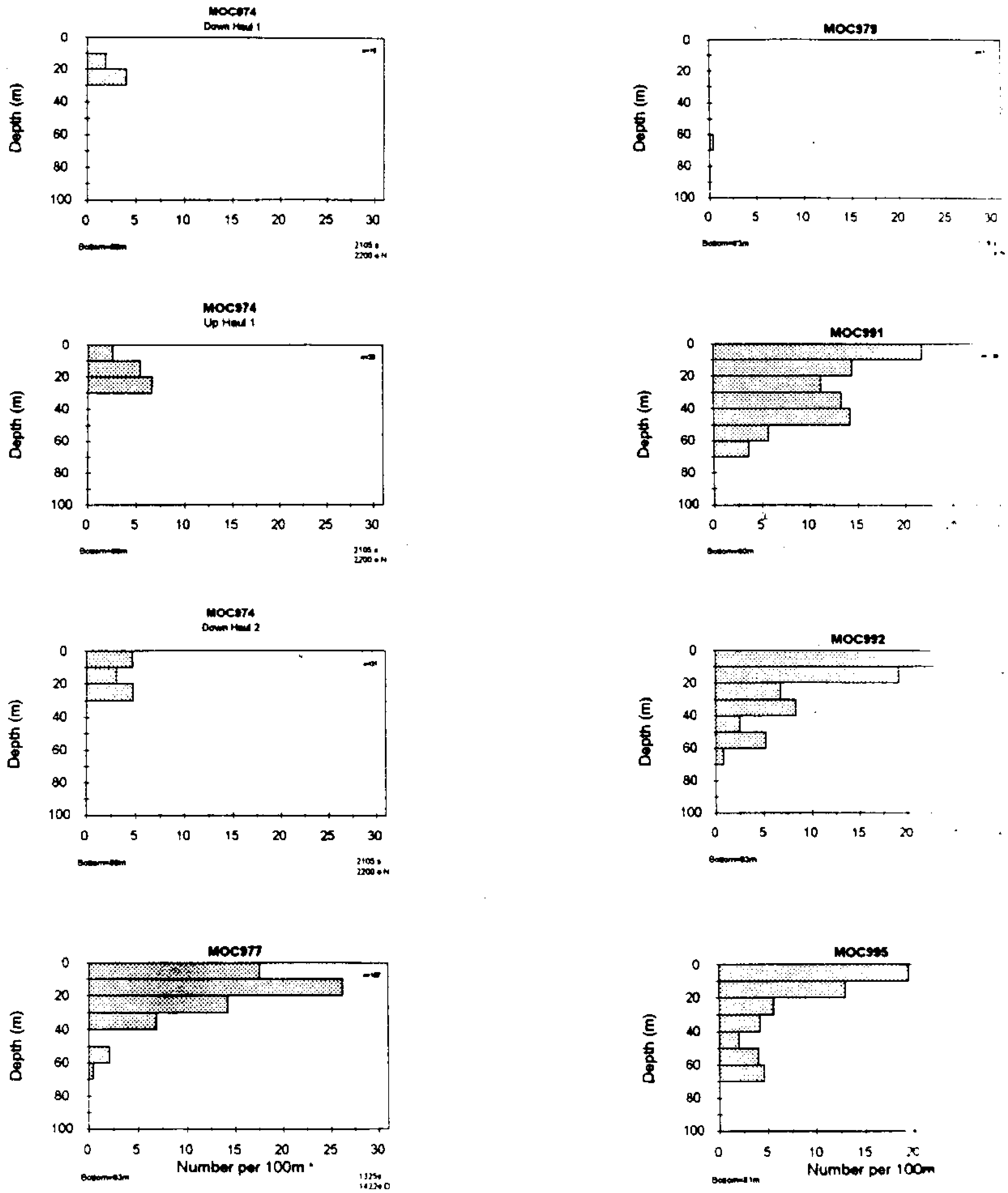


Figure 52. AL9205- egg distribution at the stratified site.

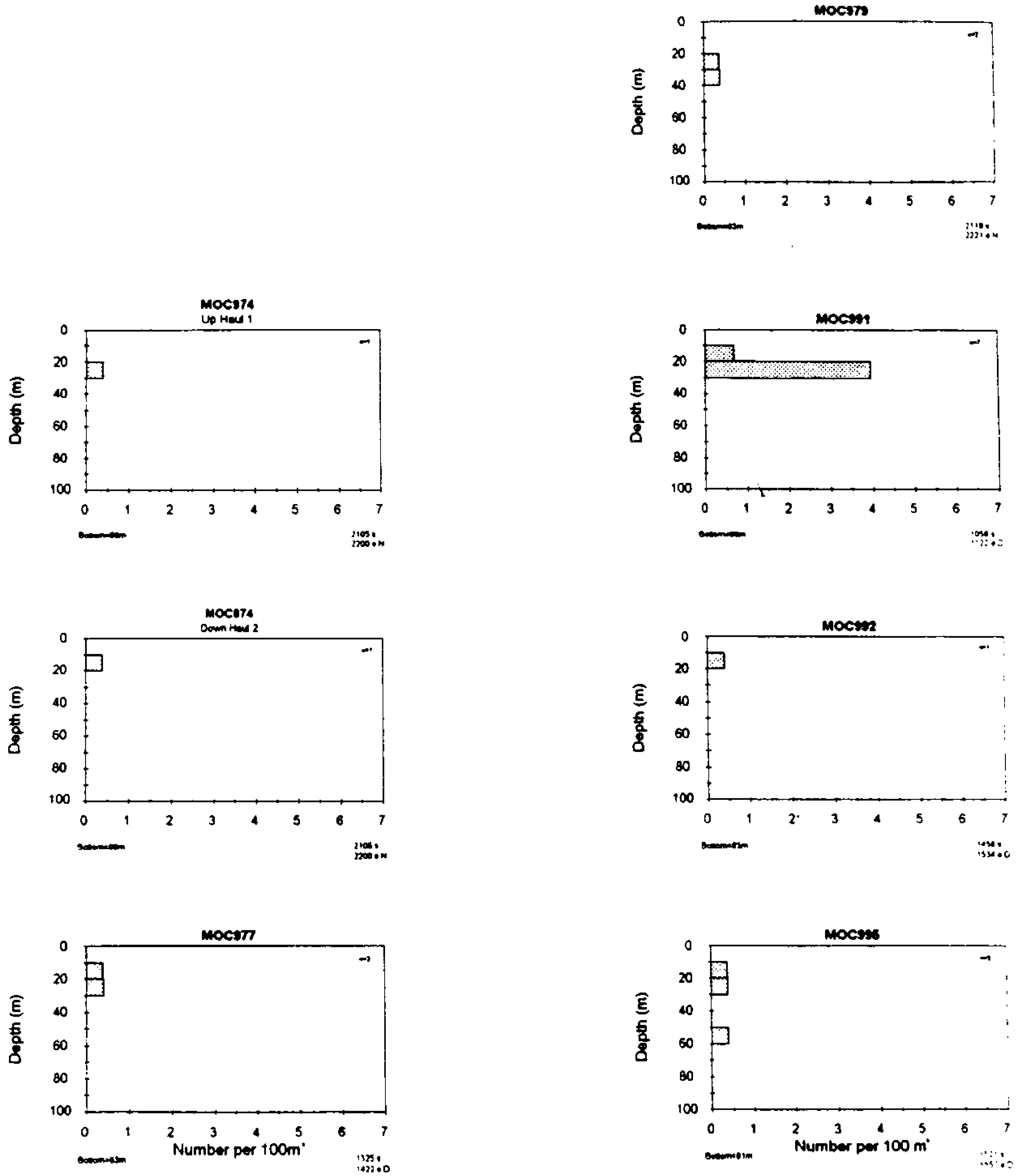


Figure 53. AL9205- cod distribution at the stratified site.

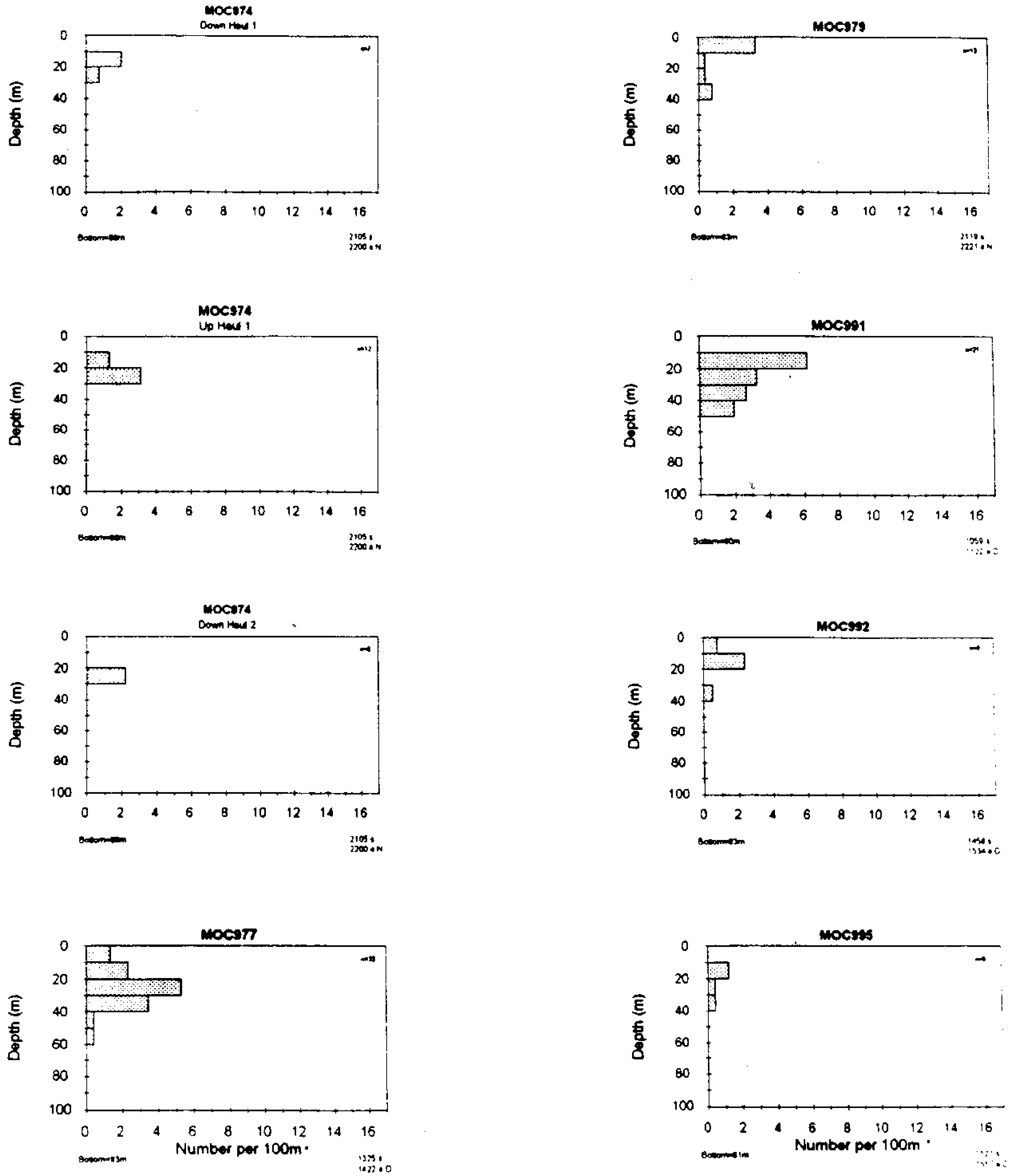


Figure 54. AL9205- haddock distribution at the stratified site.

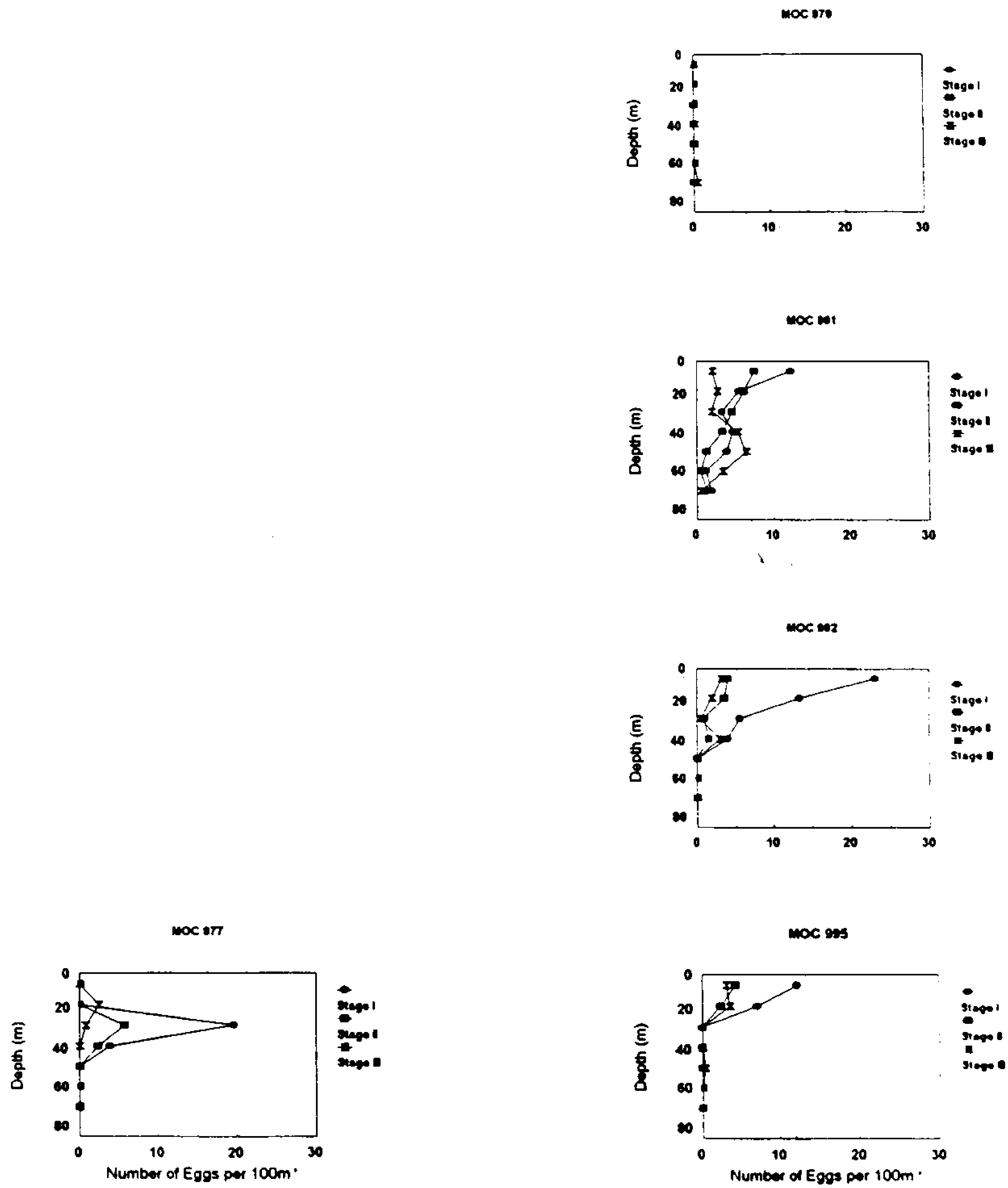


Figure 55. AL9205- egg distribution by stage at the stratified site.

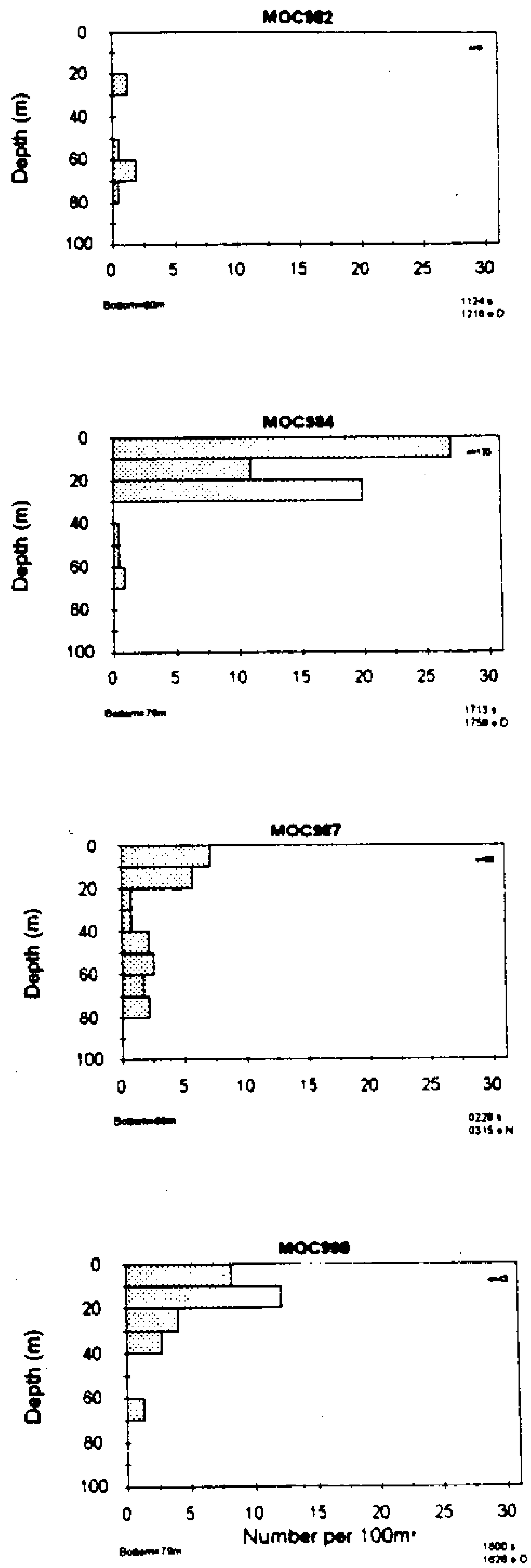


Figure 56. AL9205- egg distribution at the drifter site.

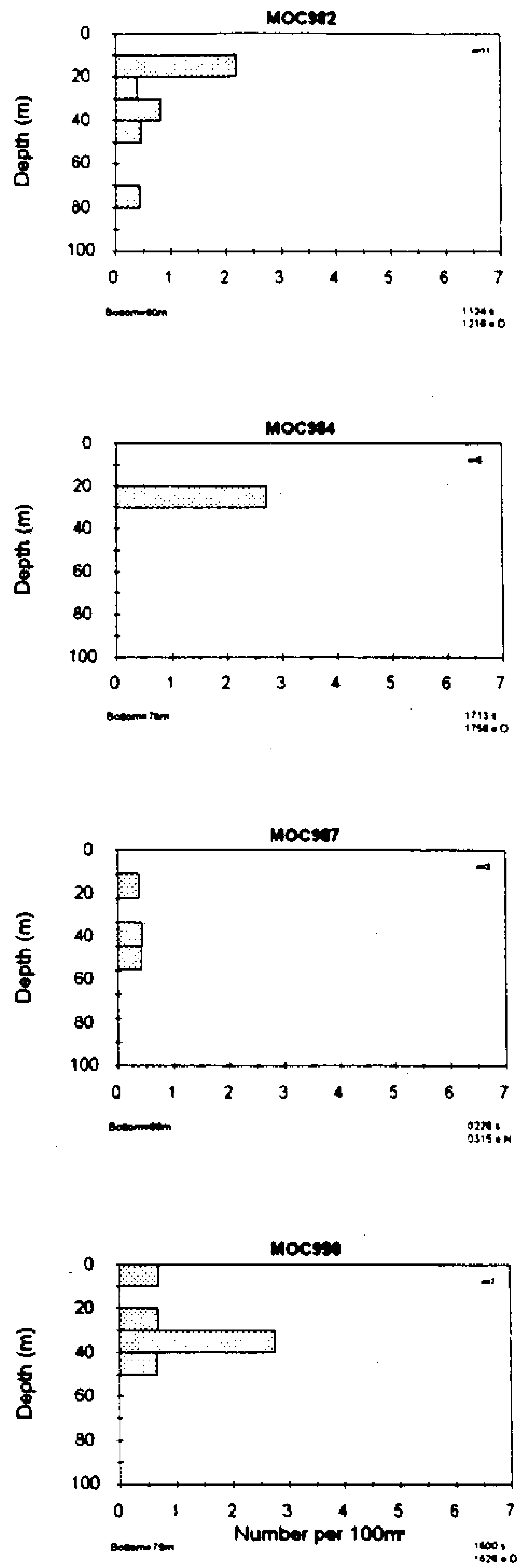


Figure 57. AL9205- cod distribution at the drifter site.

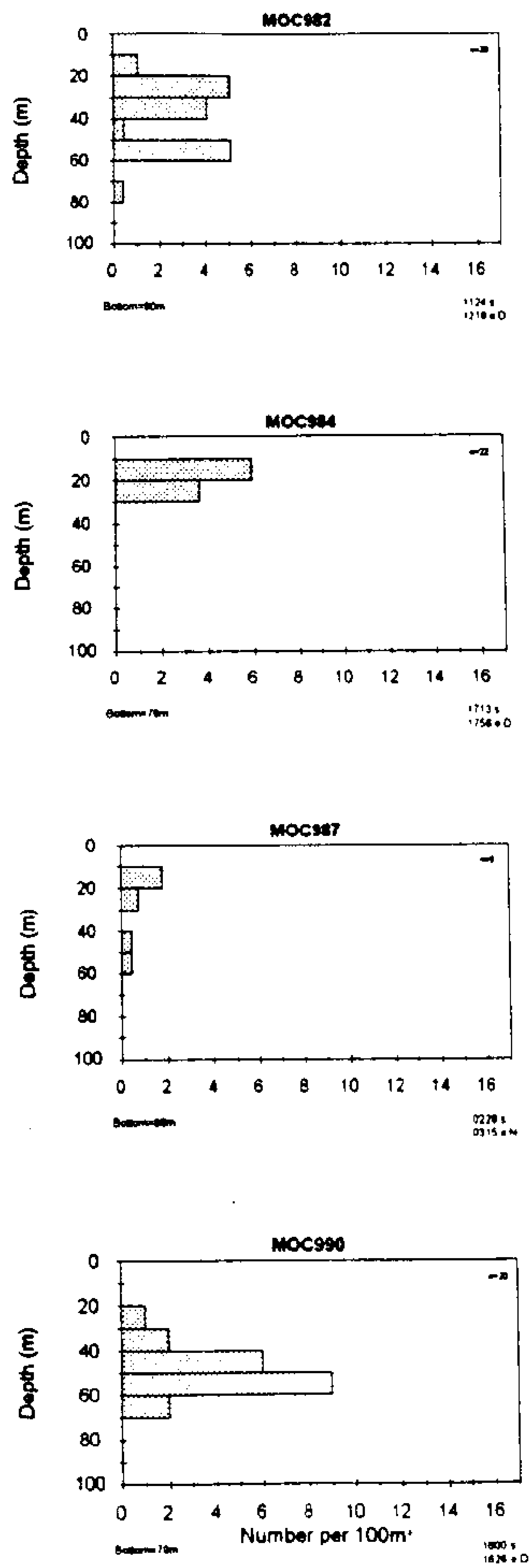


Figure 58. AL9205- haddock distribution at the drifter site.

Data Report: AL9204 and AL9205

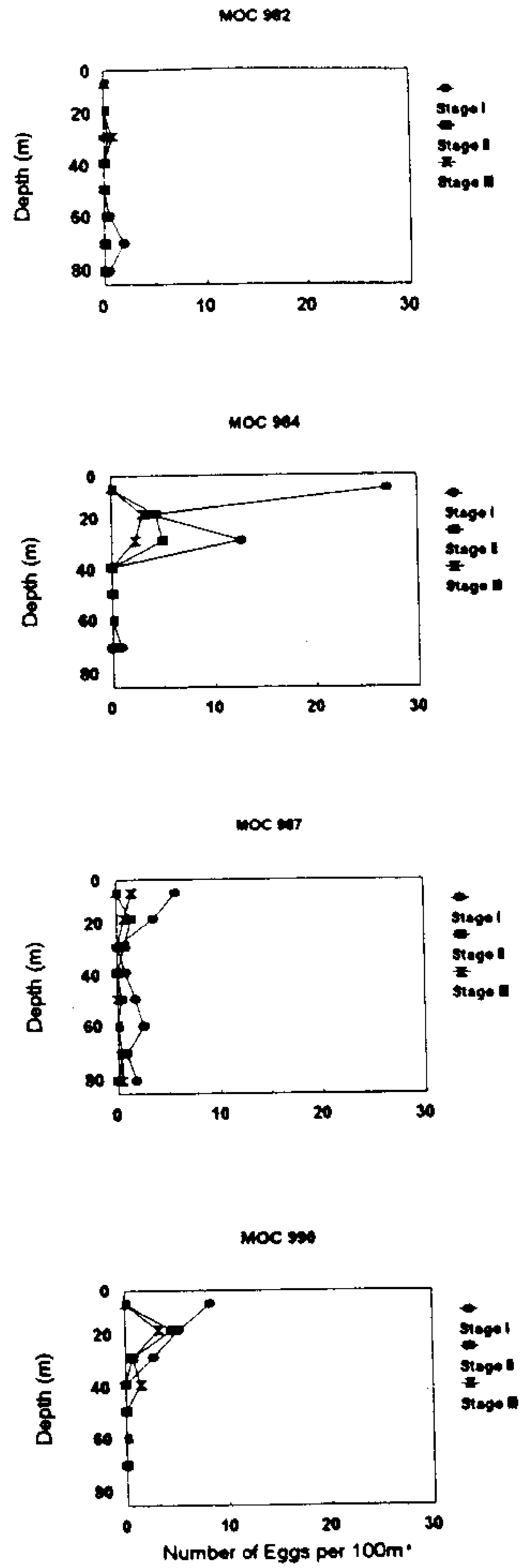


Figure 59. AL9205- egg distribution by stage at the drifter site.

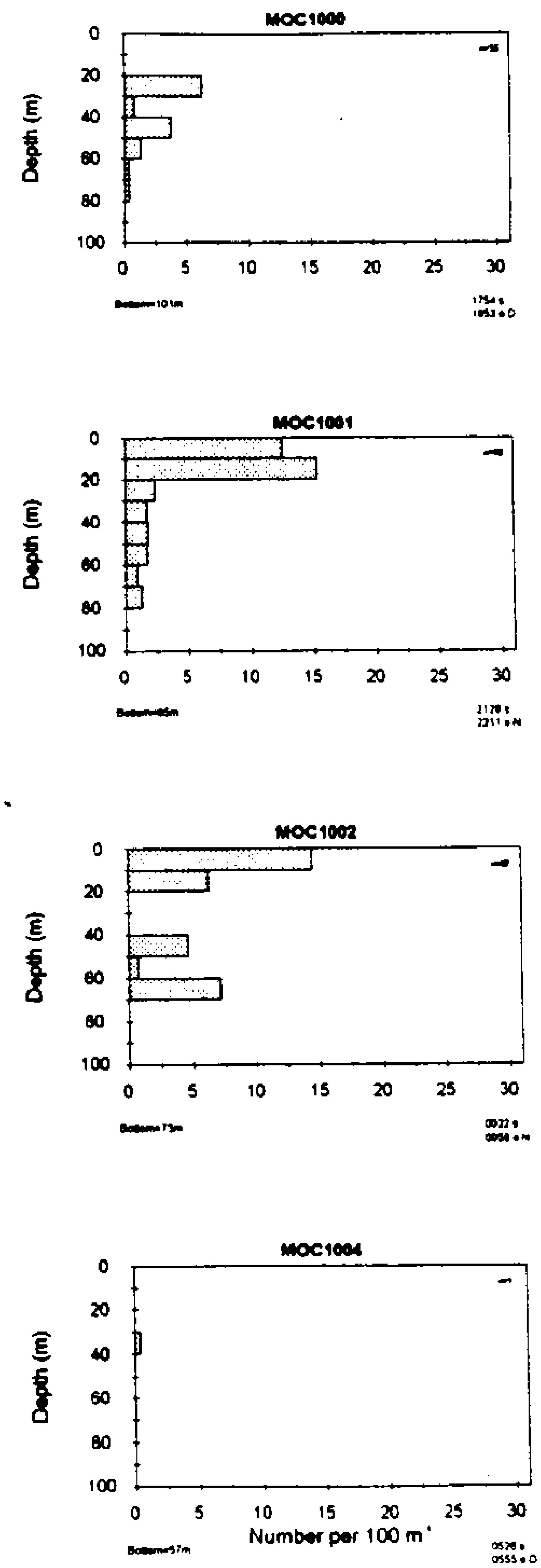


Figure 60. AL9205- egg distribution at the Western site.

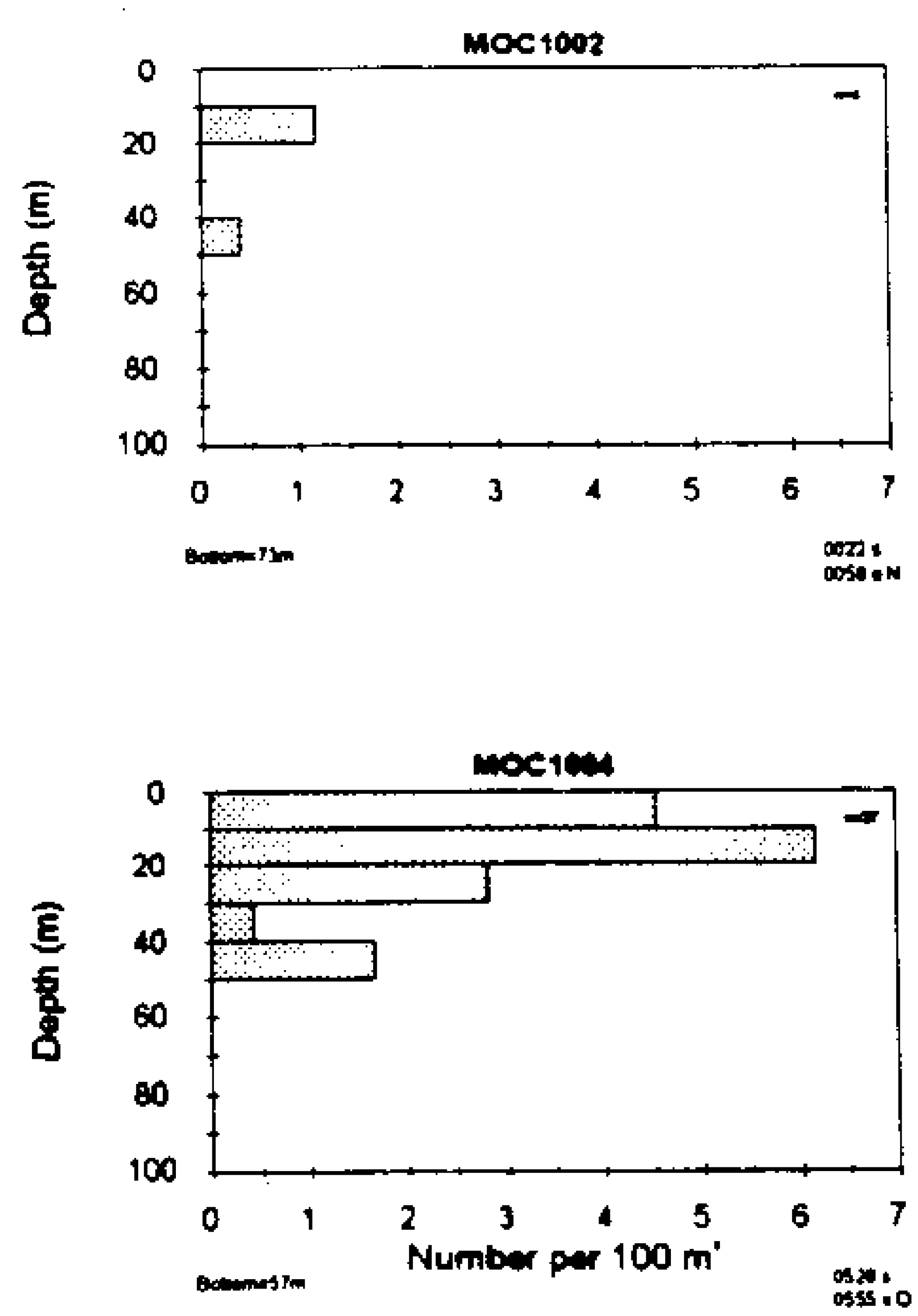


Figure 61. AL9205- cod distribution at the Western site.

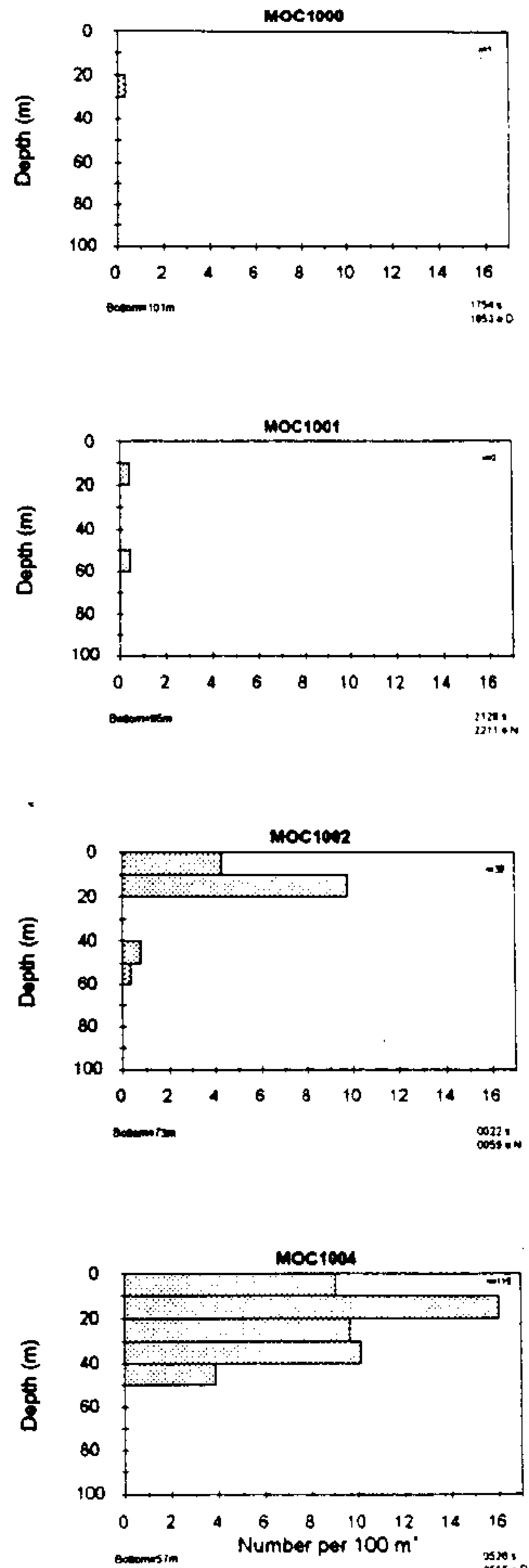
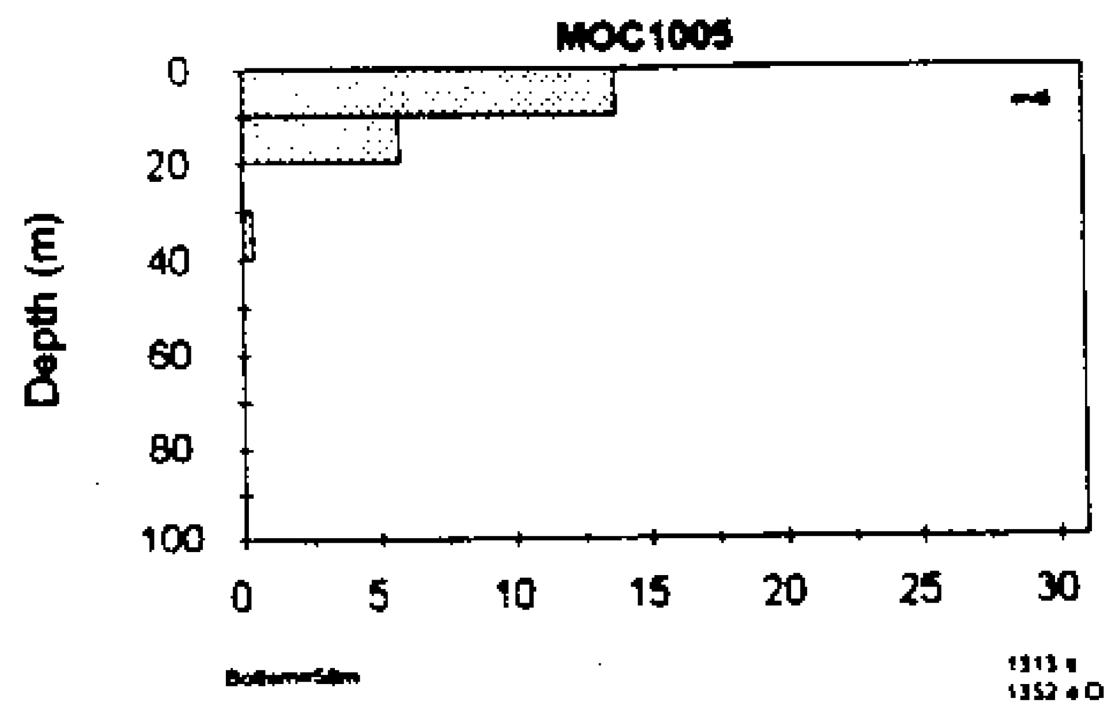


Figure 62. AL9205- haddock distribution at the Western site.



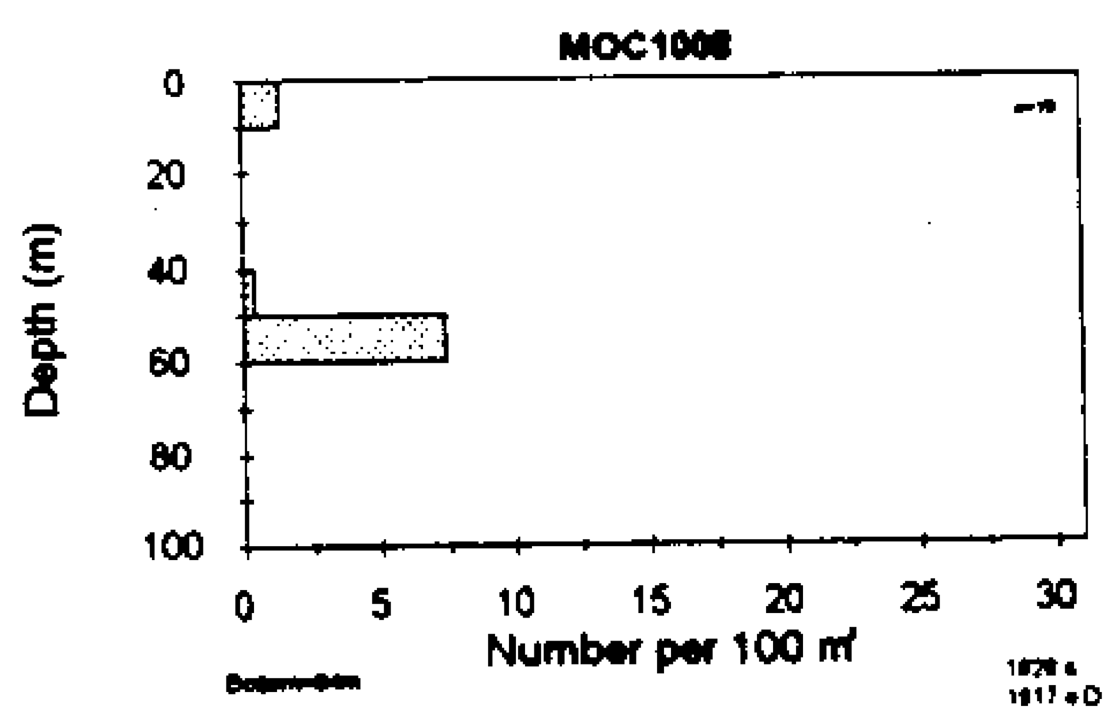


Figure 63. AL9205- egg distribution at the Great South Channel site.

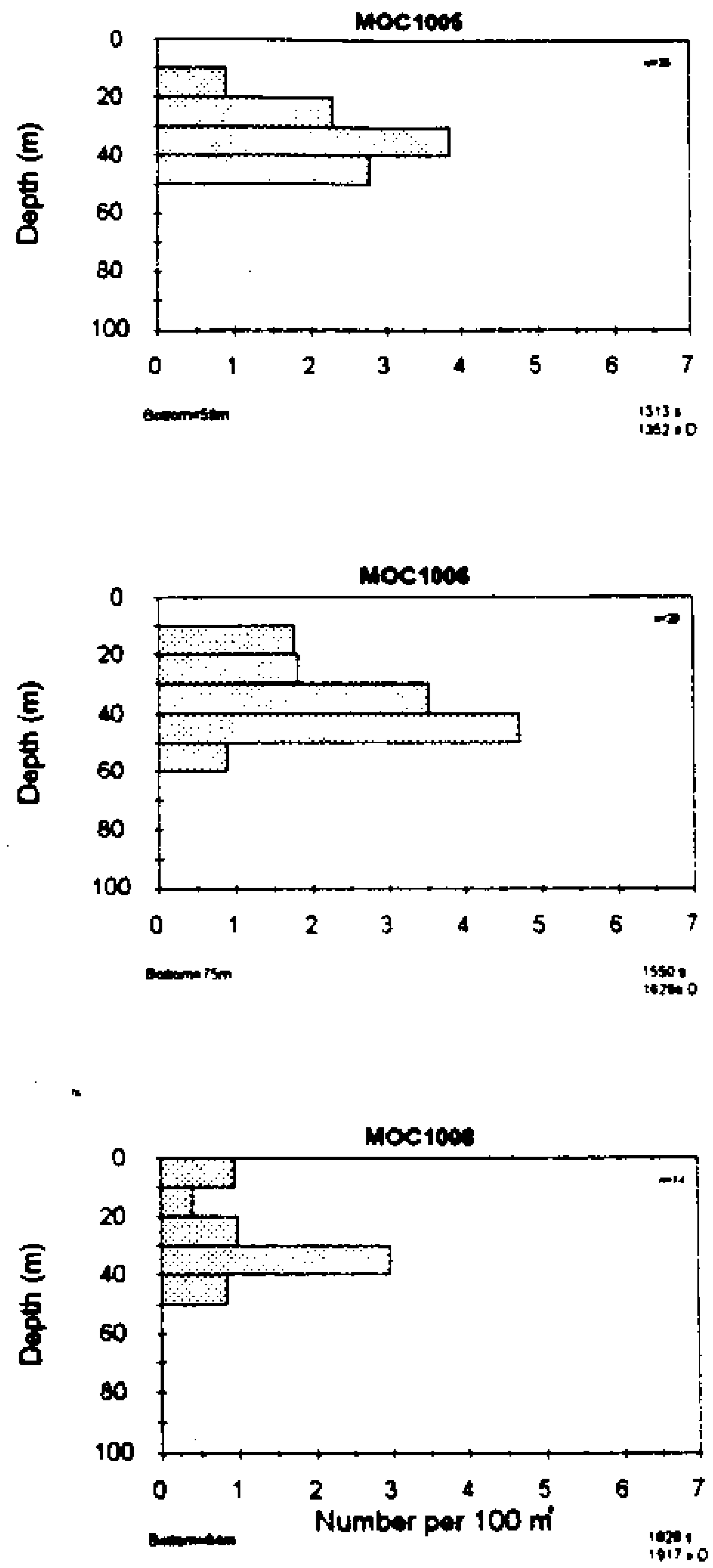


Figure 64. AL9205- cod distribution at the Great South Channel site.

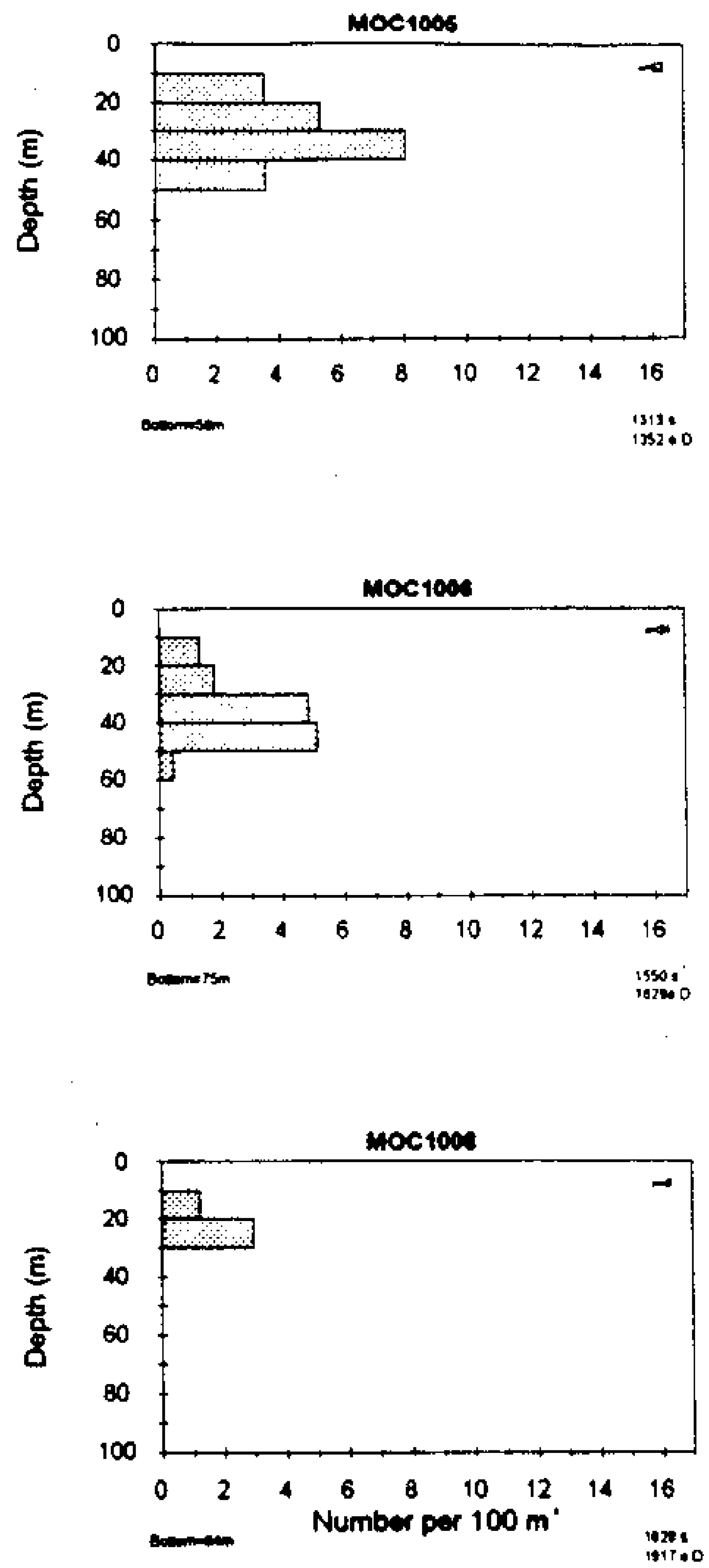


Figure 65. AL9205- haddock distribution at the Great South Channel site.

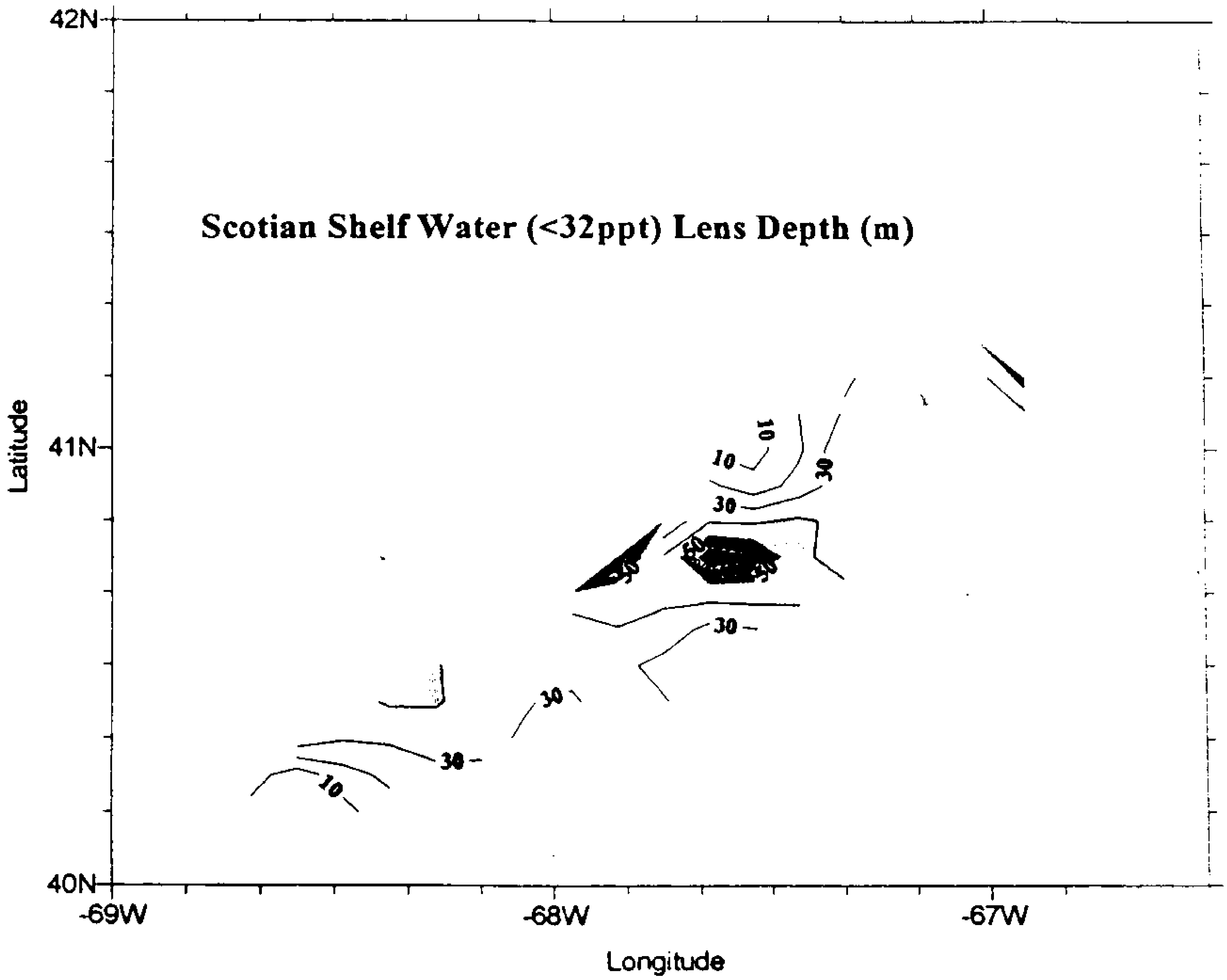


Figure 66.. Scotian Shelf Water lens thickness contour.

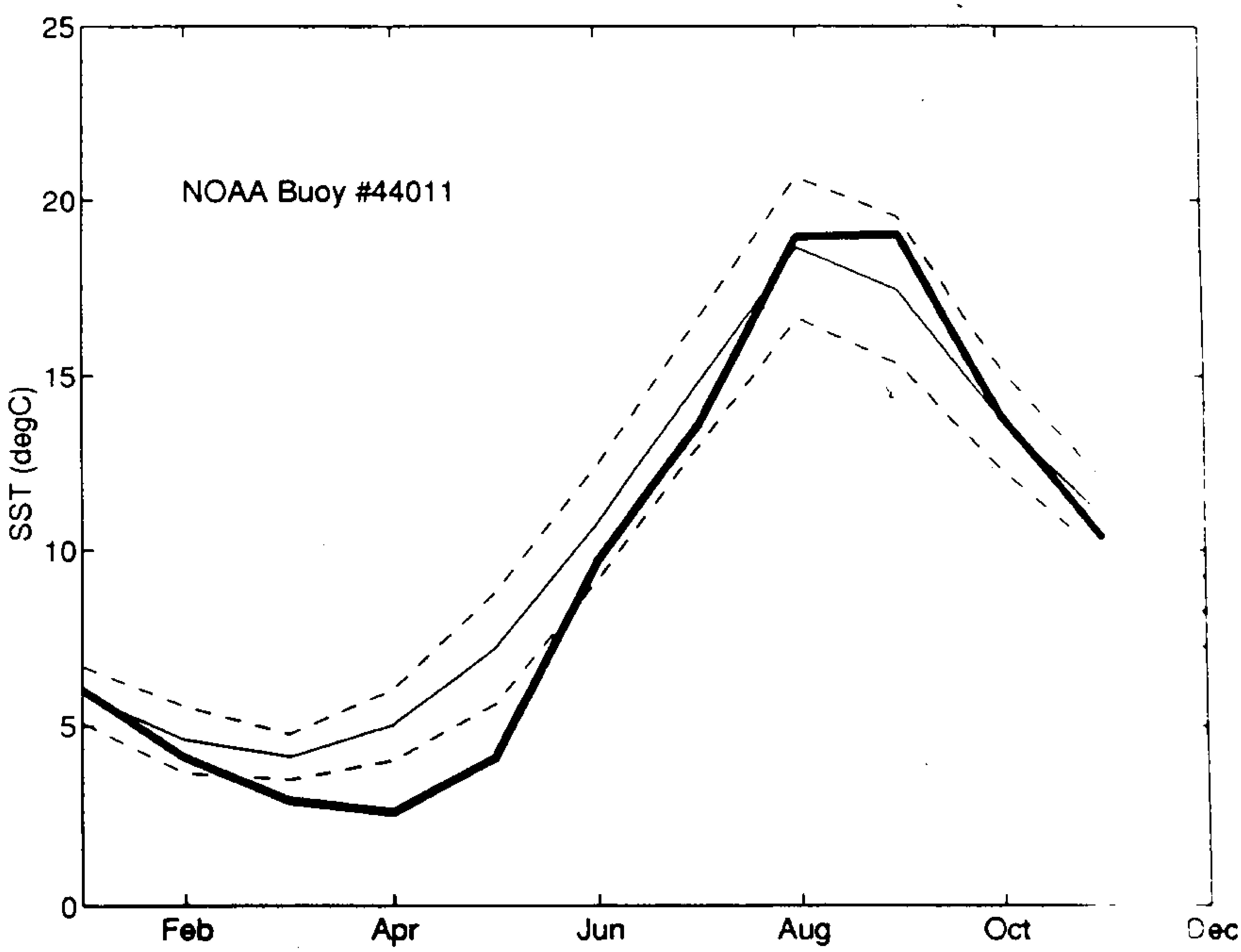


Figure 67. SST as measured at NOAA buoy 44011 in 1992 vs long term mean.

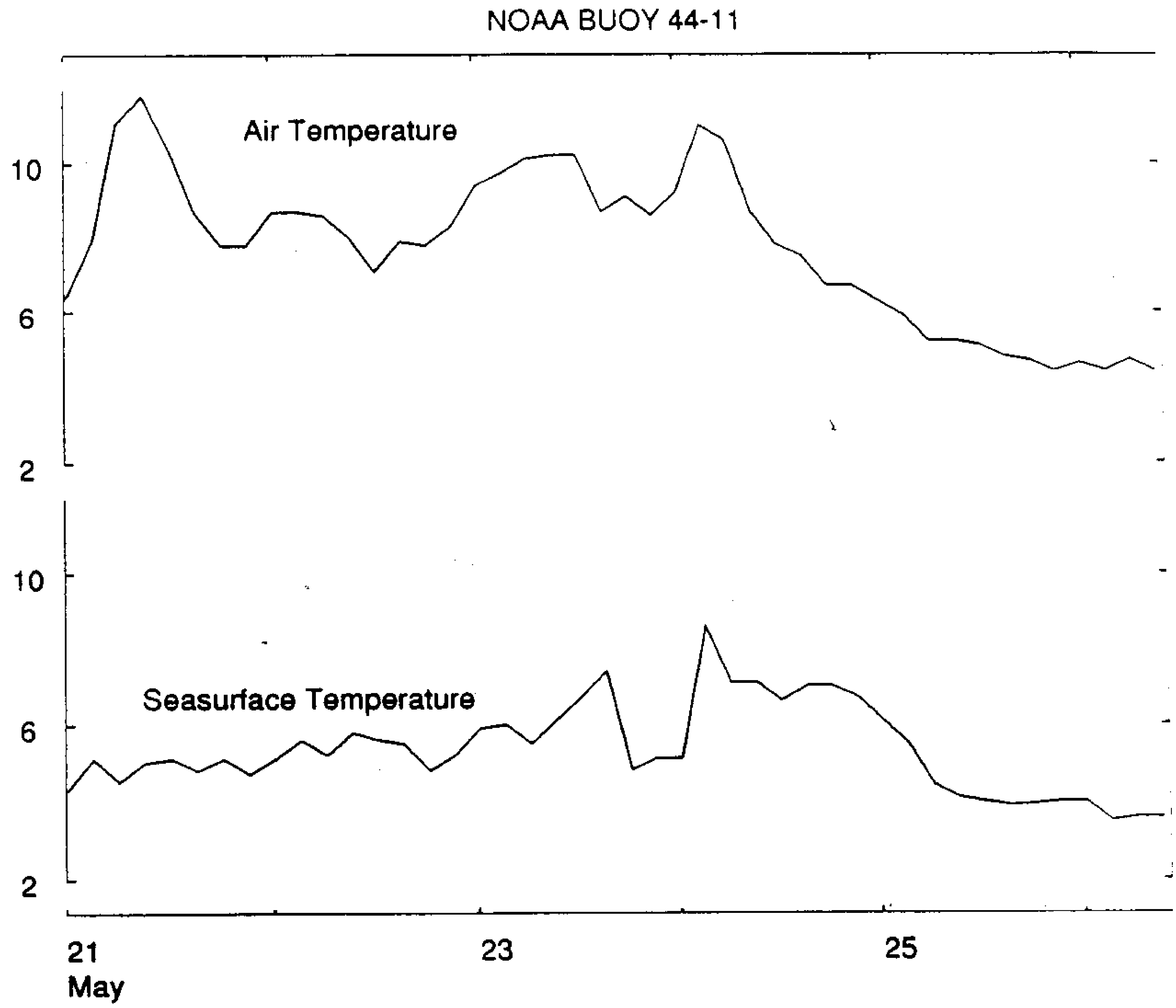


Figure 68. Air temperature and SST as measured at buoy #44011.

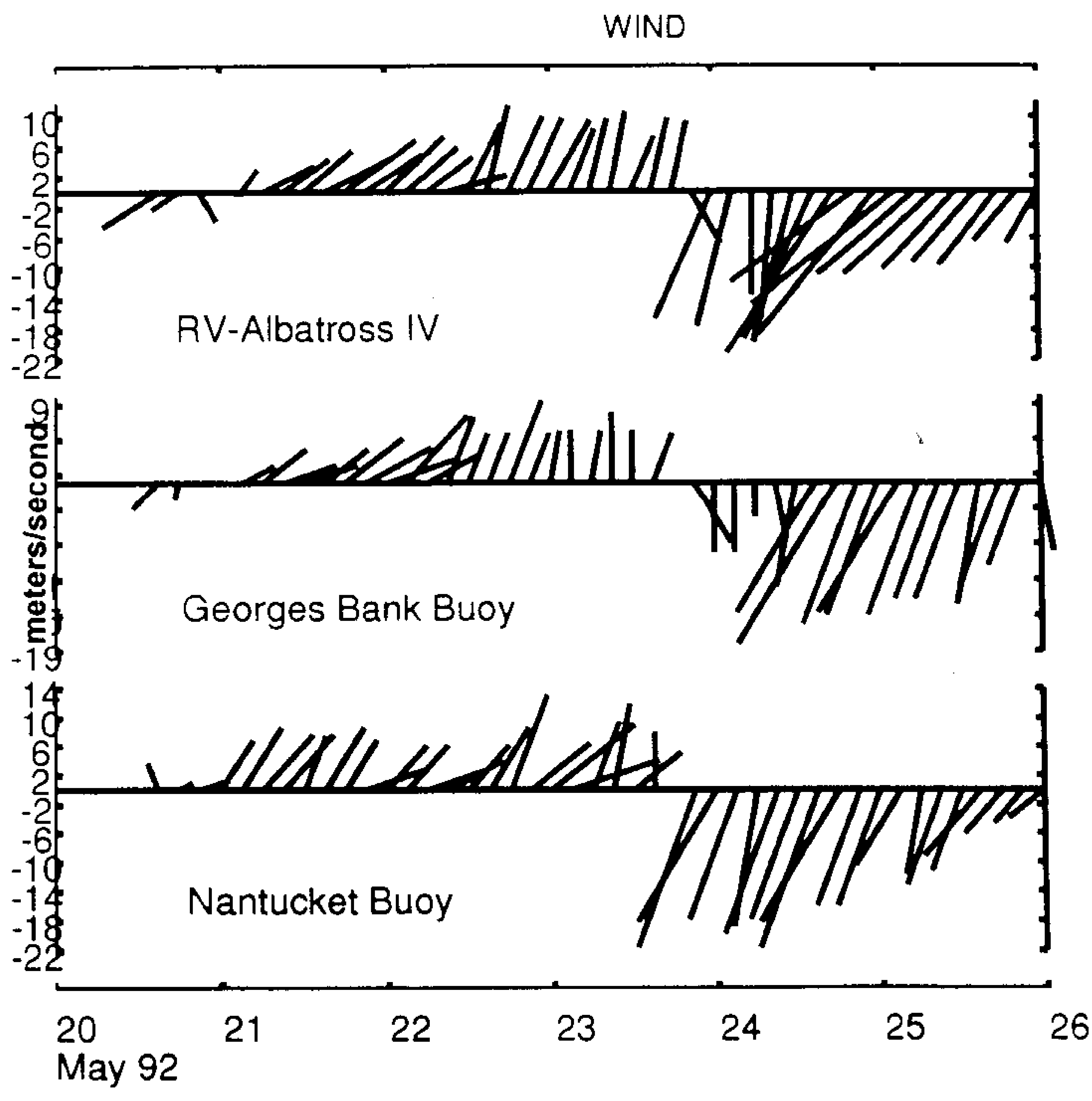


Figure 69. Stick plot of the May 24th wind event as measured at three different locations on Georges Bank.