Cruise Report

R/V KNORR Cruise 149 to Georges Bank

U. S. GLOBEC

NW ATLANTIC/GEORGES BANK STUDY

10 - 15 April 1997

Acknowledgments

This cruise and preliminary data report was prepared by Jim Irish and Bill Williams from cruise logs and notes as a first draft document of the activities, positions, and data collected during R/V KNORR Cruise KN149. We acknowledge the superior support by Captain Paul Howland, Greg Packard (the WHOI Shipboard Scientific Services Group technician) and the crew of the Research Vessel KNORR. Their outstanding assistance and hard work allowed us to successfully deploy the GLOBEC Long-Term moored Program's buoys, Ron Schlitz's GLOBEC mooring and take supportive CTD profiles and sections.

The GLOBEC research effort is sponsored by the National Science Foundation and the National Oceanic and Atmospheric Administration. Support for the Long-Term Moored Program, as part of the U.S. GLOBEC Northwest Atlantic/Georges Bank Study, was provided by NSF research grant OCE-96-32348. All data and results in this report are to be considered preliminary.

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GLOBEC R/V KNORR KN149

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Cruise Report

GLOBEC R/V KNORR - KN149

US State Department Cruise No. 97-115
Woods Hole to Georges Bank to Woods Hole
10 - 15 April 1997

Purpose

The primary purpose of KNORR Cruise KN149 was to turnaround the GLOBEC Program's Long-Term Moorings on Georges Bank in the middle of the third year of the GLOBEC field effort, to redeploy Ron Schlitz's mooring, to take supportive *in situ* CTD yo-yo calibration profiles, and to make our standard CTD sections across Georges Bank. The ship's track sailed on KN149 is shown in Figure 1.

Accomplishment Summary

The GLOBEC Long-Term Mooring Program's moorings on Georges Bank were deployed from the R/V OCEANUS in February after emergency recovery just before Christmas 1996 and repair. The Northeast Peak mooring was cut loose about three weeks after this deployment, and was recovered by the R/V OCEANUS, serviced and successfully redeployed during KN149. Since the Canadian (Peter Smith's) guard buoys were also missing from the Northeast Peak site, the guard mooring meant for replacement of one guard mooring on the Southern Flank site was deployed at the Northeast Peak instead. The Southern Flank mooring and bottom pressure instrument were recovered. The mooring was serviced and redeployed between the two guard buoys at the site. Although one was moved, the lights were working and they were left deployed until fall 1997.

Before the recovery of the Southern Flank mooring and after the deployment of the Southern Flank and Northeast Peak moorings, a 1 hour yo-yo *in situ* CTD calibration series was made by the moorings. These data will be used as a check on the sensor calibrations and to determine sensor drift. Additionally, our standard Northeast Peak (15 stations) and the Southern Flank (15 stations) CTD sections were occupied. Since time was available while we serviced the moorings, an additional section (10 stations) to the east of the Southern Flank section was taken. While underway, shipboard meteorology and sea surface conditions were logged with navigation. No shipboard ADCP data was collected during this cruise, as the equipment was loaned to the R/V ENDEAVOR for their GLOBEC process cruise to replace nonfunctioning equipment there.

Finally, in support of the GLOBEC program, a mooring was deployed for Dr. Ron Schlitz near the Great South Channel as part of the recirculation studies being conducted there. This mooring was recovered earlier by the Coast Guard, and KN149 was able to redeploy the mooring in position without difficulty on the way back into port.

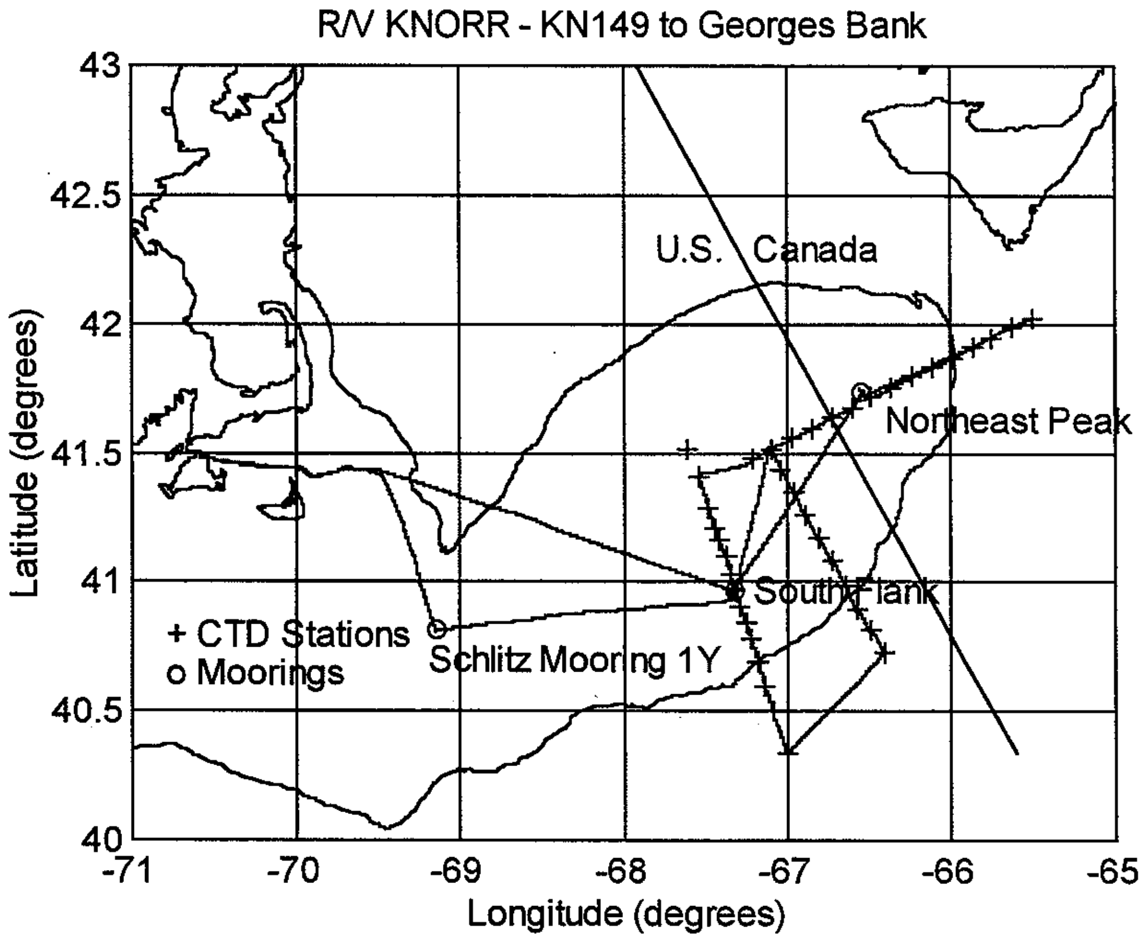


Figure 1: The ship's track for KN149 is shown from Woods Hole to Georges Bank to Woods Hole. The mooring sites are indicated by with an "O" and the CTD stations with a "+".

Cruise Results

Background Status:

In early December 1996, problems were observed in the two Long-Term Moored Program's scientific moorings at the Northeast Peak and Southern Flank sites on Georges Bank. The Northeast Peak buoy showed a slowly decreasing battery voltage since deployment and finally the solar power could not keep up with the power drain, and the system shut down due to low battery voltage on 13 December 1996. To that point the data telmetered and recorded was good. At that time the data from the Southern Flank mooring was checked more closely, and although the system was telemetering data regularly with full batteries, the data was bad, indicating a problem with the main sensor interface in the data system. Shiptime was obtained from the R/V OCEANUS with little advance notice when she came out of the shipyard. A quick recovery cruise was made from 18 to 20 December 1996 (R/V OCEANUS Cruise OC294) and both moorings were successfully recovered with no damage to the mooring components.

Both buoys were returned to WHOI for servicing and repair. The Northeast Peak buoy (with dead batteries) was disassembled, the data system powered up and tested. The current drain was normal and all indications were that there were no problems with the data system or sensors. The solar power regulators and batteries were then checked and appeared to be working properly. Because the batteries were discharged to about 6 volts (from standard 12 v) they were replaced with new ones. The solar panels were checked, and one was bad, causing a loss of one quarter of the charging capacity. The other three appeared to be charging properly. Finally, the guard light was checked, and it became apparent that here was the major problem. The bulbs were changed before the cruise, and somehow bulbs with twice the current drain were used (1.1 amps at 12 v rather that 0.5 amps), thus doubling the power. Also the flashing unit itself was drawing significantly more power than it should and the daylight shutoff switch was open, and not shutting off the light during daylight hours. These things would marginally cause the loss of power, and were probably the cause of the failure of the Northeast Peak mooring.

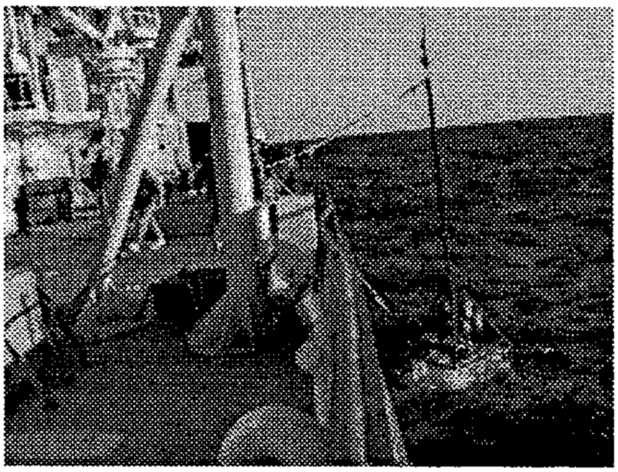
The Southern Flank mooring appeared to have a dead sensor interface unit. Upon opening and checking out the unit, it would not digitize reference signals or pass any diagnostic tests. The End Device Interface Module was replaced with a new unit fresh from calibration, and the system appeared to be working properly again. There is a strong likelihood that the system was damaged by a static storm which was picked up on the signal leads of the meteorology sensors. We observed some problems with the wind sensor last winter, so there may be a basic problem that we will have to address in the future. Good data was retrieved from the ADCPs and SeaCats on both moorings.

We attempted to get on a January GLOBEC mooring deployment cruise, but there was no room on the R/V OCEANUS for our moorings. After they had deployed Ron Schlitz's moorings, the weather prevented a second leg to deploy our moorings. We were able to successfully deploy both systems from the R/V OCEANUS OC298 during the GLOBEC Broad Scale survey cruise from 11 to 24 February 1997. The Southern Flank mooring was deployed on 14 February at 40° 50.041' N x 67° 19.209'W between the two existing guard buoys. The Northeast Peak mooring was deployed on 16 February 1997 at 41° 43.962' N x 66° 32.152'W. The two Canadian guard buoys deployed by Peter Smith were missing and the science mooring was deployed without guard buoys. Supportive CTD profiles were made by each mooring, and showed well mixed water. The fluorometer indicated low chlorophyll-a concentrations so the spring bloom had not yet started.

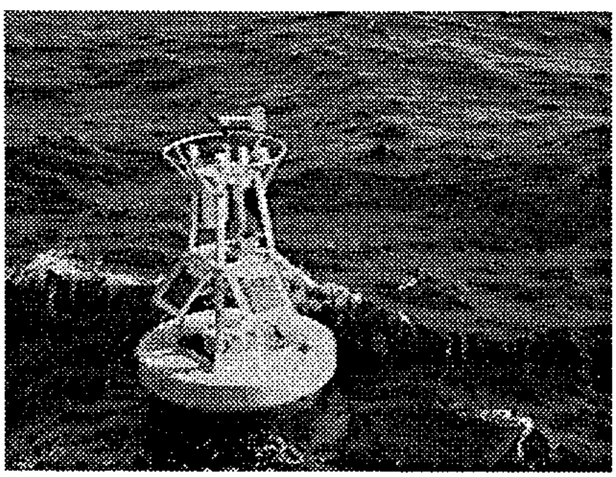
Three weeks later, on 8 March 1997 the ARGOS positioning on the Northeast Peak mooring indicated that it was not in position, and adrift. Craig Lee and the SeaSoar survey cruise on the R/V OCEANUS were in the area, and were able to recover the mooring and return it to WHOI for repair. It appears that one of the elastic tethers was cut, and three others were broken by being pulled apart under high tension (it is not clear what happened to the final two elastic elements). This is the first indication of a possible mooring failure of this kind. If three tethers were cut, then the others might be expected to fail in this manner. However, if there were high waves and currents stressing the tethers, the anchor should have been dragged before the tethers broke. Since the anchor and bottom of the mooring was in the original deployment position, this was not the case.

Southern Flank Mooring Site

Guard Buoys - The Southern Flank scientific mooring "E" and one of the guard buoys "C" was in position when the ship arrived on station. The second guard buoy "F" had moved and was now located south of guard buoy "C" (see Table 1). Since the guard buoys appeared to be in good shape, and the guard lights were working properly, it was decided to leave both of them in position, and redeploy the science mooring between them. This would free up the replacement guard mooring (Buoy "A") meant for deployment at this site to act as a guard mooring at the Northeast Peak site.



Picture 1. Recovery of the bottom pressure instrument from the Southern Flank site.

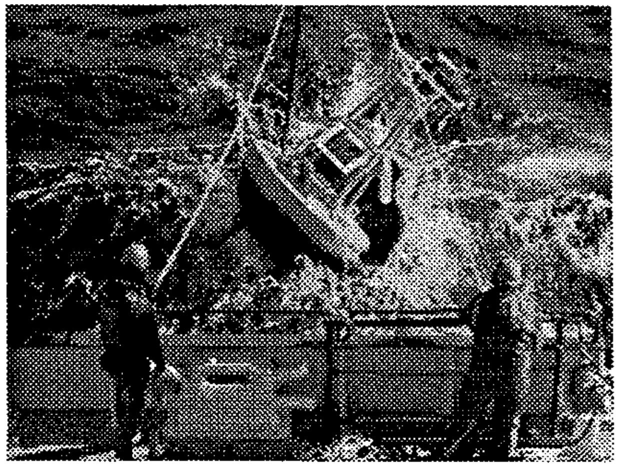


Picture 2. The Southern Flank Science Buoy after release as the R/V KNORR approaches for recovery.

Bottom Pressure - The bottom pressure instrument was recovered first. It was acoustically commanded, dropped its anchor and returned to the surface on the buoyancy on the frame (see Picture 1). While the recovery was successful, the instrument failed. Therefore, this instrument was not deployed on KN149. The old electronics will be replaced by up-to-date systems and the bottom pressure instrument redeployed on a future GLOBEC cruise.

Science Mooring - The Southern flank science mooring (see Picture 2) was also successfully recovered. It was acoustically commanded to release the anchor, the subsurface float appeared at the surface and the mooring was picked up (see Picture 3). There was little fouling on the buoy and sensors. What little there was was cleaned up with a power washer. To check on system operation before redeployment, the data was successfully dumped from the PCMCIA backup recorder in the buoy, from the ADCP and the three seacats. Rough at-sea normalization was applied to check the data return and system operation. All systems worked, except for two temperature sensor failures (the sea surface and 15 meter deep sensors).

Since the air temperature, and relative humidity sensor appeared to be working well, they were not replaced. The long-wave radiation sensor requires a battery with a 6 month life, so it was replaced. Not having connectors at the sensors was a major problem, requiring that the instrument well in the buoy be opened on deck to change the sensor cables where they attached to the data system. This should be changed in future deployments for at-sea servicing and for reliability. Figure 2 shows the meteorology results and Figure 3 the radiation results.



Picture 3. The Southern Flank Science Buoy E being recovered from the R/V KNORR.

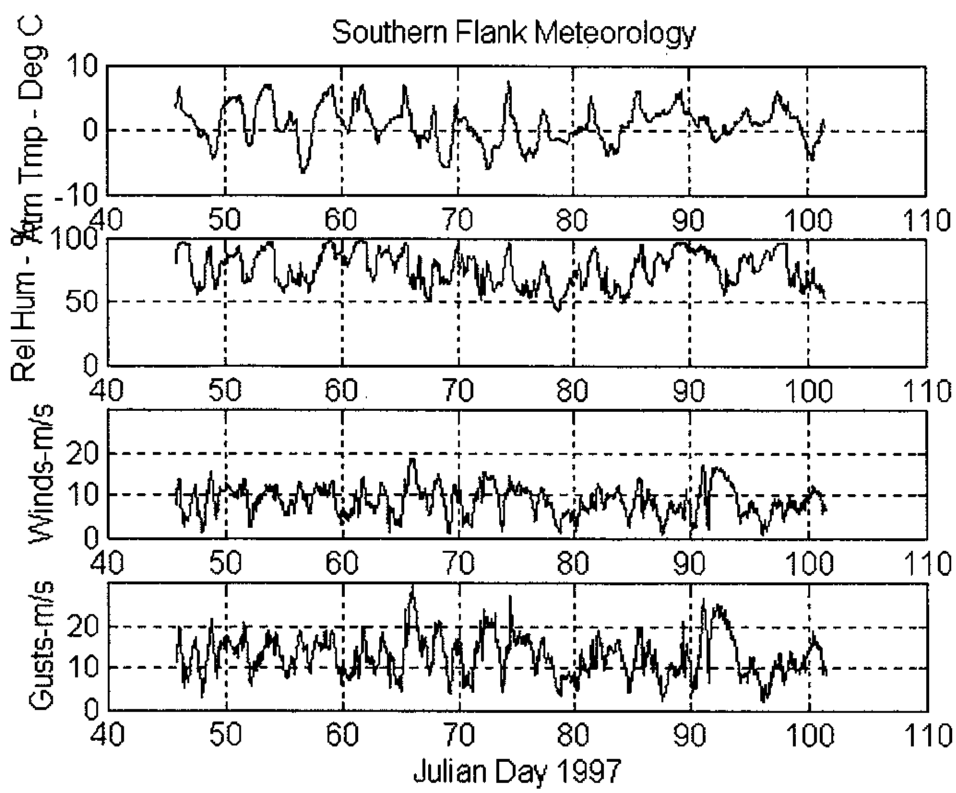


Figure 2. Southern Flank Meteorology observations. Unedited hourly averaged atmospheric temperature, relative humidity, wind speed, and maximum wind speed (gusts) in that hour.

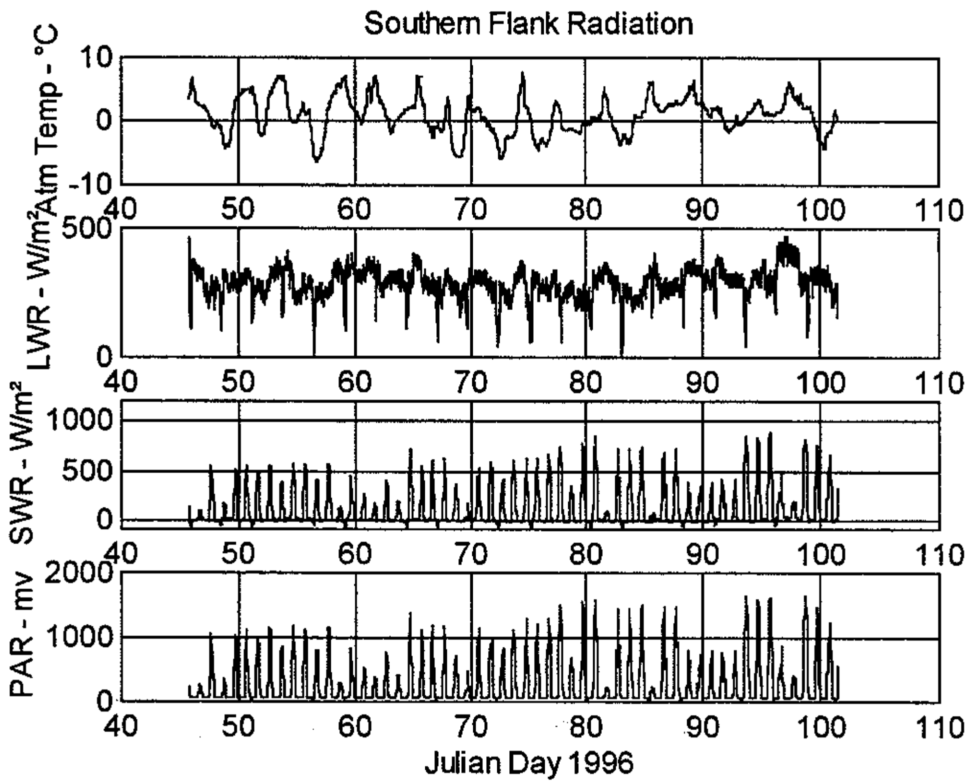


Figure 3. Southern Flank Radiation Observations. Unedited hourly averaged atmospheric temperature, long wave radiation, short wave radiation and photosynthetically active radiation.

The indications are that the winter cooling is just about over, and the spring heating is starting as the short wave radiation and PAR show a trend toward greater incoming solar energy. The moored temperature (see Figure 4) show a cooling until the last week or so of the record, then indicate a leveling off. The water column is thermally well mixed, and does not show any spring stratification (although a working sea surface temperature sensor may have indicated the slight surface warming which was seen in the CTD sections below) The SeaCat temperatures (Figures 6, 7, and 8) show the same picture, with a hint of a new temperature and salinity signal at the bottom of the water column in early April (JD95-98).

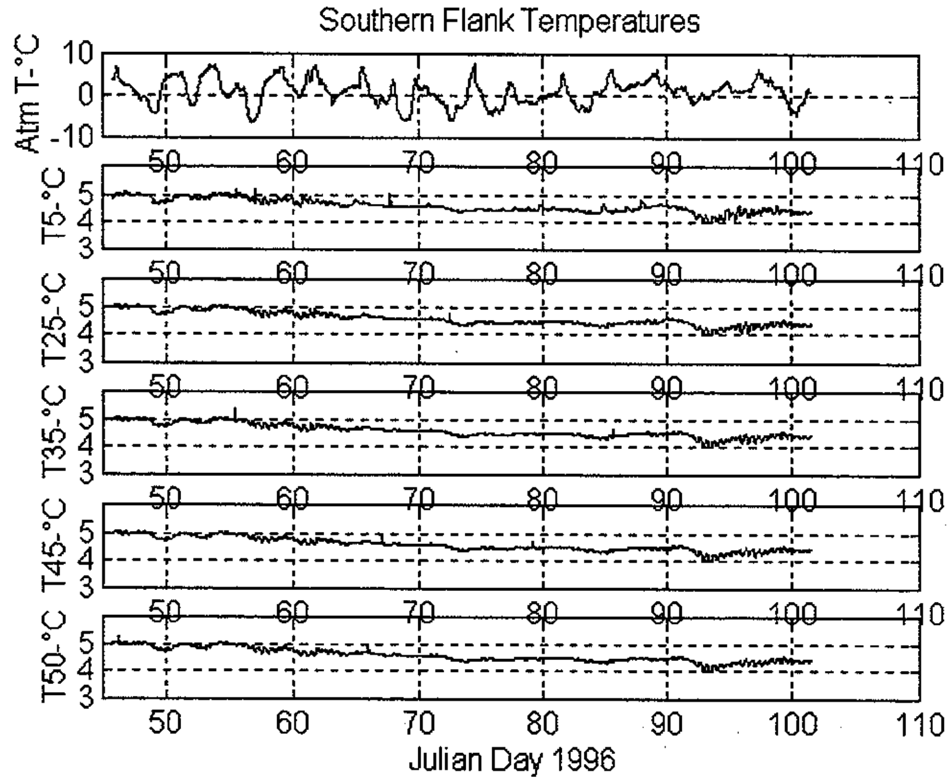


Figure 4. Southern Flank Moored Temperatures. Unedited atmospheric temperature and temperture at 5, 25,35,45, and 50 meters showing a generally well mixed water column.

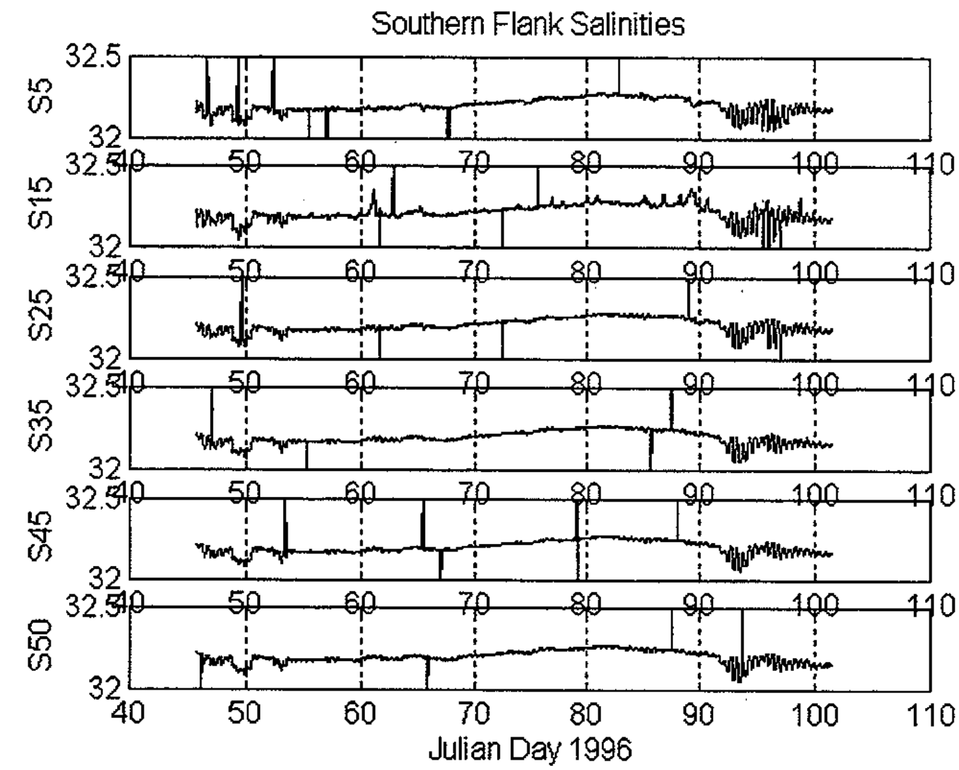


Figure 5. Southern Flank Moored Salinities. Unedited Salinites at 5, 15, 25, 35, 45, and 50 meters are shown, indicating a generally well mixed water column.

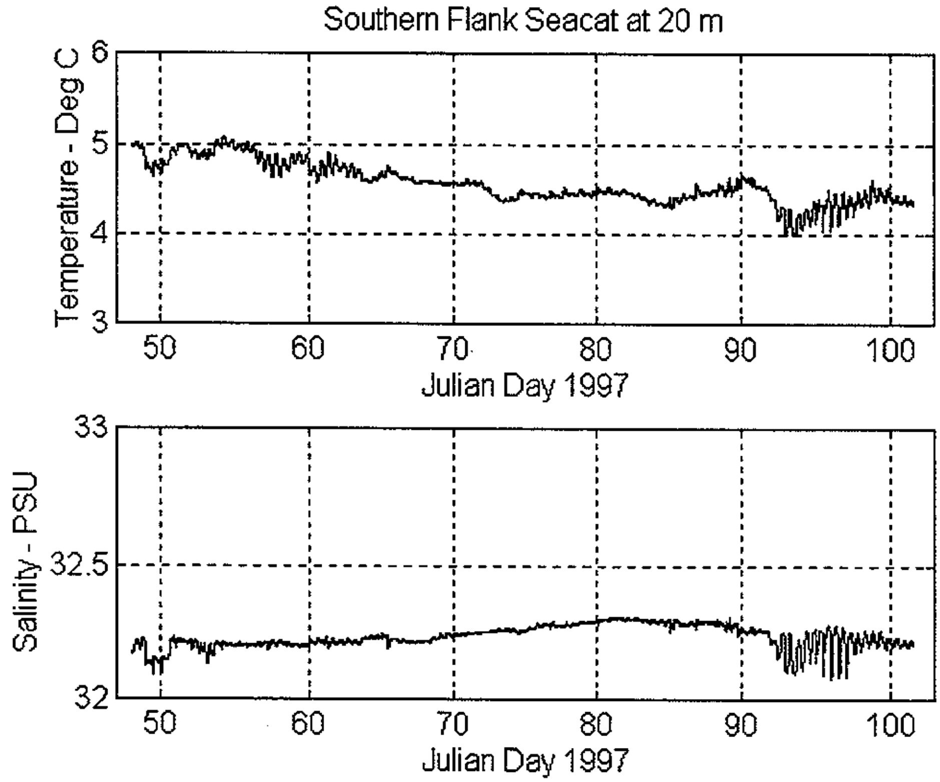


Figure 6. Southern Flank SeaCat at 20 meters.

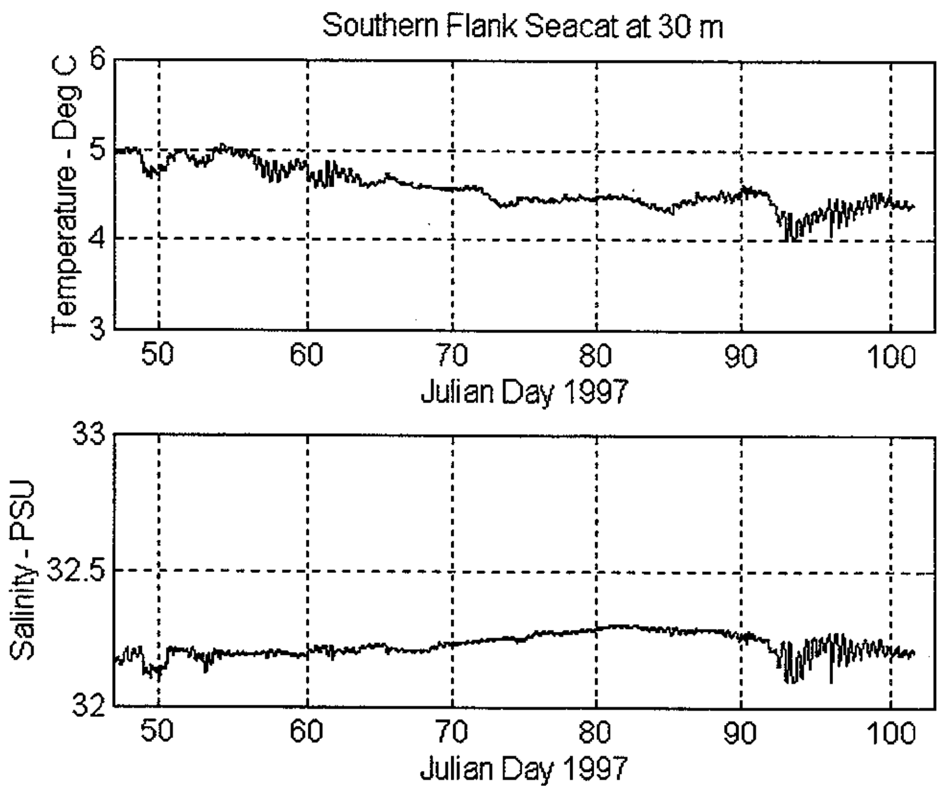


Figure 7. Southern Flank SeaCat at 30 meters.

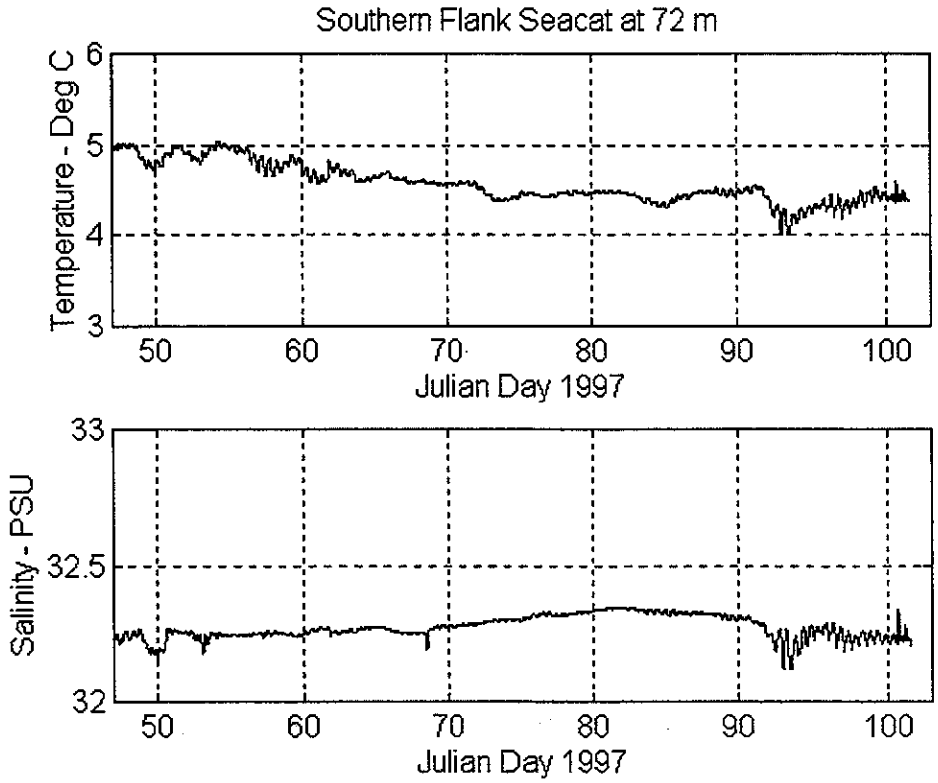


Figure 8. Southern Flank SeaCat at 72 meters.

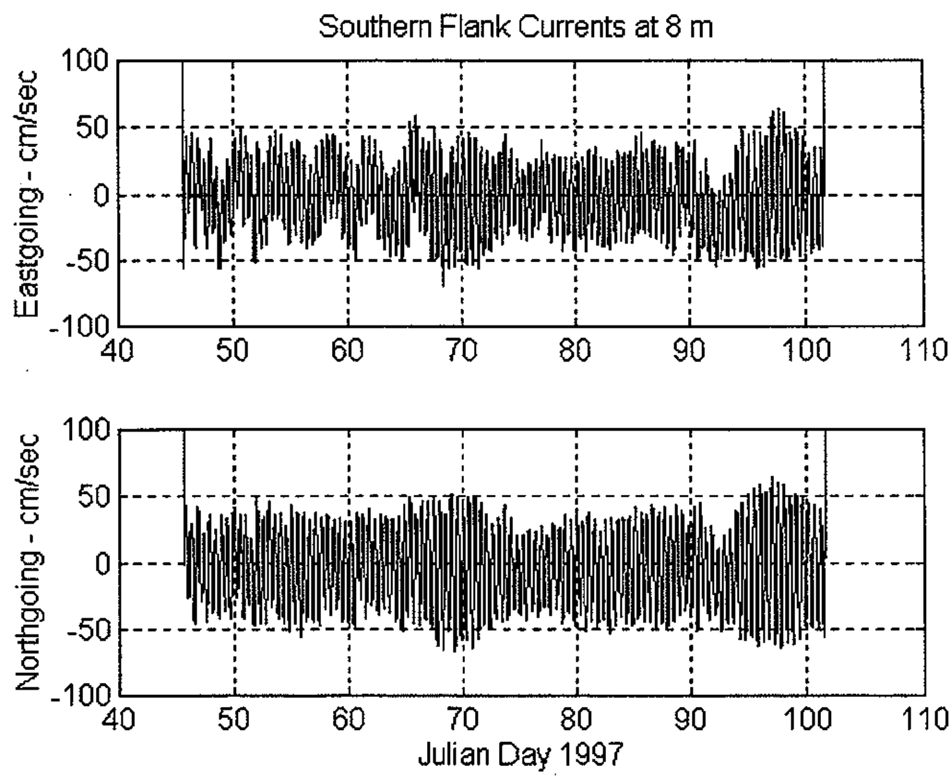


Figure 9. ADCPs velocities at 8 meteres depth.

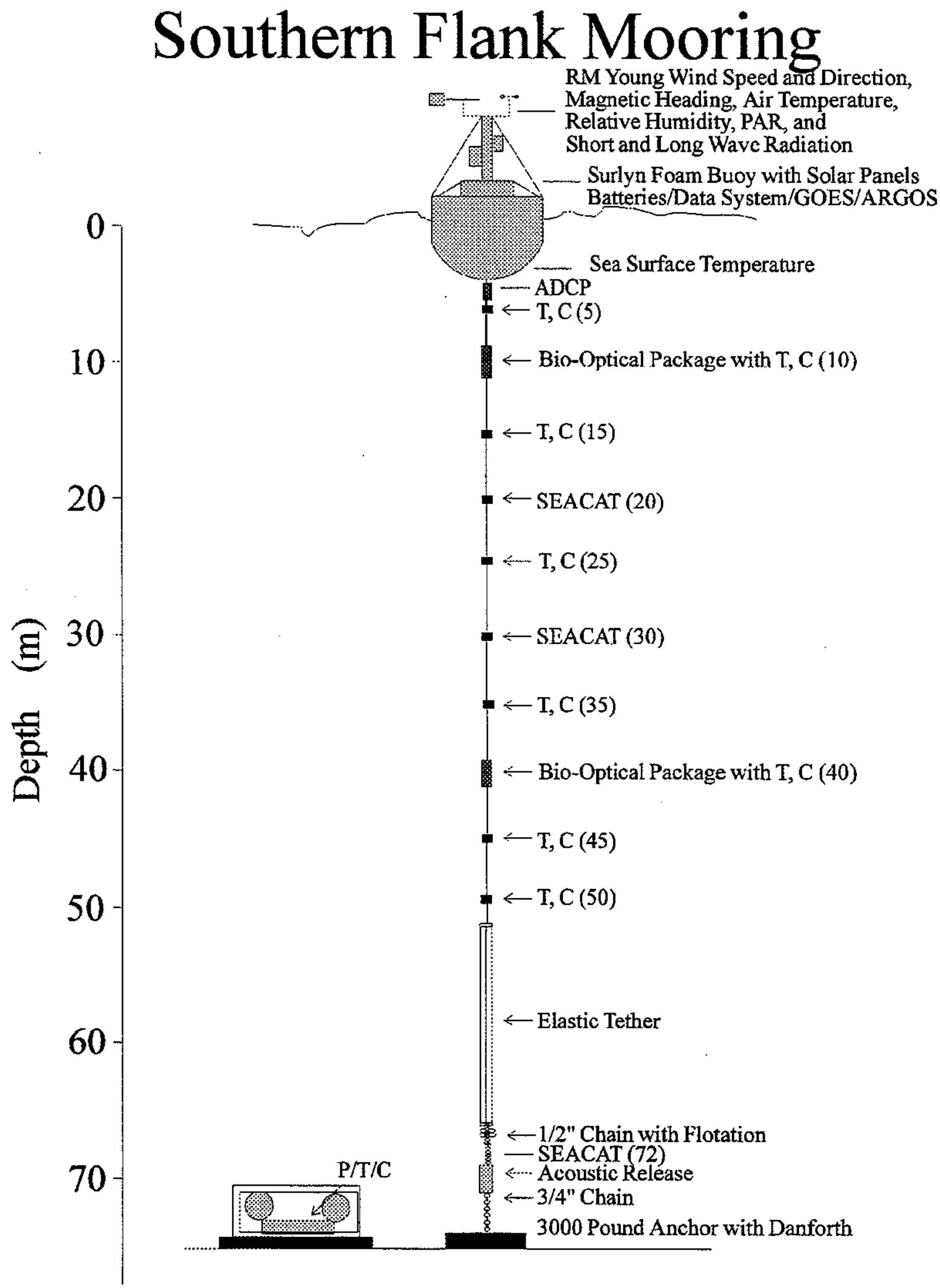


Figure 10. Southern Flank Mooring configuration.

GLOBEC Guard Mooring

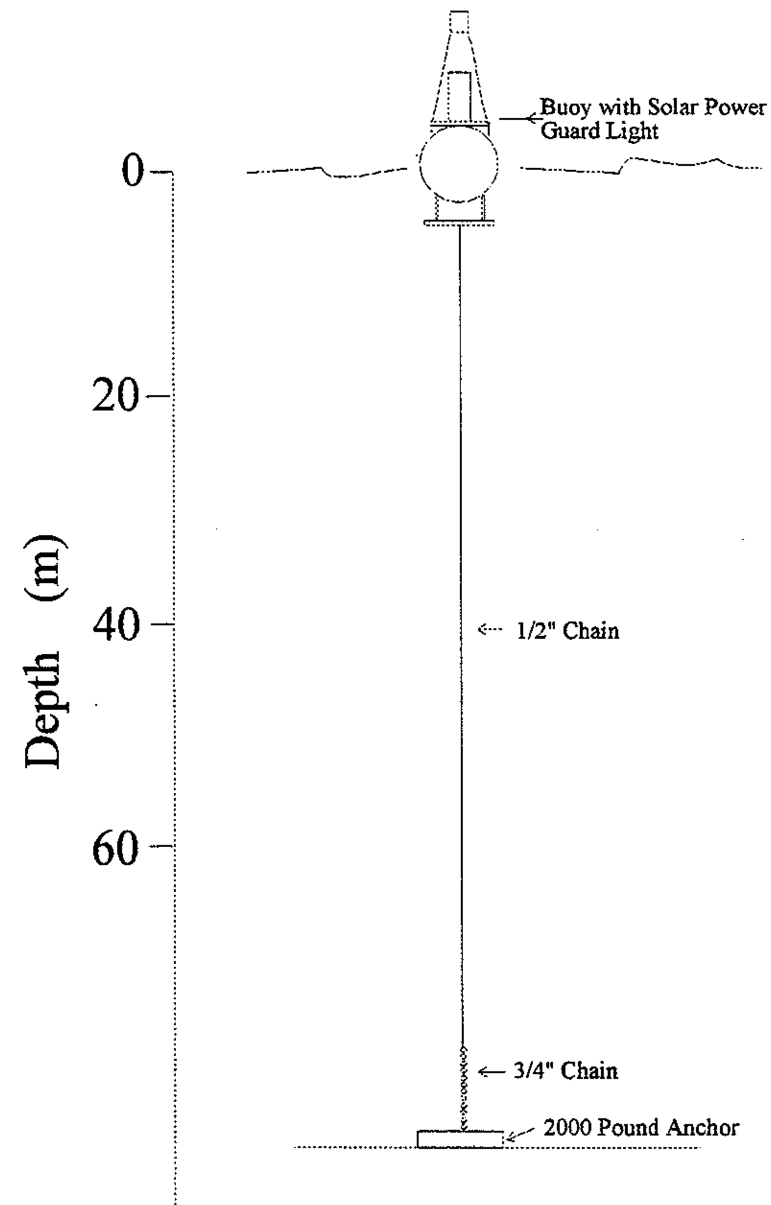


Figure 11. GLOBEC standard guard mooring.

Table 1. Mooring Deployment Times and Positions.

Location	Instrument	ID	Deployment Date	Time (UTC)	North Latitude	West Longitude	Depth (m)
Southern Flank							
	Steel Guard Buoy	C	26-Oct-96	13:12	40 58.104	67 19.160	76
	Science Buoy	E	15-April-96	02:14	40 57.974	67 19.139	76
	Foam Guard Buoy	F	26-Oct-96	20:44	40 57.807	67 19.103	76
Northeast Peak							
	Science Buoy	B	12-April-97	14:27	41 43.92	66 32.16	74
	Steel Guard Buoy	A	12-April-97	16:42	41 43.988	66 32.380	74

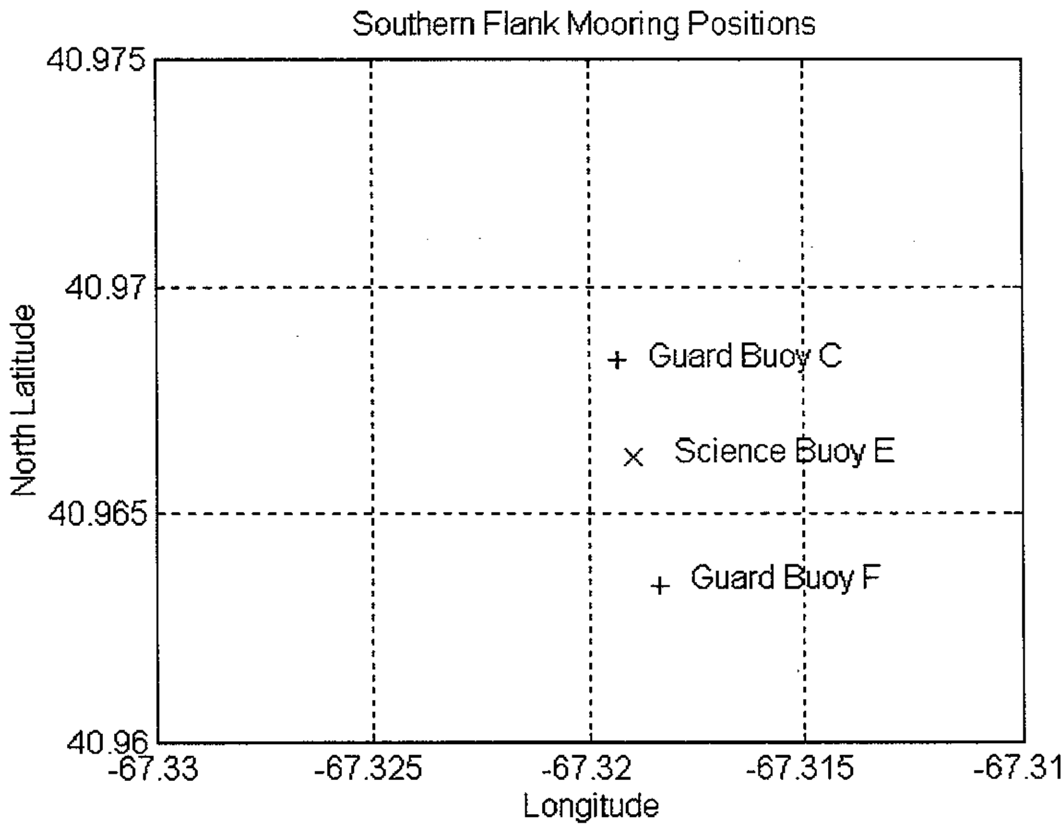


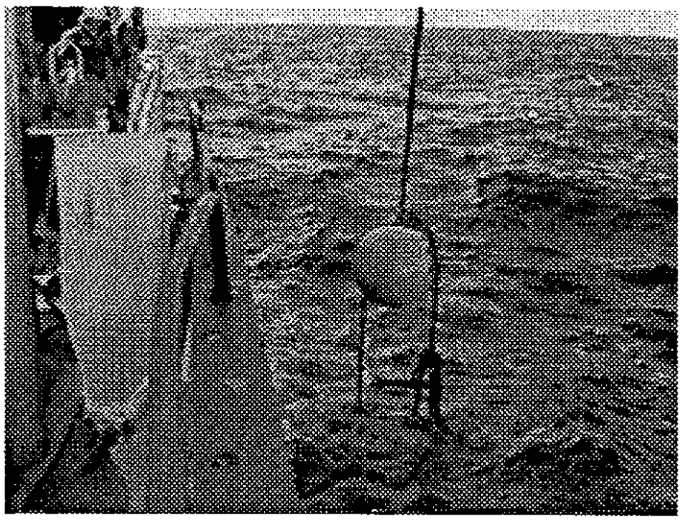
Figure 12. The Southern Flank Mooring Location from Table 1.

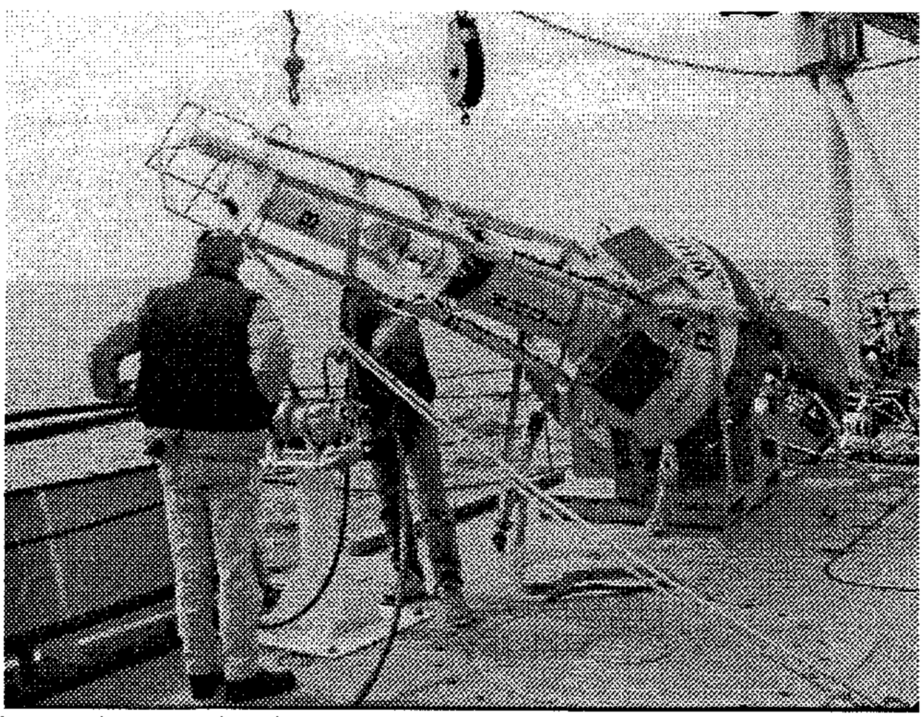
Table 2. Sensor Type, Depth and Serial Number

			Southern Flank	Northeast Peak
			Serial	Serial
Sensor Type		Company	Number	Number
Air Temperature		Rotronics	35851	WHOI type
Relative Humidity		Rotronics	35851	None
PAR		LiCor	5018	4948
Wind Speed and Dir		R.M. Young		None
Long wave Rad		Eppley	27953F3	None
Short wave Rad		Eppley	28771	None
SST		Sea Bird	31632	32064
SSC		Sea Bird	None	41379
ADCP		RDInstruments	125	130
T@5		Sea Bird	31624	None
C@5		Sea Bird	41365	None
Biop @ 10		Luigi	3A	4
	T	Sea Bird	31629	482
	C	Sea Bird	41625	56
	Trans	Sea Tech	617	628
	Fluor	Sea Tech	???	306
	PAR	LiCor	1661	1792
T @ 15		Sea Bird	30481	None
C @ 15		Sea Bird	41343	None
T/C@20	Sea Cat	Sea Bird	1818	1820
T @ 25		Sea Bird	31621	None
C @ 25		Sea Bird	41341	None
T/C@30	Sea Cat	Sea Bird	1819	2006
T @ 35		Sea Bird	493	None
C @ 35		Sea Bird	41340	None
Biop @ 40		Luigi	5	None
	Temperature	Sea Bird	31628	32173
	Conductivity	Sea Bird	41596	41370
	Transmissometer	Sea Tech	626	None
	Fluorometer	Sea Tech	???	None
	PAR	LiCor	1972	None
T @ 45		Sea Bird	30478	None
C @ 45		Sea Bird	41333	None
T @ 50		Sea Bird	30490	32176
C @ 50		Sea Bird	41342	41377
T/C @ 72	Sea Cat	Sea Bird	1736	1735
Acoustic Release	BACS	EG&G	15050	15055

Northeast Peak Mooring Site

Recovery - The Northeast Peak mooring failed at the tethers, and the bottom portion was not recovered on the earlier OCEANUS cruise. The first task on arriving on station at the Northeast Peak was to ascertain that the bottom portion of the mooring was there, and then if it was to recover it. Acoustic interrogation showed the release at about the correct range, and a release was commanded. The release acknowledged the release command, and that it had released. However, no visual contact was made with the surface float. The KNORR was moved up to the position where the mooring was deployed, and the acoustic range indicated that the release was still in the position deployed. We were preparing to move the ship to acoustically range on the release to pinpoint its position for dragging operations, when the float was sighted on the surface, about one half hour after released. We suppose that the cut tethers became entangled with the anchor and chain, and held the float down after the release had dropped the chain. Then, with the currents and the pulling of the float's buoyancy, the tethers untangled and allowed the float to come to the surface.


Picture 4. Recovery of the bottom of the Northeast Peak mooring.


Picture 5. The Northeast Peak Science Buoy "B" ready for deployment on the KNORR

The data from the SeaCats was dumped and checked. The 72 meter SeaCat was recovered with the bottom part of the Northeast Peak mooring (see Picture 4). The water column was well mixed during the time of the overlapping observations. The SeaCat results are shown in Figures 13, 14 and 15. The data at the end of the records, shown in Figures 13 and 14, shows the signal recorded when the mooring was adrift and should be ignored. The later half of the 72 meter record is good, and after JD92shows large tidal fluctuations due to the advection of different water masses past the sensors by tidal currents.

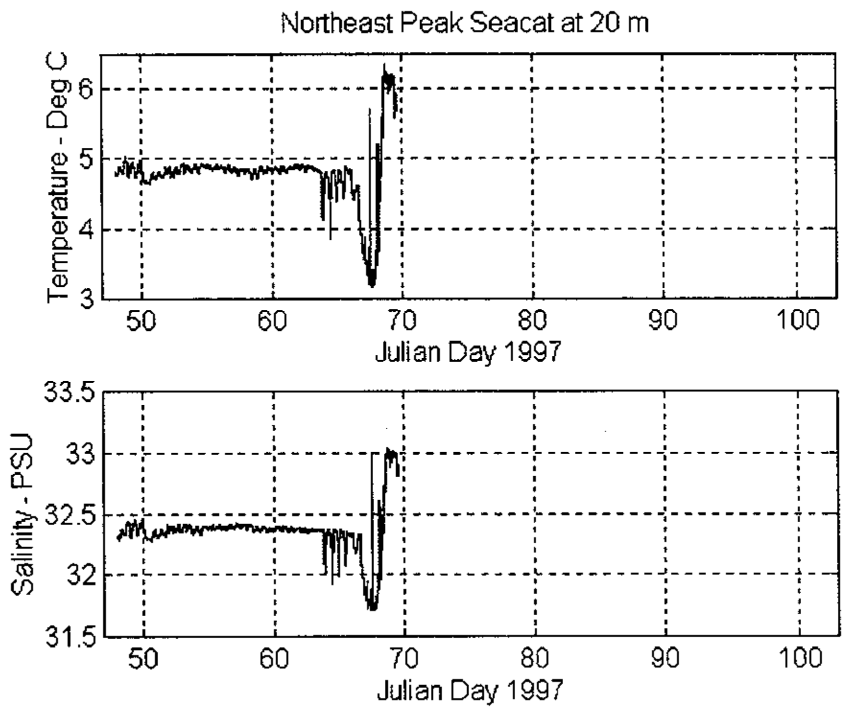


Figure 13. The uncorrected SeaCat observations at 20-meters depth. The sudden large fall then rise in temperature and salinity after JD67 are after the mooring broke loose, and should be ignored.

The data from the buoy was dumped to a notebook computer, and the buoy restarted. However, the notebook computer hard disk failed before the data was backed up, and so we will have to rely on the ARGOS and GOES telemetry to reconstruct the data recorded in the buoy. Historically, we should be able to get at least 3/4 of the data and probably more. As a standard practice we normally backup our data on a second medium (Panasonic rewritable or WORM optical, ZIP and a second hard disk) before deleting the data. We did a quick plot of the data from the Northeast Peak mooring on the notebook computer, then did not back it up immediately.

The ADCP data was dumped next, and the data at a few depths plotted. It appeared to be good. We were interested to see if there were excessive currents at the time that the mooring broke loose which may have caused the problems, but the record from 8 meters depth (Figure 16) does not show any excessive velocity at the end of the record. The day before during a strong wind, the tidal signals exceeded 1 knot, but it was not at the maximum when it broke loose, and

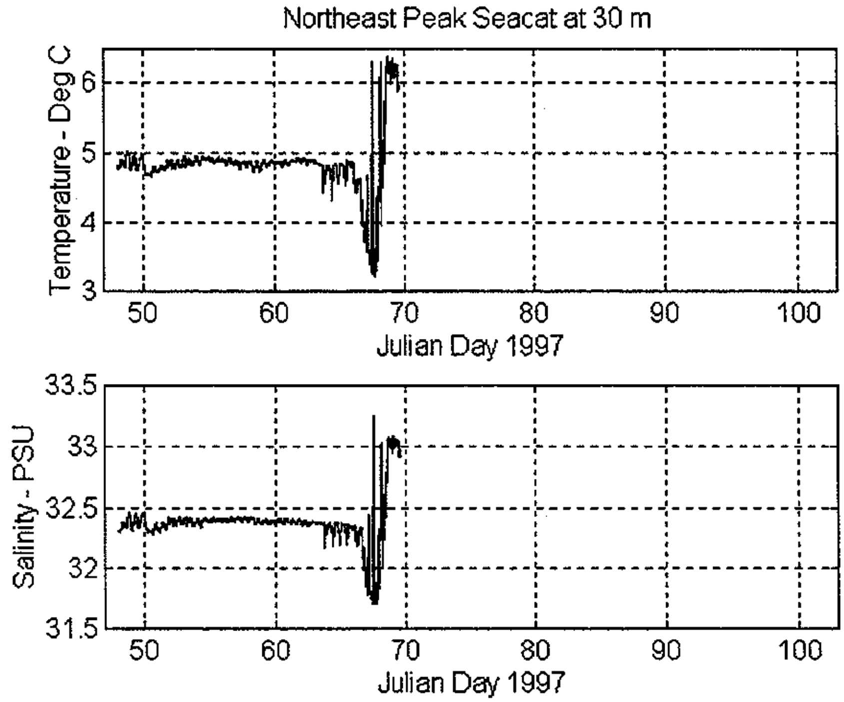


Figure 14. The uncorrected SeaCat observations at 30-meters depth. The sudden large fall then rise in temperature and salinity after JD67 are after the mooring broke loose, and should be ignored.

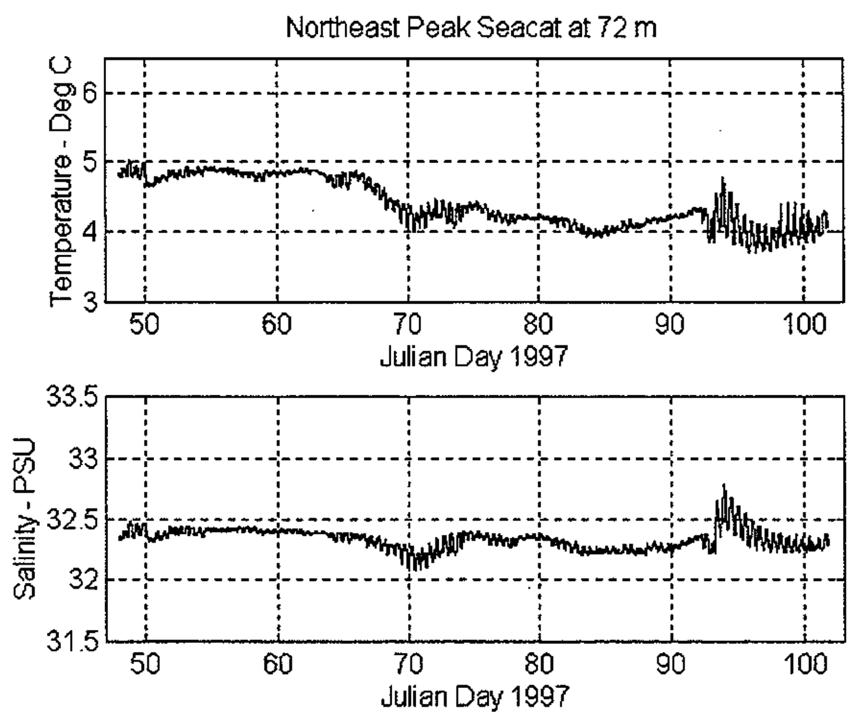


Figure 15. The uncorrected SeaCat observations at 72-meters depth from the full deployment time since this sensor was did not break loose with the buoy. .

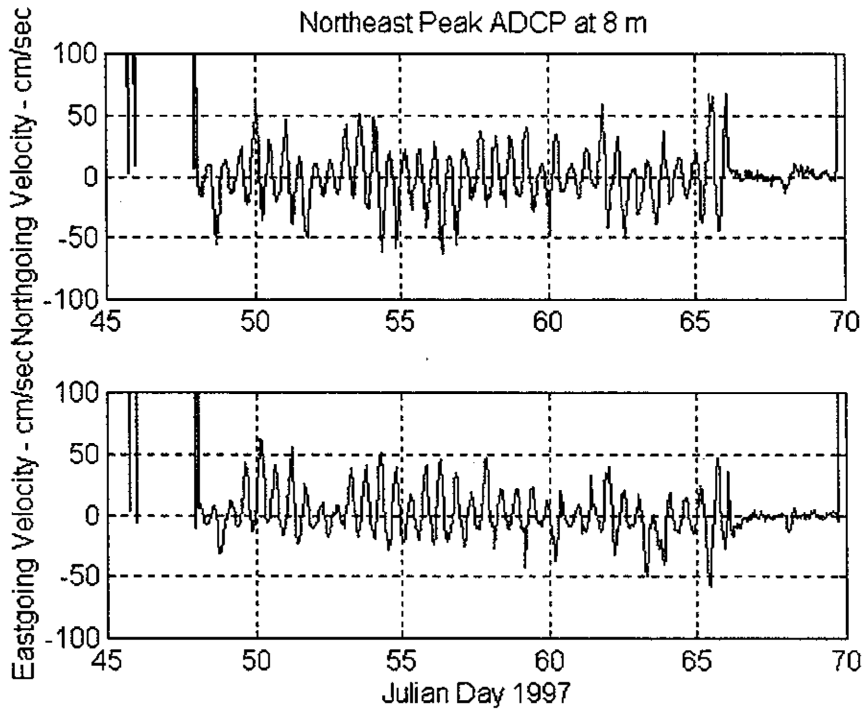


Figure 16. ADCP record from the Northeast Peak mooring at 8 meters.

not as high as seen this fall before the mooring was recovered due to the premature battery failure. The exact reason the mooring broke loose is therefore still somewhat unresolved. The tidal currents in the Northeast Peak record (Figure 16) are larger, and more regular than those at the Southern Flank (Figure 9), as we have seen before.

The buoy was readied for deployment back at WHOI and loaded on the ship ready to deploy. The SeaCats were attached to the mooring (see Picture 6), the ADCP was put in mooring line just below the buoy (see Picture 7), and the Bio-optical package was put in the mooring line at 10 meters depth (see Picture 8). The buoy was then set at the rail ready to launch (Figure 5), and the array stretched out on deck prior to deployment (Picture 9).

NE Peak Mooring

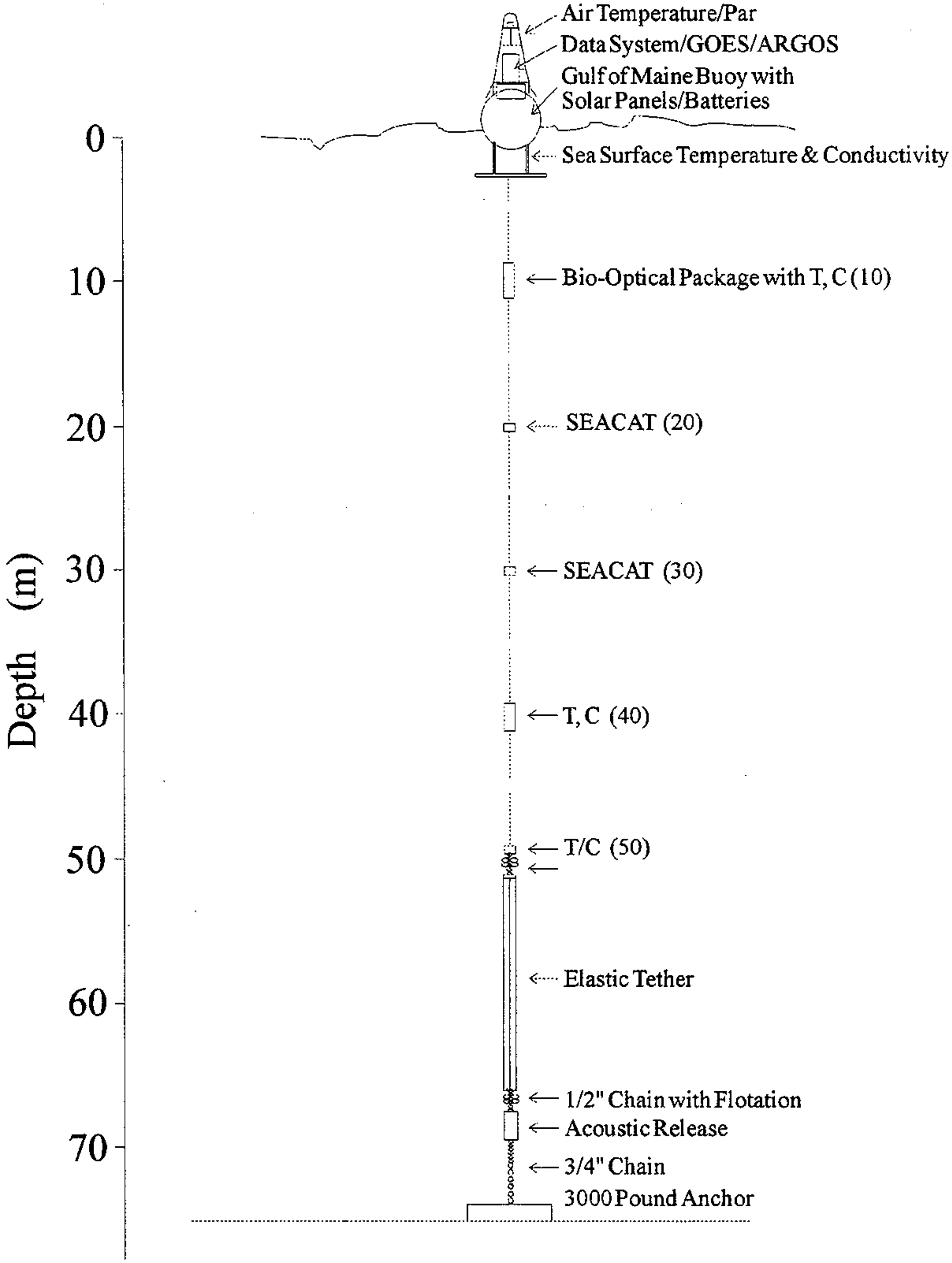
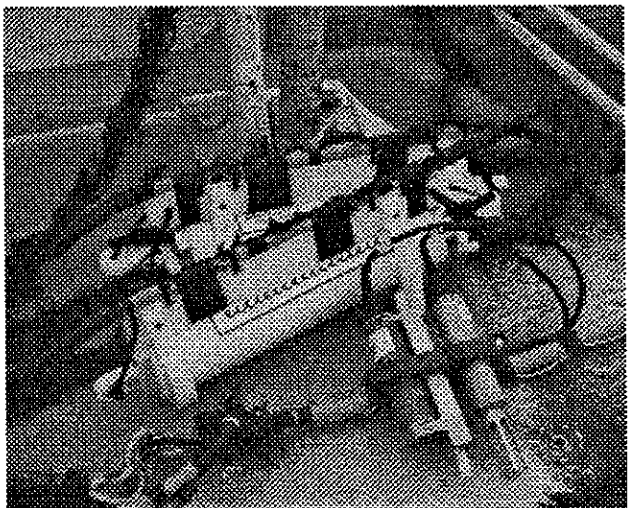


Figure 17. Northeast Peak mooring configuration.



Picture 6. The Northeast Peak Moored temperature and conductivity sensors. The SeaCat temperature and conductivity recorders are shown attached to the electromechanical cable at 20 and 30 meters depth. The Sea Bird temperature and conductivity sensor at 50 meters is also shown. It is attached to the cable with a PVC clamp to hold the temperature sensor out into the flow, and to allow maximum flow through the conductivity sensor. The white tubes on the conductivity sensor are poison cells to reduce biofouling.

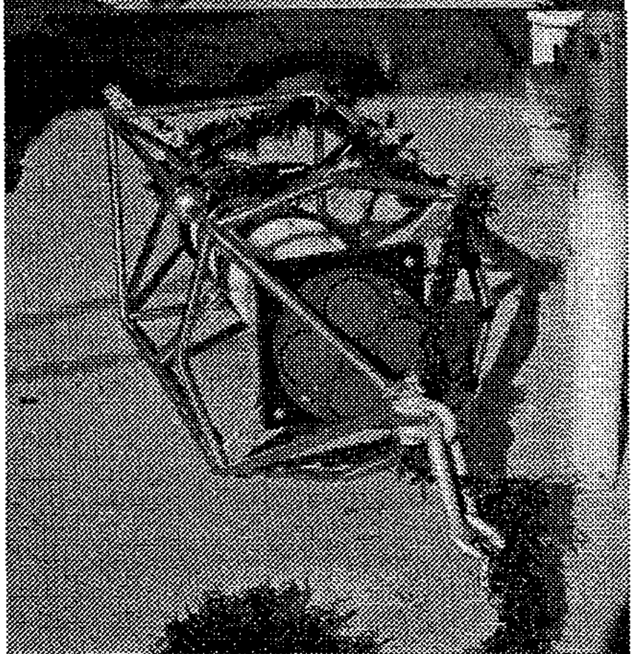


Figure 7. The RDI 300 kHz Workhorse ADCP and auxiliary battery case in the mooring cage below the Northeast Peak buoy. The frame was made for the standard 300 kHz Broadband ADCPs which have been unreliable and caused loss of data during the first year and a half of GLOBEC. The Workhorse ADCPs have returned data in all the deployments to date, and have been very reliable and easy to program. The chain in back of the picture goes to the buoy, and the electromechanical cable is attached to the frame in the front of the picture.

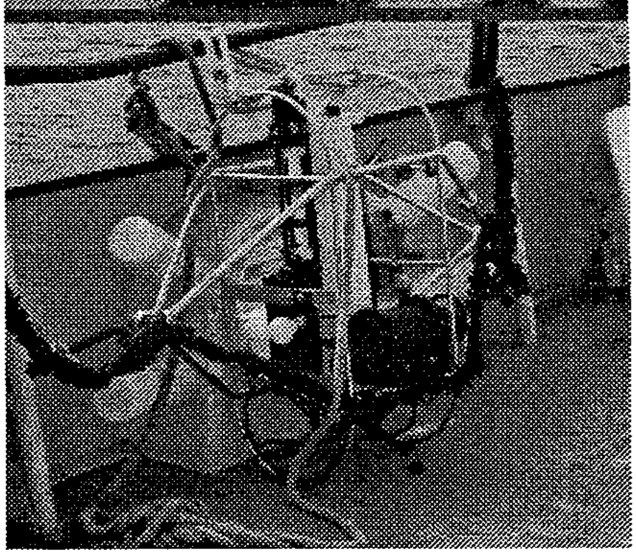
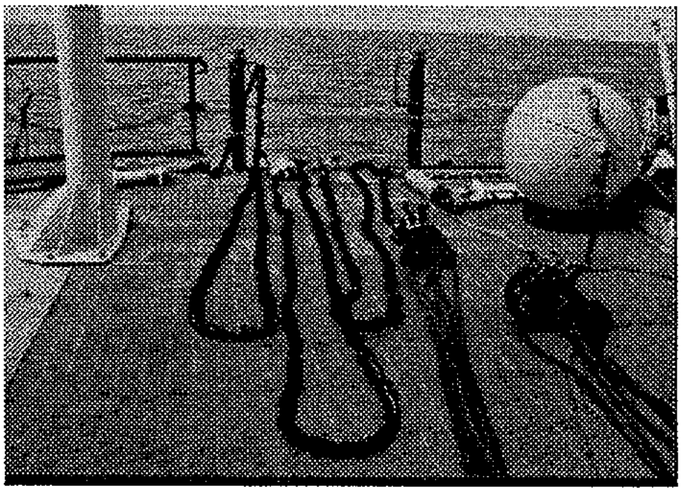
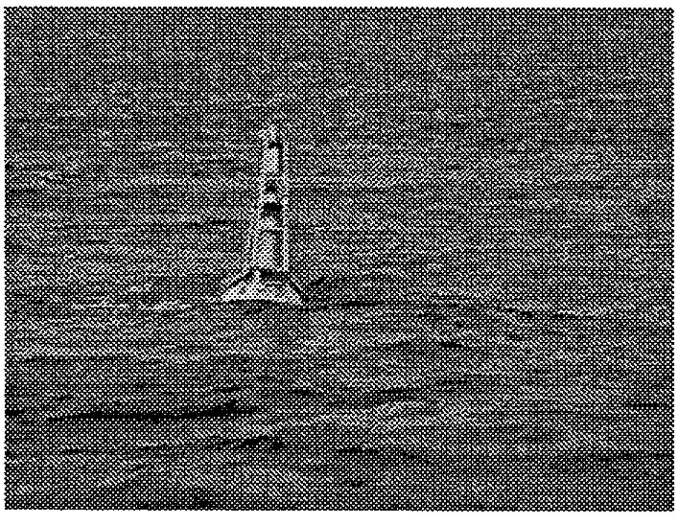


Figure 8. The bio-optical package at 10 meters depth, tied to the rail prior to deployment. The "light bulb" is a PAR sensor, the transmissometer is seen just above it, and the fluorometer to the right. The Sea Bird temperature and conductivity sensors are above the fluorometer on the right. The frame is sized to take the transmissometer horizontally, to reduce the possibility of particulates settling on the lower window. The large white pressure case houses the batteries and Tattletale based PCMCIA recorder.



Picture 9. The Northeast Peak mooring strung out on deck prior to launch with the sensors located at the rail. The "hair faring" on the cable is visible in Picture 6 as well as here. The elastic tether is the set of black cables running off the bottom of the picture on the right. The subsurface float, acoustic release and 72-meter Seacat are seen at the top of the picture. The 3000 pound anchor is hidden behind the subsurface float.



Picture 10. The Northeast Peak science buoy just after deployment. The anchor has just reached the bottom, and the buoy is still moving toward the ship and before the mooring reached equilibrium The electronics case, guard light, and radar reflector in the tower, and the white ARGOS/GOES antenna on top of the tower can clearly be seen.

Ron Schlitz Recirculation Mooring:

The retention of water on Georges Bank is being studied this year by several programs. As part of this activity, Dr. Ron Schlitz, National Marine Fisheries Services, Woods Hole, and the USGS, Woods Hole, had deployed nine moorings at the South End of Georges Bank in early 1997. One of these was recovered by the U.S. Coast Guard, and required redeployment. The foam buoy, VACM current meter, and all chain rigging with anchor was loaded on the R/V KNORR in preparation for deployment. After the GLOBEC Long-Term moorings were deployed, the R/V KNORR headed back for Woods Hole, and stopped at the Great South Channel to deploy the mooring.

The mooring was chain from the buoy to the anchor with a VACM at about 12 meters depth. The whole mooring was rigged with all the shackles, links, and chain (except for the connection to the anchor) before deployment. The VACM current meter (S/N VA51047) was hung on a slip line over the starboard rail, and the chain tied to the stern with a 1/4" line. The extra chain was wound on the mooring winch for ease of deployment. The buoy's light was plugged in and tested. The solar shutoff worked, and the light was flashing. The GPS/ARGOS system was then initialized with three pulses of the magnet to set the watch circle for 1500 m. The buoy was then deployed (see Picture 11), the current meter was slipped into the water and the chain paid out by the winch until the anchor was reached. The anchor was then attached, and the mooring towed into the deployment position. The anchor was dropped at 1320 UTC on 15 April 1997 at 40° 49.005' N x 69° 09.000' W. The buoy was riding well, but low in the water.

Pictue 11. The NMFS/USGS current meter mooring being deployed in the Great South Channel.

CTD Profiles and Sections

Yo-Yo *In Situ* Calibration profiles:

After the moorings were deployed, a one hour CTD yo-yo series was taken beside the science moorings for *in situ* calibration purposes. Practically, it is quite difficult to do a *good in situ* calibration because of the natural variability of the water, and the difficulty in keeping the surveying vessel by the mooring. However, the results do give us statistics on how well the CTD and moored observations agree for use in end of deployment comparisons, and, in times of low horizontal and vertical variability, to give good comparisons. When the temperatures agree quite well, then the salinities can be used to correct for moored salinity sensor drift. Since the moorings average each sensor's output over one hour, the CTDs used for comparison should be averaged over the same time interval - extending from the half hour to the next half hour. While the CTD yo-yo was being made, the ARGOS transmissions from the buoys were being monitored to assure that all was well. Finally, during the CTD yo-yo, the acoustic releases on the science moorings were checked and disabled.

Standard CTD Sections:

Northeast Peak Section - The standard Northeast Peak section (see Figure 1) was done on 12 April 1997. Contour plots of the raw data for this section are shown in Figures 18 through 22 (temperature, salinity, calculated density, transmissometer output and fluorometer output) and a T-S plot of all the data collected on the section shown in Figure 23. The continuous series of profiles was interrupted at CTD10, to deploy the Northeast Peak mooring and do a yo-yo, so an additional 7 hours were consumed in taking the section. Typically the section takes 12 to 14 hours to make. The section stretches from the well-mixed region over the crest of the bank out over the Northeast Peak and into the center of the mouth of the Northeast Channel. It does not cross the Atlantic shelf-break so the shelf-slope front is absent.

Starting at on-bank end of the section, the water at CTD station 17 appears to be just within the summer tidally mixed front (known to be at about the 60-m isobath) with low transmissometer readings there and high fluorometer readings of over 4.5 V. This indicates the spring bloom that occurs over the center of the bank at this time of year. The fluorometer reading drops from over 4.5 V to 2 V from CTD station 17 to 15 with an associated increase in the transmissometer reading. Between this fluorescence front and the Northeast Channel the fluorometer reading falls slowly from 2 V to 1 V with an associated increase in the transmissometer reading. In terms of temperature, salinity and density the water is vertically well mixed from the center of the bank to CTD station 8, which is approaching the Northeast Channel. There are horizontal gradients in these waters, however, as with the fluorescence and tranmission. The shallower stations on the bank have a temperature of 4.5 ° C and the deeper stations are a little cooler at 4 ° C. The contour intervals used are not fine enough to resolve the change in density and salinity which appear to be constant at < 32.4 PSU and 25.6 kg/m^3.

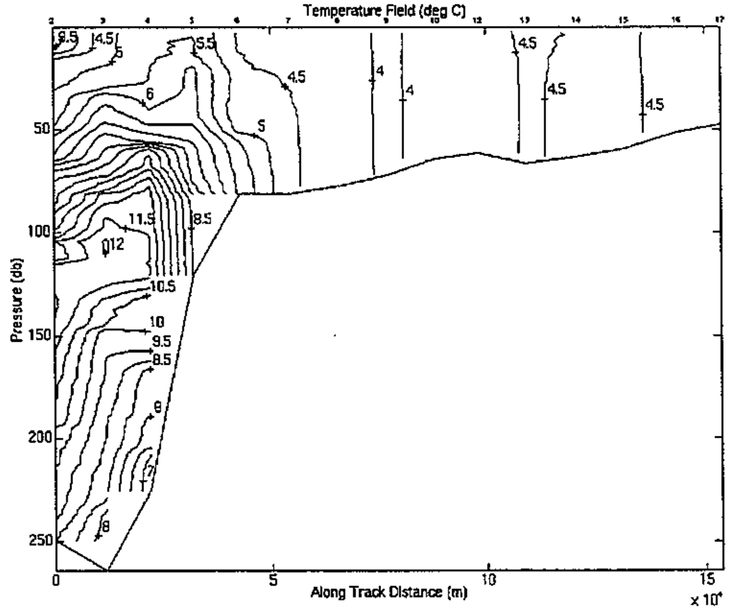


Figure 18. Contours of temperature at 0.5 ° C intervals for the Northeast Peak Section conducted on 12 April 1997. The blanked out region shows the depth to which data was collected and closely follows the bathymetry except in the deep casts. The numbers at the top of the figure are the CTD cast numbers and mark the position of each profile in the section.

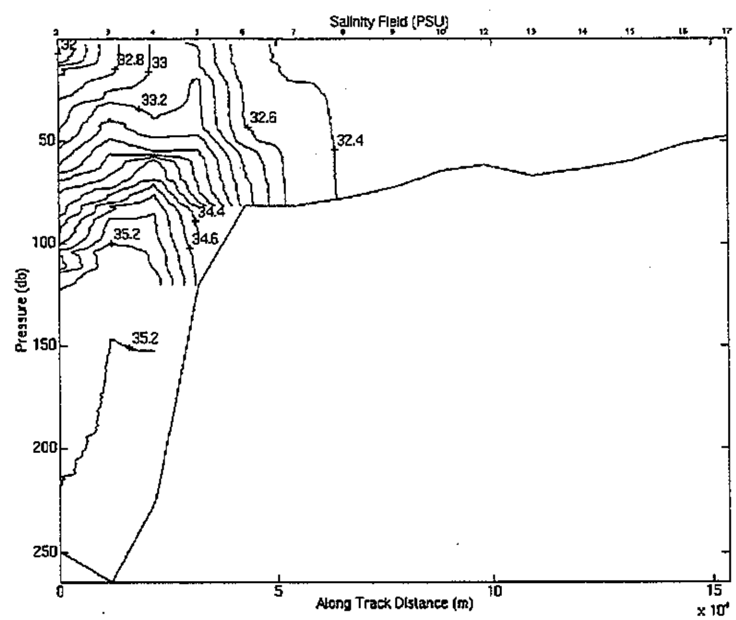


Figure 19. Contours of salinity at 0.2 PSU intervals for the Northeast Peak Section conducted on 12 April 1997. The blanked out region shows the depth to which data was collected and closely follows the bathymetry except in the deep casts. The numbers at the top of the figure are the CTD cast numbers and mark the position of each profile in the section.

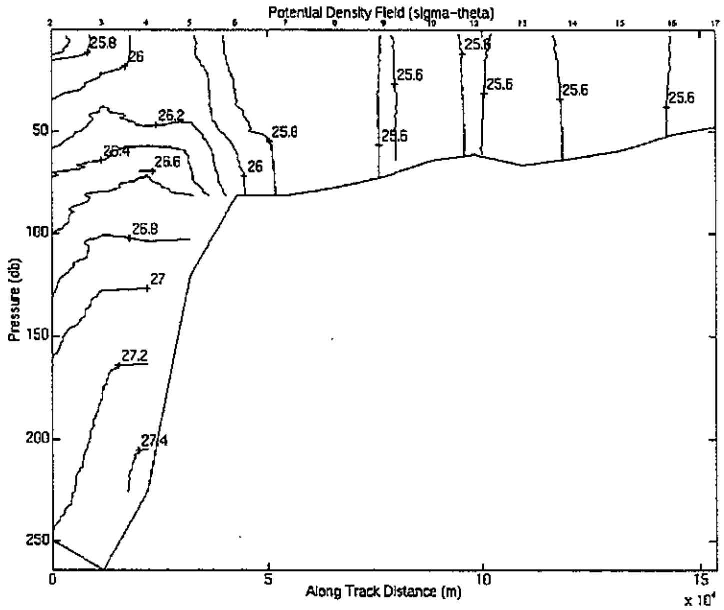


Figure 20. Contours of potential density at 0.2 kg/m^3 intervals for the Northeast Peak Section conducted on 12 April 1997. The blanked out region shows the depth to which data was collected and closely follows the bathymetry except in the deep casts. The numbers at the top of the figure are the CTD cast numbers and mark the position of each profile in the section.

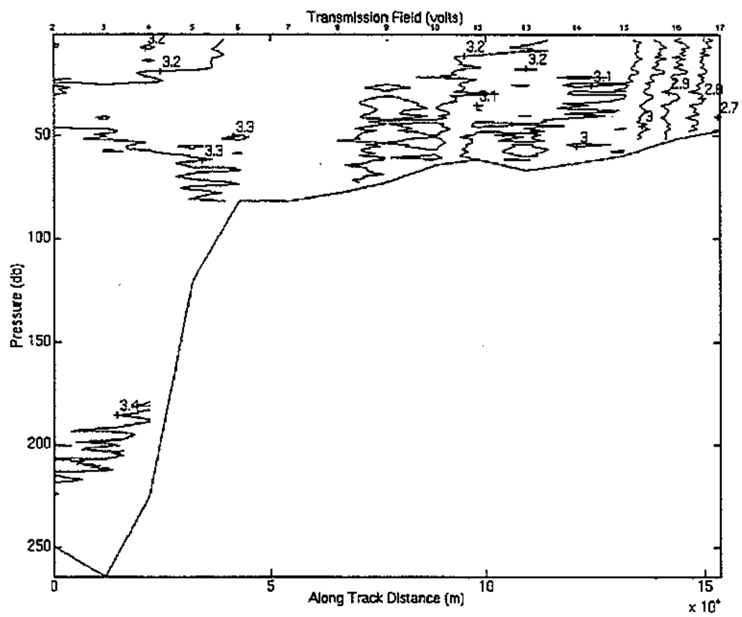


Figure 21. Contours of transmission at 0.1 V intervals for the Northeast Peak Section conducted on 12 April 1997. Note that the full scale on this transmissometer was about 3.4 V. The blanked out region shows the depth to which data was collected and closely follows the bathymetry except in the deep casts. The numbers at the top of the figure are the CTD cast numbers and mark the position of each profile in the section.

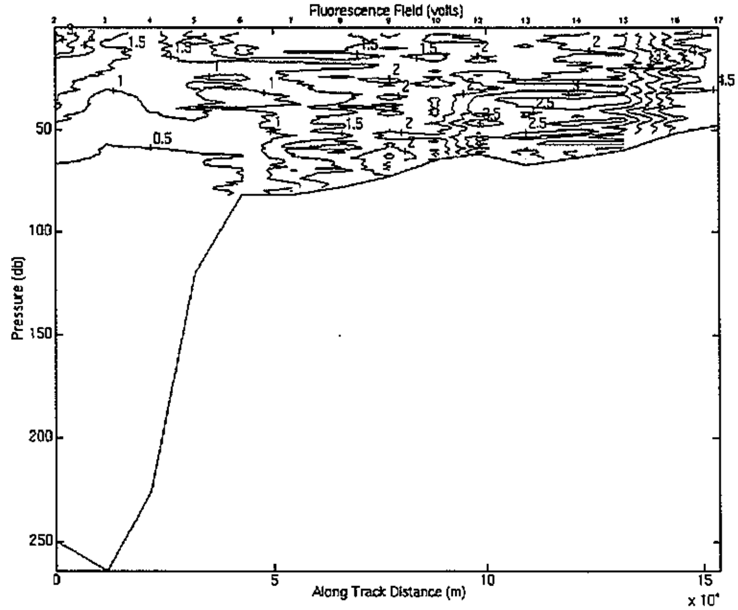


Figure 22. Contours of fluorescence at 0.5 V intervals for the Northeast Peak Section conducted on 12 April 1997. The blanked out region shows the depth to which data was collected and closely follows the bathymetry except in the deep casts. The numbers at the top of the figure are the CTD cast numbers and mark the position of each profile in the section.

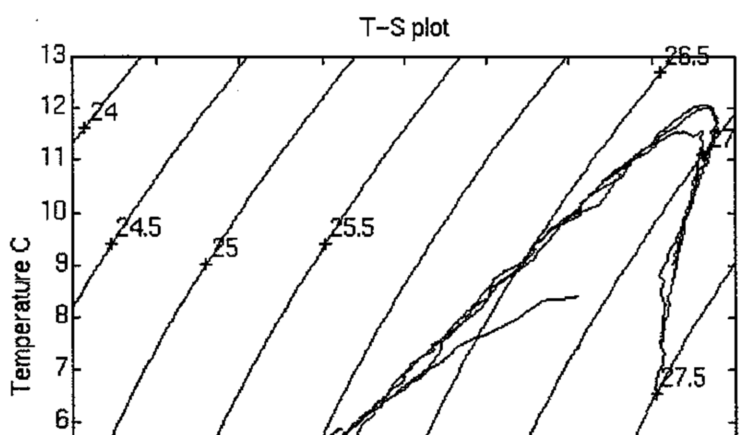


Figure 23. Northeast Peak section Temperature-Salinity plot for the section conducted on 12 April 1997. The smooth contour lines are lines of constant density at zero pressure. The contour interval is 0.5 kg/m^3.

Over the Northeast Channel three distinct water masses are present. In the deep waters below about 80-m deep there is water flowing into the Gulf of Maine. The upper layer of this water is Warm Slope Water with a maximum temperature of about 12 ° C and a salinity of about 35.2 PSU. Below this, hugging the side of the Northeast Channel, is slope water which has a similar salinity (35.2 PSU) but is much cooler at a minimum of 7 ° C. The surface waters over the Northeast Channel show Scotian Shelf Water reaching some way across the channel from the Scotian Shelf. This water is cold, with a minimum temperature of 3.5 ° C, and fresh, the minimum salinity recorded being less than 32 PSU. It also shows evidence of a spring bloom with the fluorometer reading increasing to 3 V on entering this water mass.

Long-Term Section - The standard Long-Term section (see Figure 1) was done on 13 April 1997. Contour plots of the raw data for this section are shown in Figures 24 through 28 (temperature, salinity, calculated density, transmissometer output and fluorometer output) and a T-S plot of all the data collected on the section shown in Figure 29. The continuous series of profiles takes 12 to 14 hours to make. The section stretches from the well-mixed region over the crest of the bank out over the southern flank of the bank and across the shelf-break.

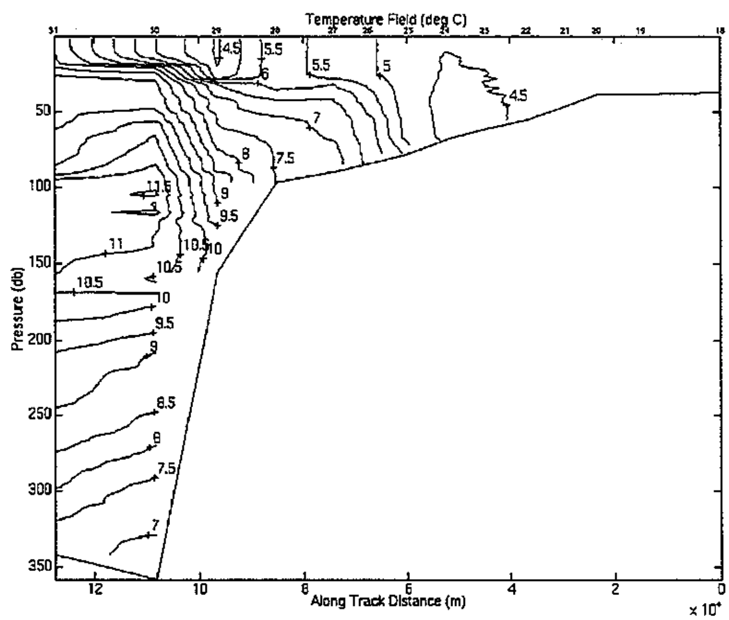


Figure 24. Contours of temperature at 0.5 ° C intervals for the Long Term Section conducted on 13 April 1997. The blanked out region shows the depth to which data was collected and closely follows the bathymetry except in the deep casts. The numbers at the top of the figure are the CTD cast numbers and mark the position of each profile in the section.

Starting at on-bank end of the section, the water at CTD station 18 at a depth of less than 50 m appears to be well within the summer tidally mixed front (known to be at about the 60-m isobath). There are low transmissometer readings there and high fluorometer readings of over 4.5 V. This indicates the spring bloom that occurs over the center of the bank at this time of year. The fluorometer reading drops from over 4.5 V to 1 V from CTD station 20 to 22 with an

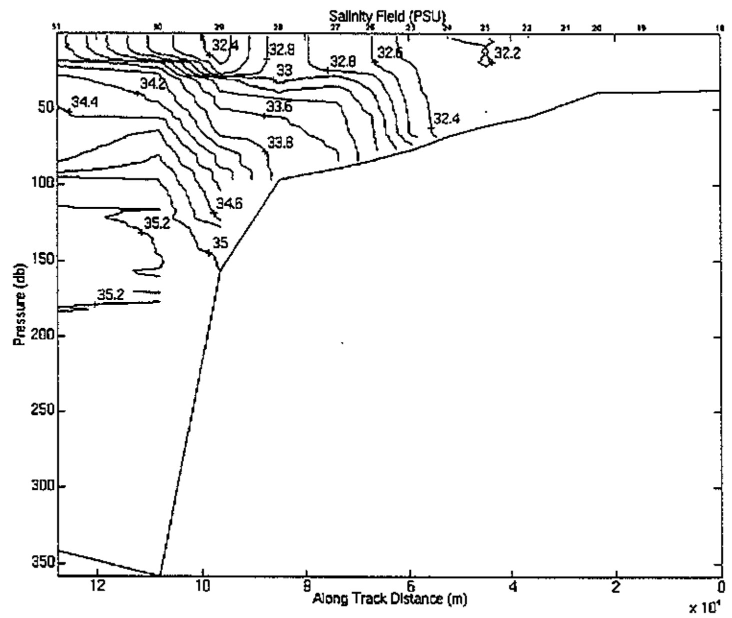


Figure 25. Contours of salinity at 0.2 PSU intervals for the Long Term Section conducted on 13 April 1997. The blanked out region shows the depth to which data was collected and closely follows the bathymetry except in the deep casts. The numbers at the top of the figure are the CTD cast numbers and mark the position of each profile in the section.

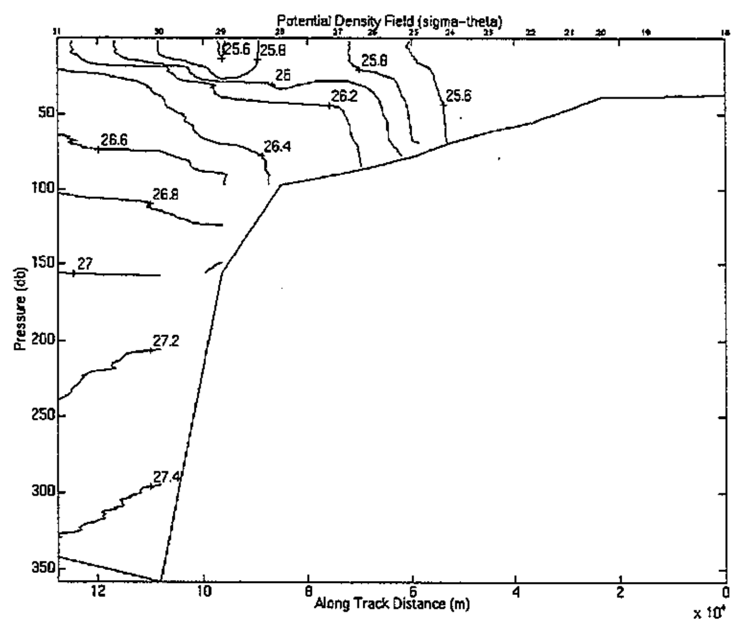


Figure 26. Contours of potential density at 0.2 kg/m^3 intervals for the Long Term Section conducted on 13 April 1997. The blanked out region shows the depth to which data was collected and closely follows the bathymetry except in the deep casts. The numbers at the top of the figure are the CTD cast numbers and mark the position of each profile in the section.

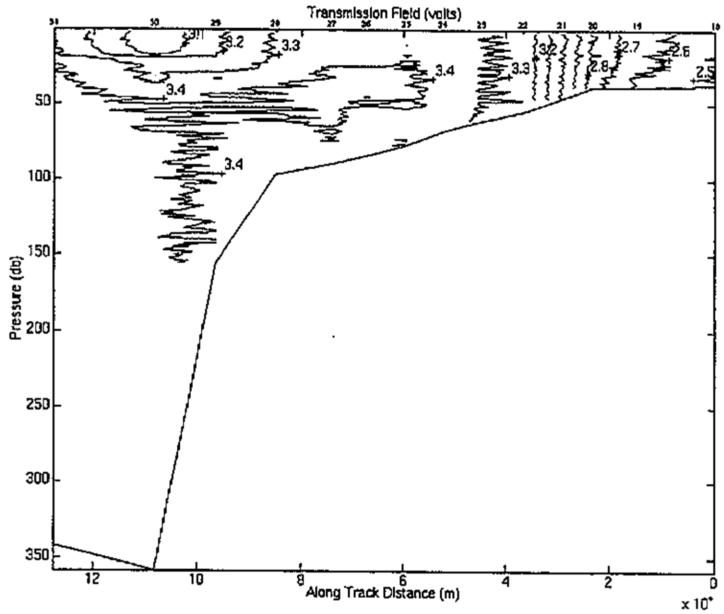


Figure 27. Contours of transmission at 0.1 V intervals for the Long Term Section conducted on 13 April 1997. The blanked out region shows the depth to which data was collected and closely follows the bathymetry except in the deep casts. The numbers at the top of the figure are the CTD cast numbers and mark the position of each profile in the section.

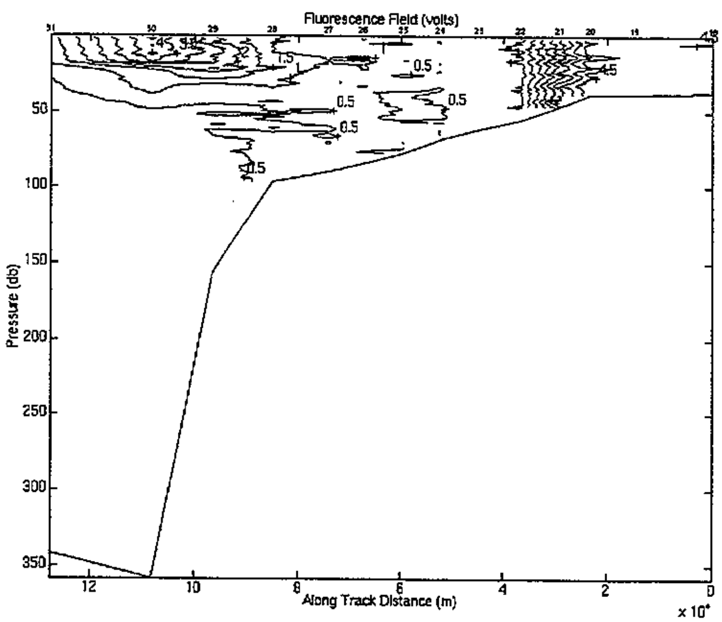


Figure 28. Contours of fluorescence at 0.5 V intervals for the Long Term Section conducted on 13 April 1997. Note that the full scale on this transmissometer was about 3.4 V. The blanked out region shows the depth to which data was collected and closely follows the bathymetry except in the deep casts. The numbers at the top of the figure are the CTD cast numbers and mark the position of each profile in the section.

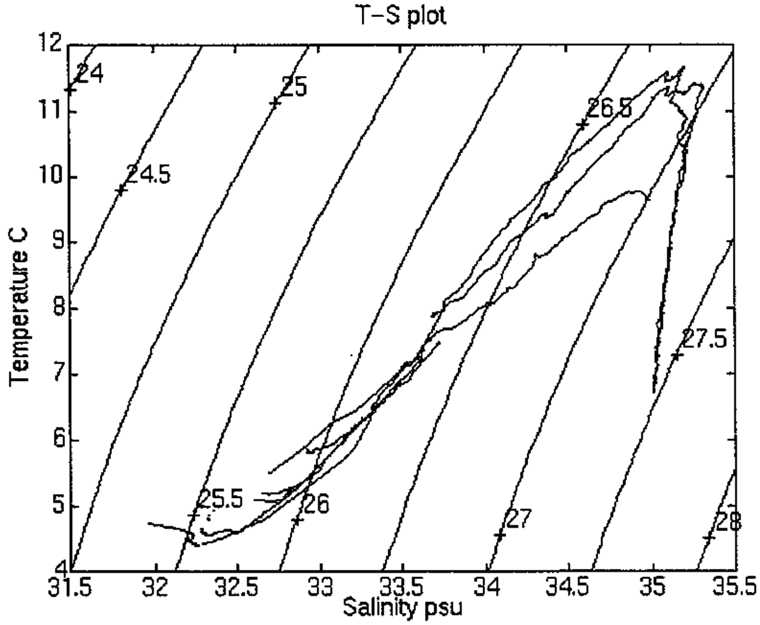


Figure 29. Long Term section Temperature-Salinity plot for the section conducted on 13 April 1997. The smooth contour lines are lines of constant density at zero pressure. The contour interval is 0.5 kg/m^3.

associated increase in the transmissometer reading. Between this fluorescence front and the shelf-break the fluorometer reading is roughly constant at 0.5 - 1 V with an asscociated high transmissometer reading. In terms of temperature, salinity and density the water is vertically well mixed from the center of the bank to CTD station 25, which is approaching the base of the shelf/slope front. The contouring intervals are not fine enough to show clear horizontal temperature and salinity gradients in this region, which are roughly constant at about 4.5 ° C and 32.3 PSU.

From CTD station 25 to the shelf-break (CTD station 28) the water is both vertically stratified and horizontally stratified with the presence of the shelf/slope front. The temperature near the bottom increases from 5 ° C to 7.5 ° C towards the shelf-break and the salinity increases from 32.4 PSU to 33.8 PSU. The upper waters are at about 5.5 ° C and about 32.7 PSU.

Beyond the shelf-break there are three water masses present. At the surface there appears to be a patch of water from the spring bloom region over the center of the bank. This is identified by its salinity, temperature and fluorescence values of 32.4 PSU, 4.5 ° C and 4 V respectively which are very similar to those found over the bank. The water is possibly a little too saline to originate from the Scotian Shelf. Below this layer of water is the Warm Slope Water which has a maximum salinity of 35.2 PSU and a maximum temperature of 11.5 ° C. Below this there is slope water of similar salinity (35.2 PSU) but much cooler at a minimum temperature of 7 ° C.

Mid-Bank Section - The Mid-Bank section (see Figure 1) was done on 14 April 1997 using the extra time available on the cruise. Contour plots of the raw data for this section are shown in Figures 30 through 34 (temperature, salinity, calculated density, transmissometer output and fluorometer output) and a T-S plot of all the data collected on the section shown in Figure 35. The continuous series of profiles takes about 11 hours to make. The section stretches from the well-mixed region over the crest of the bank out over the southern flank of the bank and across the shelf-break. It runs approximately parrallel to the Long-Term section between the Long-Term section and the Northeast Peak section.

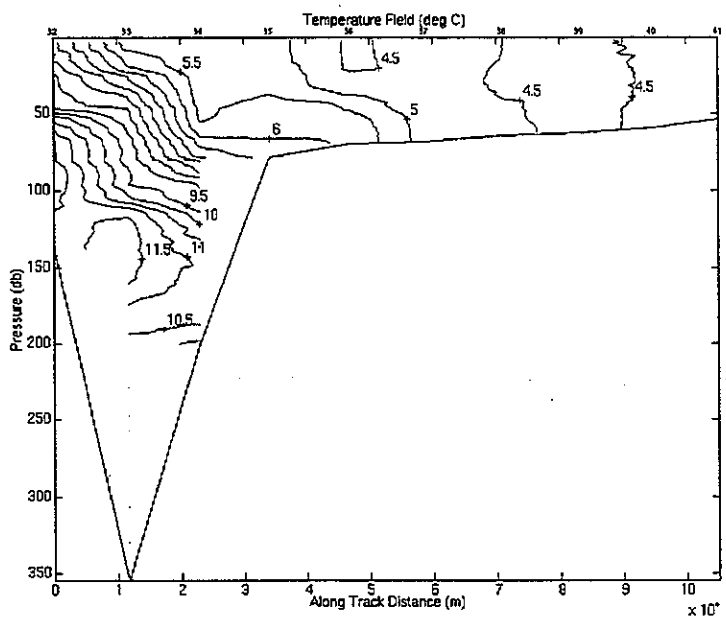


Figure 30: Contours of temperature at 0.5 deg C intervals for the Mid-Bank Section conducted on 14/4/97. The blanked out region shows the depth to which data was collected and closely follows the bathymetry except in the deep casts. The numbers at the top of the figure are the CTD cast numbers and mark the position of each profile in the section.

Starting at on-bank end of the section, the water at CTD station 41 at a depth of less than 50 m appears to be within the summer tidally mixed front (known to be at about the 60-m isobath). There are low transmissometer readings there and high fluorometer readings of about 3.5 V. This is not as high as in the other two sections and indicates the edge of the spring bloom that occurs over the center of the bank at this time of year. The fluorometer reading drops from 3.5 V to 1 V from CTD station 41 to 38 with an associated increase in the transmissometer reading. Over the rest of the section the fluorometer reading is roughly constant at a low 0.5 - 1 V with an associated high transmissometer reading. In terms of temperature, salinity and density the water is vertically well mixed from the center of the bank to CTD station 37, which is approaching the base of the shelf/slope front. The contouring intervals are not fine enough to show clear horizontal temperature and salinity gradients in this region, which are roughly constant at about 4.5 deg C and 32.4 PSU.

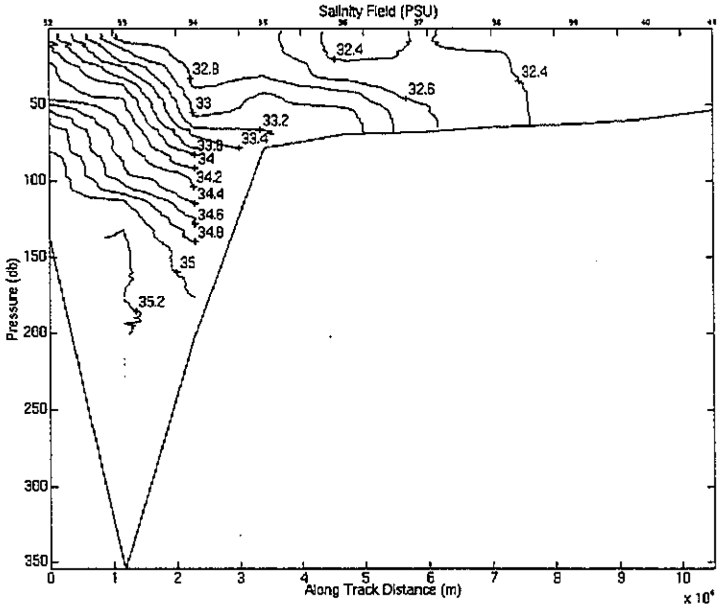


Figure 31: Contours of salinity at 0.2 PSU intervals for the Mid-Bank Section conducted on 14/4/97. The blanked out region shows the depth to which data was collected and closely follows the bathymetry except in the deep casts. The numbers at the top of the figure are the CTD cast numbers and mark the position of each profile in the section.

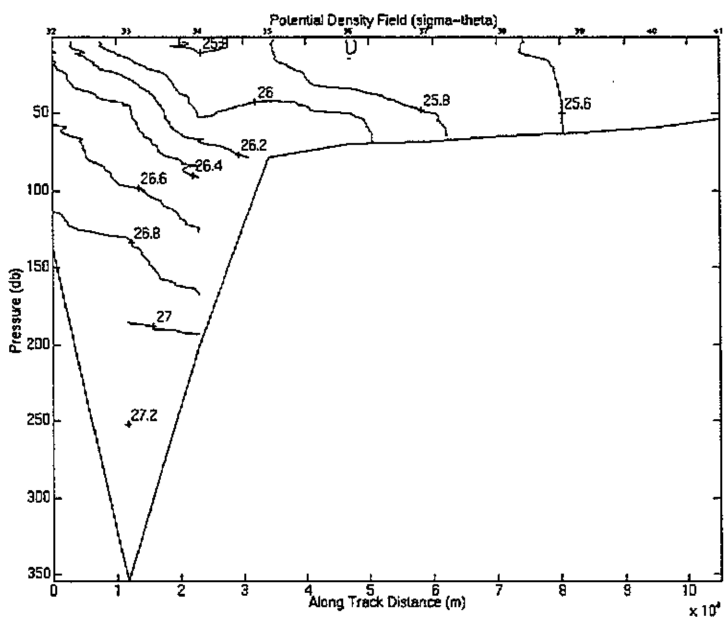


Figure 32: Contours of potential density at 0.2 kg/m^3 intervals for the Mid-Bank Section conducted on 14/4/97. The blanked out region shows the depth to which data was collected and closely follows the bathymetry except in the deep casts. The numbers at the top of the figure are the CTD cast numbers and mark the position of each profile in the section.

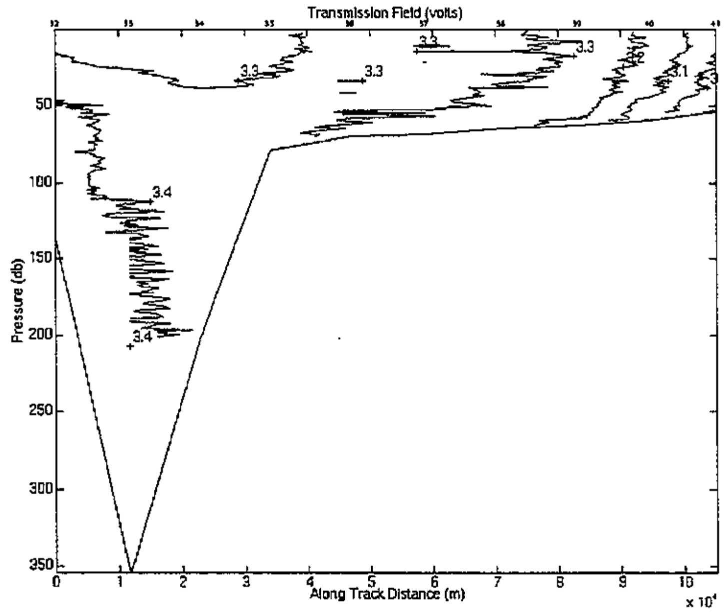


Figure 33: Contours of transmission at 0.1 V intervals for the Mid-Bank Section conducted on 14/4/97. Note that the full scale on this transmissometer was about 3.4 V. The blanked out region shows the depth to which data was collected and closely follows the bathymetry except in the deep casts. The numbers at the top of the figure are the CTD cast numbers and mark the position of each profile in the section.

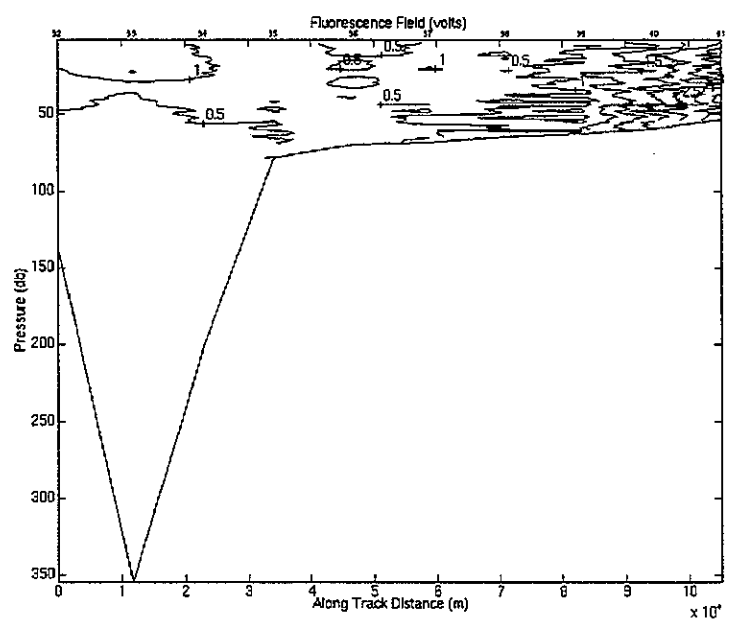


Figure 34: Contours of fluorescence at 0.5 V intervals for the Mid-Bank Section conducted on 14/4/97. The blanked out region shows the depth to which data was collected and closely follows the bathymetry except in the deep casts. The numbers at the top of the figure are the CTD cast numbers and mark the position of each profile in the section.

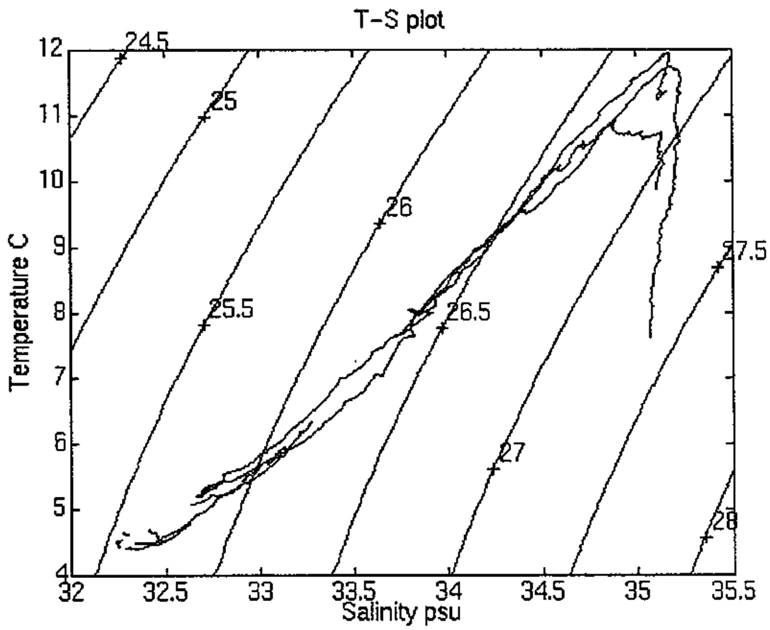
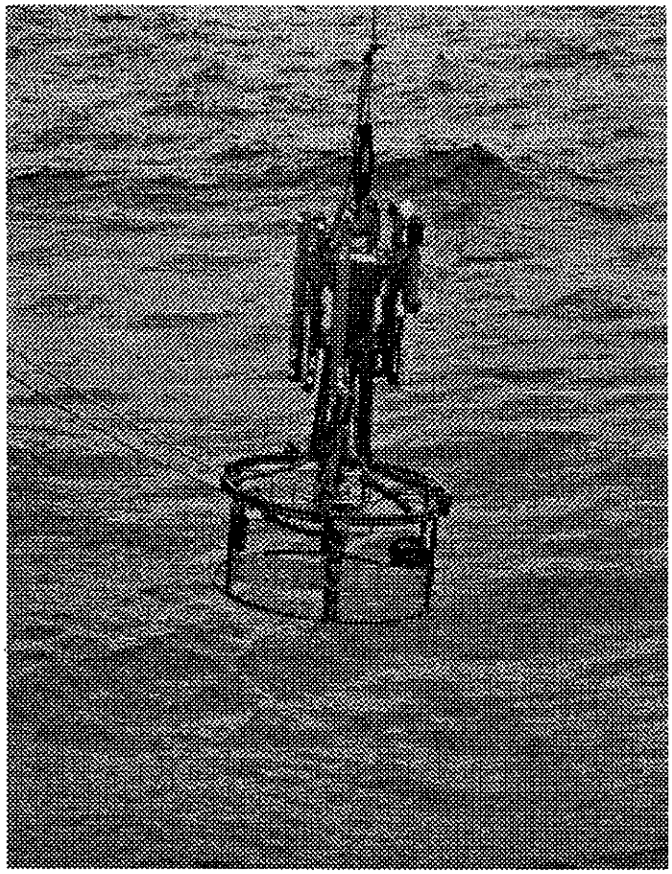


Figure 35: Mid-Bank section Temperature-Salinity plot for the section conducted on 14/4/97. The smooth contour lines are lines of constant density at zero pressure. The contour interval is 0.5 kg/m^3.

In the upper 70-m of water from CTD station 37 to the end of the section (CTD station 32) is the shelf/slope front. Below this, in the deeper waters beyond the shelf-break, Warm Slope Water can be seen with a maximum temperature of 11.5 deg C and a maximum salinity of 35.2 PSU. The cooler slope water cannot be seen in this section since the deeper data collected was considered erroneous due to the problems with the CTD.

FSI CTD Performance: During this cruise, the FSI CTD package (see Picture 12) did not perform to the level expected from a Level-1 CTD package aboard a UNOLS vessel. The problems with the instrumentation on KN149 are listed below so they can be addressed before the next cruise.



Picture 12. The FSI CTD system being deployed from the R/V KNORR. The "lightbulb" on top of the water sampler is the PAR sensor

The FSI CTD system consists of the FSI ICTD and water samper with LiCor PAR, SeaTech transmissometer and fluorometer and Datasonics altimeter. The unit was loaded aboard the KNORR before it was tested, and during these tests the water sampler did not respond. Paul Dugas of FSI came immediately, and the fault was repaired. It is very convienient to have FSI nearby. The problem was inside the CTD where the wires from the electronics to the underwater connector to the water sampler had not been plugged in, thereby causing the intial tests of the package to fail when trying to trip the Niskin bottles. This problem would have been caught if a full test of the system had been made ahead of time. Fortunately, there was a two day Leg 1 of the cruise on which the CTD was not required which allowed time to fix and test the system before it was required. Otherwise, the cruise would have had to be unacceptably delayed to allow for CTD repair time.

In most of the longer or deeper casts an error appears in the pressure and all of the temperatures and the conductivity records. Two examples of this erratic behavior for the pressure record and the 150-ms PRT temperature record are shown in Figures 36 and 37 from CTDs 032 and 034 respectively. The errors are characterized by what are apparently slow drifts in the pressure record which are not consistent with a constant lowering rate, then sudden jumps of about 20 dB which return the pressure to that expected. On these casts it is unclear what the true pressure is, thus making the entire cast suspect. The temperature records and conductivity records for these casts are also corrupted in what appears to be a similar manner, so it is most likely in the central digitizing electronics. This fault needs to be found and repaired before this CTD would be again usable.

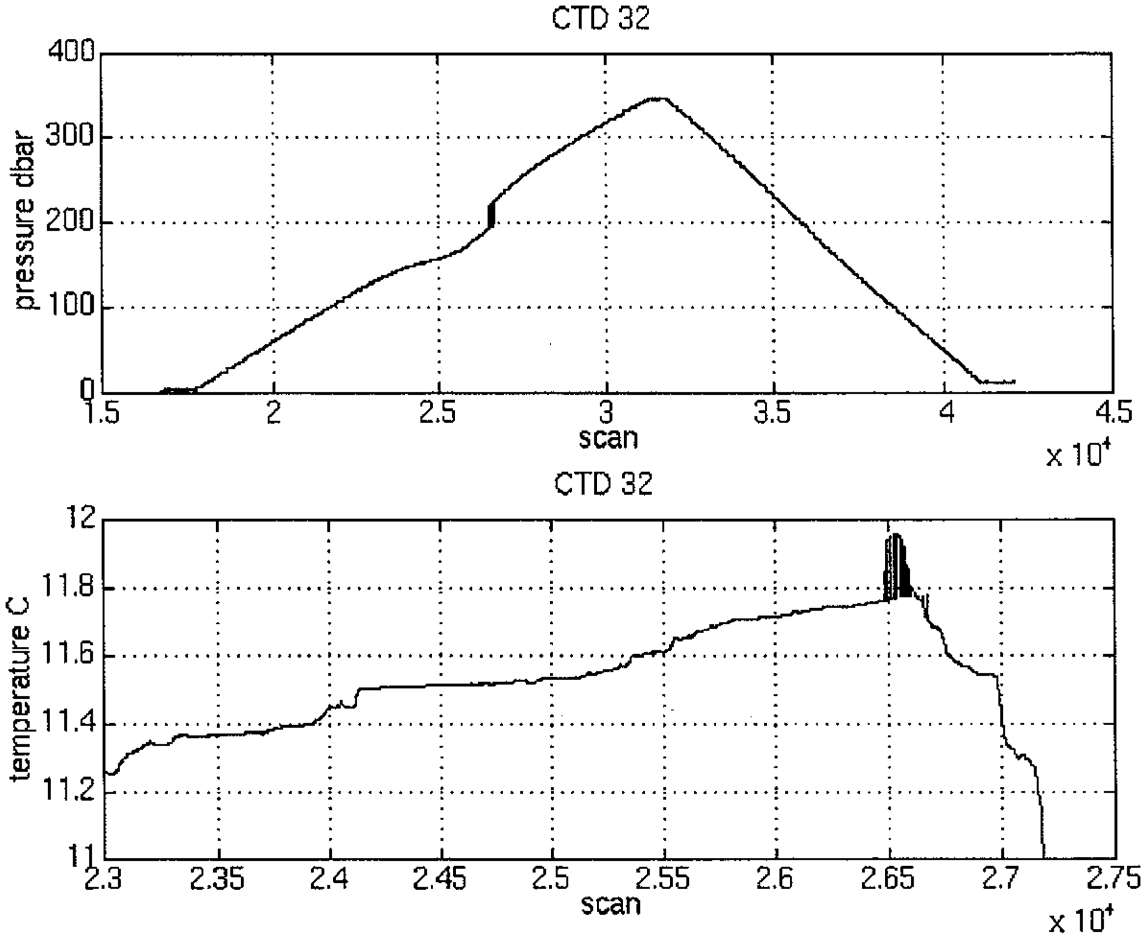


Figure 36. The pressure and temperature records from CTD032 plotted against scan number. The pressure record shows a deviation from constant lowering rate, then a sudden jump back to the expected pressure. Also the pressure also does not return to zero at the end of the profile. The temperature record also shows a noisy record at the same time as the pressure noise.

There is a persistant, intermittant noise in the 400-ms temperature sensor. An example of this noise for CTD001 is shown in Figure 38. It appears to be digital noise since the erroneous values are often repeated. Because of consistent noisy behavior during the entire cruise, this sensor was not used in the post processing of the data. The 150ms temperature sensor combined with the 25-ms temperature sensor produced temperature profiles of the required accuracy for our purposes.

The software provided by FSI is barely adequate. The acquisition program is liable to crash if the rosette is 'homed' during a cast or if the 'down-cast' is ended. Consequently we adopted the procedure of always homing the rosette before starting the cast and using the down-cast option in the software to collect all the data for the cast. This worked fairly reliably, barring occasional inexplicable software crashes which would require the computer to be rebooted. It is inconvenient to be rebooting the computer during a cast, particularly since it often occurs at the bottom of the cast when the CTD is possibly only 2-m off the ocean floor.

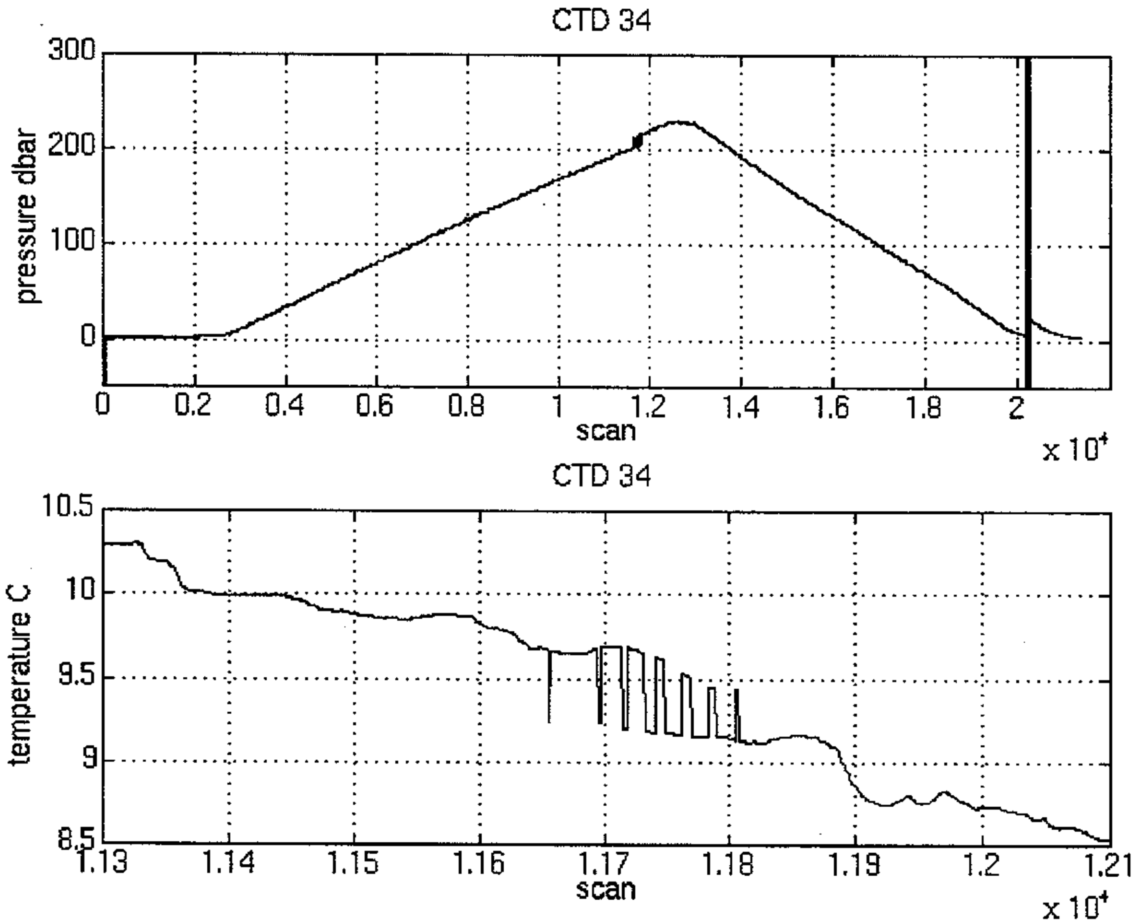


Figure 37. The pressure and temperature records from CTD034 plotted against scan number. The pressure record (top panel) again shows a deviation from constant lowering rate, then a sudden jump back to the expected pressure. The temperature record (on an expanded scale in the bottom panel) again shows a noisy record at the same time and coherent with the pressure noise.

At the recommendation of the CTD group at WHOI I have never used the post processing software that is provided with this package and cannot comment further on it. To process FSI CTD data I use the program scaler (provided by FSI) to write the data into ASCII format and then load it into MATLAB. Once in MATLAB I use a set of programs that I have developed to process the data fairly quickly.

The CTD frame needs another guard ring attached above the bottles and water sampler. This will simplify attaching lines to the frame on its recovery and better protect the bottles against any knocks. Three bottles were broken (and the anodizing on the water sampler scratched because of the lack of a top guard ring to protect the bottles and system) when the CTD was brought up too close to the KNORR and the package caught on the bulge keel. Fortunatley, no forther damage was done, and the package was successfully recovered, and wire termination checked with a pull test before used again.

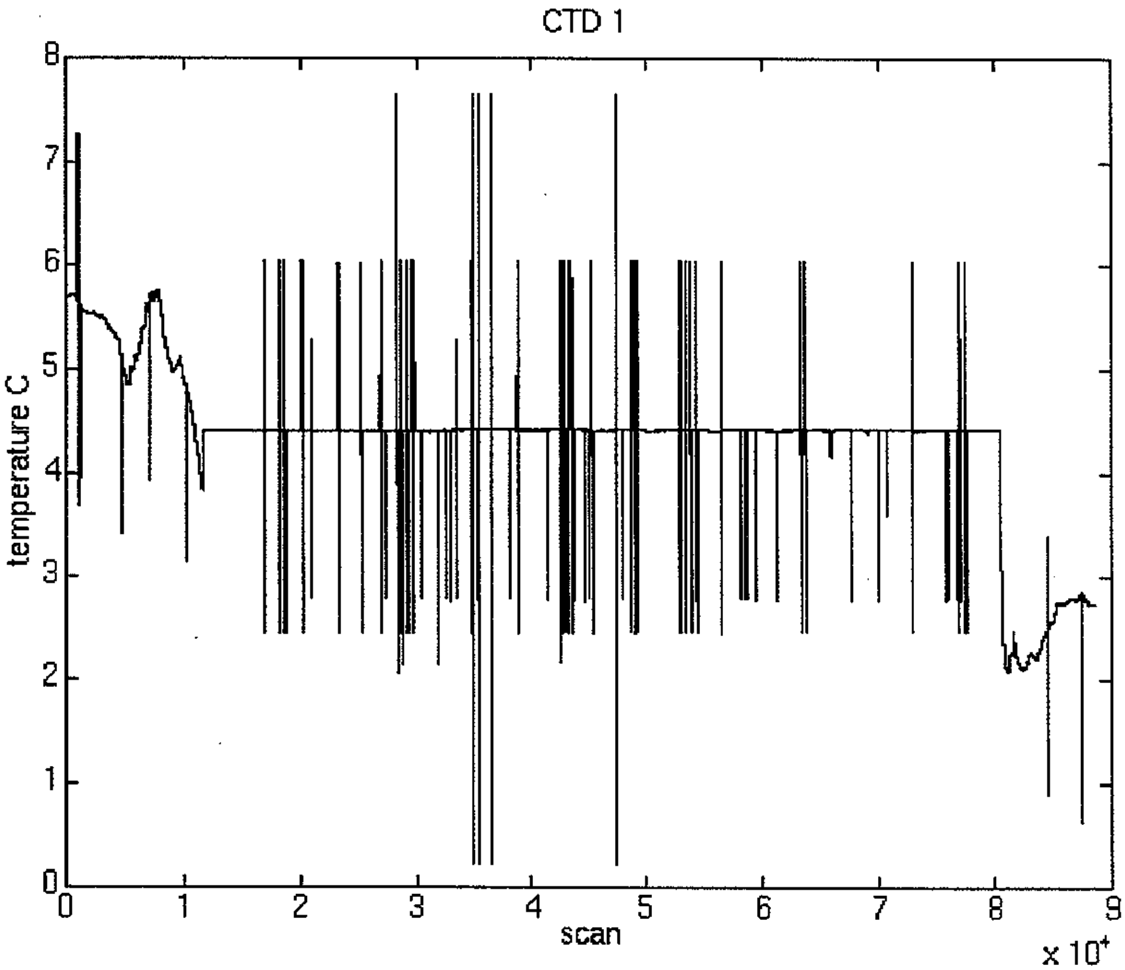


Figure 38. The temperature record from the primary 400 ms temperature sensor during CTD profile 001 during the 1 hour yo-yo comparison profile (12 ups and down between the surface and abour 75 meters). The noise which often appears like a bit error, dominates this sensor's record.

EVENT	INSTRUMENT	CAST	STATION	Year	Month	Day	HR:MN	S/E	N. Latitude	W. Longitude	Cast	Water	Comments
1	FSI CTD	1	Southern Flank	97	April	11	9:10	S	40° 57.866	67° 19.416	76	76	1 hr yo-yo
							10:10	E					Bottles J1, J2, J3
2	Bottom Press		Southern Flank	97	April	11	11:00	S				76	Recovery
3	Science Buoy		Southern Flank	97	April	11	12:15	S				76	Recovery
4	Guard "C"		Southern Flank	97	April	11	14:20	S	40° 58.104	67° 19.160		76	Present GPS Position
5	Guard "F"		Southern Flank	97	April	11	14:20	S	40° 57.807	67° 19.099		76	Present GPS Position
6	Science Buoy		Northeast Peak	97	April	11	20:00	S				75	Recovery Bottom Section
7	FSI CTD	2	NE15	97	April	12	2:10	S	42° 01.499	65° 30.077	320	850	
							2:45	E	42° 01.45	65° 30.467			Bottles Misfired
8	FSI CTD	3	NE14	97	April	12	3:15	S	41° 59.249	65° 37.508	321	700	
							4:17	E	41° 59.077	65° 38.757			Bottle J4
9	FSI CTD	4	NE13	97	April	12	5:00	S	41° 56.958	65° 44.681	217	230	
							5:19	E	41° 56.944	65° 45.162			Bottle J5
10	FSI CTD	5	NE12	97	April	12	6:05	S	41° 54.597	65° 51.759	130	135	
							6:19	E	41° 54.592	65° 51.765			Bottle J6
11	FSI CTD	6	NE11	97	April	12	7:05	S	41° 52.105	65° 58.705	80	90	
							7:15	E	41° 51.959	65° 58.526			Bottle J7
12	FSI CTD	7	NE10	97	April	12	8:06	S	41° 49.760	66° 06.468	81	90	
							8:17	E	41° 49.686	66° 06.444			Bottle J8
13	FSI CTD	8	NE09	97	April	12	9:05	S	41° 47.338	66° 14.377	75	80	
							9:16	E	41° 47.203	66° 14.081			Bottle J9
14	FSI CTD	9	NE08	97	April	12	10:03	S	41° 45.068	66° 21.735	71	75	
							10:14	E	41° 44.813	66° 21.618			Bottle J10
15	FSI CTD	10	NE07	97	April	12	10:57	S	41° 42.557	66° 28.999	68	75	
							11:06	E	41° 42.271	66° 28.819			Bottle J11
16	Science Buoy		Northeast Peak	97	April	12	14:27		41° 43.92	66° 32.16	75		Deploy Steel Buoy "B"
17	Guard Buoy "A"		Northeast Peak	97	April	12	16:42		41° 43.988	66 32.280	75		Deploy Steel Guard "A"
18	FSI CTD	11	BS20	97	April	12	17:21	S	41° 44.252	66° 32.068	64	69	1 Hour Yo-Yo
							18:24	E	41° 44.225	66° 31.998			Bottles J12, J13, J14
19	FSI CTD	12	NE06	97	April	12	19:27	S	41° 40.442	66° 35.741	60	64	
							19:37	E	41° 40.287	66° 35.629			Bottle J15
20	FSI CTD	13	NE05	97	April	12	20:23	S	41° 38.146	66° 43.092	65	70	
							20:34	E	41° 38.265	66° 42.805			Bottle J16
21	FSI CTD	14	NE04	97	April	12	21:30	S			65	67	
							21:45	E	41° 35.409	66° 50.512			Bottle J17

EVENT	INSTRUMENT	CAST	STATION	Year	Month	Day	HR:MN	S/E	N. Latitude	W. Longitude	Cast	Water	Comments
22	FSI CTD	15	NE03	97	April	12	22:22	S	41° 33.308	66° 57.764	59	62	
							22:34	E	41° 33.163	66° 57.728			Bottle J18
23	FSI CTD	16	NE02	97	April	12	23:14	S	41° 31.054	67° 05.756	51	55	
							23:25	E	41° 30.839	67° 05.807			Bottle J19
24	FSI CTD	17	NE01	97	April	13	0:00	S	41° 28.425	67° 12.184	45	51	
							0:13	E	41° 28.416	67° 12.147			Bottle J20
25	FSI CTD	18	LT02	97	April	13	9:59	S	41° 24.380	67° 32.458	37	40	
							10:10	E	41° 24.308	67° 32.226			Bottle J21
26	FSI CTD	19	LT03	97	April	13	10:55	S	41° 16.930	67° 28.533	37	41	
							11:10	E	41° 16.741	67° 28.212			No Bottle
27	FSI CTD	20	LT04	97	April	13	11:39	S	41° 12.594	67°26.444	39	45	
							11:45	E	41° 12.540	67° 26.512			Bottle J22
28	FSI CTD	21	LT05	97	April	13	12:20	S	41° 09.691	67° 24.500	46	50	
								E					Bottle J23
29	FSI CTD	22	LT06	97	April	13	13:18	S	41° 06.003	67° 22.322		60	
							13:25	E					Bottle J24
30	FSI CTD	23	LT07	97	April	13	13:59	S	41° 01.893	67° 20.581	60	63	
								E					Bottle J25
31	FSI CTD	24	LT08	97	April	13	14:42	S	40° 58.013	67° 18.939	69	73	
							14:49	E	40° 57.991	67° 18.954			Bottle J26
32	FSI CTD	25	LT09	97	April	13	15:26	S	40° 54.517	67° 16.926	77	78	
							15:32	E	40° 54.533	67° 16.913			Bottle J27
33	FSI CTD	26	LT10	97	April	13	16:20	S			82	86	
							16:33	E	40° 50.573	67° 14.946			Bottle J28
34	FSI CTD	27	LT11	97	April	13	17:20	S	40° 47.175	67° 13.049	88	90	
							17:32	E	40° 47.217	67° 13.011			Bottle B1
35	FSI CTD	28	LT12	97	April	13	18:37	S			96	99	
							18:48	E	40° 41.556	67° 10.371			Bottle B2
36	FSI CTD	29	LT13	97	April	13	19:55	S	40° 35.816	67° 08.053	155	157	
							20:10	E	40° 35.610	67° 08.089			Bottle B3
37	FSI CTD	30	LT14	97	April	13	21:18	S			342	~500	
							21:41	E	40° 29.750	67° 04.931			Bottle B4
38	FSI CTD	31	LT15	97	April	13	22:52	S	40° 20.065	66° 59.901	340		
								E					Bottle B5
39	FSI CTD	32	M18	97	April	14	10:24	S	40° 44.005	66° 23.884	345	650	
							10:50	E	40° 43.852	66° 24.074			Bottle B6

EVENT	INSTRUMENT	CAST	STATION	Year	Month	Day	HR:MN	S/E	N. Latitude	W. Longitude	Cast	Water	Comments
40	FSI CTD	33	M17	97	April	14	11:33	S	40° 48.955	66° 28.929	340	1650	
							12:00	E	40° 48.920	66° 29.144			Bottle B7
41	FSI CTD	34	M16	97	April	14	12:55	S	40° 53.922	66° 33.927	227	230	
							13:05	E	40° 53.650	66° 34.035			Bottle B8
42	FSI CTD	35	M15	97	April	14	14:00	S	40° 58.959	66° 38.097	78	82	
							14:08	E	40° 58.770	66° 38.070			Bottle B9
43	FSI CTD	36	M14	97	April	14	15:07	S	41° 04.692	66° 43.159	69	75	
							15:15	E	41° 04.484	66° 43.368			Bottle B10
44	FSI CTD	37	M13	97	April	14	16:13	S	41° 09.980	66° 48.019	67	70	
							16:24	E	41° 09.827	66° 48.040			Bottle B11
45	FSI CTD	38	M12	97	April	14	17:15	S	41° 15.469	66° 53.031	65	68	
							17:25	E	41° 15.386	66° 53.056			Bottle B12
46	FSI CTD	39	M11	97	April	14	18:13	S	41° 21.001	66° 57.530	62	65	
							18:22	E	41°20.964	66° 57.692			Bottle B13
47	FSI CTD	40	M10	97	April	14	19:04	S	41° 26.042	67° 01.968	59	61	
							19:12	E	41° 26.081	67° 02.108			Bottle B14
48	FSI CTD	41	NE02	97	April	14	19:54	S	41° 30.962	67° 05.690	54	55	
							20:02	E	41° 31.079	67° 05.900			Bottle B15
49	Science Buoy		Southern Flank	97	April	15	2:14		40° 57.979	67° 19.139		76	Deploy
50	FSI CTD	42	Southern Flank	97	April	15	2:50	S	40° 57.465	67° 18.842	73	76	1 Hour Yo-Yo
							3:50	E	40° 56.509	67° 19.448			Bottle B16
51	Schlitz Mooring		1Y	97	April	15	1320		40° 49.005	69° 09.000		65	GLOBEC mooring redeploy

KNORR KN149 Leg II Personnel:

Scientific Party:

Jim Irish, Chief Scientist
Bill Williams, Scientist
Pat O'Malley, Engineer
Kent Bradshaw, Engineer
Nick Witzell, Engineer
Dave Schroeder, Technician
Rebecca Latter, Guest Student
Greg Packard, SSSG Technician

Ship's Crew

Paul Howland, Captain
George Silva, Chief Mate
John Mayer, Second Mate
Kent Sheasley, Third Mate
Ray Heimberger, Radio Officer
Mark DeRoche, Bosun
Ed Graham, AB
Jim Ryder, AB
John Drawley, AB
Scott Sirois, OS
Francis Doohan, OS
Steve Walsh, Chief Engineer
Pat Mone, Chief Engineer
Chris Morgan, Second Engineer
Piotr Marczk, Third Engineer
Guntar Bauerlein, Electircian
Joe Mayes, Oiler
Efrain Sambula, Oiler
Steve Knox, Oiler
Mirth Miller, Steward
Thomas Allen, Cook
Mike Aiguier, Mess Attendant

Chief Scientist's Cruise Log

R/V KNORR Cruise 149 - LEG II GLOBEC

Monday - 7 April 1997 (JD097)

1600 - KNORR arrived at WHOI dock after shipyard
Fueling begins (9 tank trucks total), 4 this evening
Planning meeting with Irish, Williams and Mate Silva
No loading as crew tired after overnight sail

Tuesday - 8 April (JD098)

0800 - Fueling continues with final five trucks
While fueling, loading ship with anchors, buoys, etc.
1200 - Ship basically load with all buoys, anchors, etc.
1300 - Offloaded GLOBEC steel buoys to pull test to meet Joe Coburn's new, undefined policy at request of Captain Howland.
1330 - Offload FSI CTD as water sampler failing to work.
1430 - KNORR departs WHOI dock on Coastal Mixing and Optics Leg I.
Water sampler undergoing repair in Kemp shop, appears to have had a bad RS485 chip? and cable not plugged in? inside CTD fish after repair at FSI. Problem not caught earlier by CTD group.

Wednesday - 9 April (JD099)

0900 - Started test of steel buoys under direction of Dave Simoneau
Tests consist of shackeling a weight to the mooring attachment point on the bottom of each buoy, then pulling on each of the four lifting eyes with a crane to pick up the static load of the buoy (about 2,000 pounds) plus the weight of the extra load (a standard 3,900 pound anchor) and holding for a few minutes. After setting the anchor and buoy down, the welds are inspected visually for cracks, etc.
Guard Buoy A - all four bails OK
Science Buoy B - all four bails OK
1000 - Array recoiled on Science Buoy B and readied for loading

Thursday - 10 April 1997 (JD100)

0730 - KNORR docked after Leg 1 CMO cruise
0800 - Unloading CMO moorings, tripods while loading gear by hand
0900 - Started loading buoys, etc.
1130 - Loading essentially complete
1415 - Departed WHOI for Southern Flank Site through Great Round Shoals. Temperature cool, winds from North about 10 kts with a few whitecaps, seas 2'.

Friday - 11 April 1997 (JD101)

0510 - Started 1 hour yo-yo CTD series at Southern Flank site
Three flashing lights seen
Guard buoy "F" appears to be out of position to the southeast

0630 - Moving into position for bottom presssure recovery
0640 - Talking with Southern Flank Science buoy release, Range 840 m
0645 - Talking with bottom pressure instrument, Range 765 m
0650 - Moving in closer to position
0658 - Command Bottom Pressure Release
0700 - Bottom pressure package sited on surface
0711 - Bottom Pressure Instrument on deck
0720 - Secured forward of Spare science Buoy
Light fouling on entire frame, Moderate corrosion on pressure case mounting flanges as before. Sea Slugs on frame and floats, a few barnacles
0815 - Command release of Southern Flank Science Buoy
Subsurface float seen on surface
Bouy quite clean, bio-optical packages quite clean, ADCP has brown slime growing on it.
0918 - Secured on deck, cleaning up
1000 - Buoy moved and secured on deck
1005 - Drive by guard moorings for position check
Buoy "C" - 40° 58.108 N x 67° 19.161 W - Pass by to port of ship
Buoy "F" - 40° 57.807 N x 67° 19.103 W - Pass by to starboard of ship
1020 - Radar shows buoys about N-S alignment about 0.3 nm apart
Foam buoy has moderate fouling above water line no lines on buoy, solar panels clean, light working, OK.
Steel buoy fouled above water line, solar panels good, OK.
"C" ship - 40° 58.100 x 67° 19.158
Irish - 40° 58.108 x 67° 19.161
"F" ship - 40° 57.807 x 67° 19.095
Irish - 40° 57.807 x 67° 19.103
1045 - Depart site for Northeast Peak
1556 - At NE Peak site, no buoys in site
Acoustic check of bottom of buoy - right in position, Range 262 m
1559 - Command release, acknowledged
Subsurface float not sited on surface, searching region
Moving ship back to the position of the buoy deployment, range 91 m so still on bottom - set to range
1636 - Subsurface float visually sited on surface, 50 yards from boat
1705 - Bottom part of Northeast Peak mooring secured on board
2210 - Start NE Peak CTD Section at new station NE15
2315 - CTD at NE14

Saturday - 12 April 1997 (JD102)
0100 - CTD at NE13
0205 - CTD at NE12
0305 - CTD at NE11
0406 - CTD at NE10
0505 - CTD at NE09
0600 - Starting Seacats for NE Peak mooring -1735, 1820, & 2006

Sunny, calm, few whitecaps, wind 5 kts
0603 - CTD at NE08
0657 - CTD at NE07
0700 - Setting ADCP #130 for NE Peak mooring
0717 - Set PC Clock and initialize with GLO5C - 1 hour averages
0800 - setting up for Northeast Peak Science buoy launch
Steel Science Buoy "B"
1010 - mooring all set up, ship in position
1022 - mooring strung out on anchor towing to position
1027 - Anchor launched 41° 43.92 N x 66° 32.16 W
1040 - Guard buoy "A" swung into launch position
Light plugged in, battery charged up to max by regulators
1230 - Starting to deploy steel guard buoy
1242 - Anchor away - 41° 43.988 x 66° 32.280 W
Range about 285 meters to WNW of Science mooring
1310 - Acoustic check of release - range 586 m, Disabled, all OK
1321 - Start 1 hour yo-yo CTD at BS20 beside mooring
1345 - Dumping data from Southern Flank Science Buoy
1527 - CTD at NE06
1623 - CTD at NE05
1730 - CTD at NE05
1822 - CTD at NE03
Changing long wave radiation sensor on buoy
Removed S/N 28379F3
Replaced with S/N 27953F3 with cal = 3.06E-6 v/w/m2
Attached to channel 3
1914 - CTD at NE02
Redo software for new configuration with SFLANK5C.USE
2000 - CTD at NE01
Testing buoy system
LWR in Speed sensor channel - need to open and change

Sunday - 13 April 1997 (JD103)

Long-Term Section through southern flank mooring
Windy, Rainy, Foggy
0459 - CTD at LT02
0655 - CTD at LT03
0739 - CTD at LT04
0820 - CTD at LT05
0918 - CTD at LT06
0959 - CTD at LT07
1042 - CTD at LT08 - mooring site low visibility, lights not on
1126 - CTD at LT09
1220 - CTD at LT10
1320 - CTD at LT11

1437 - CTD at LT12

Changed SST sensor to S/N 31632

Changed T15 sensor to S/N 30418 (which was removed from Biop package #2 recovered from 40 meters depth)

Both sensors check out OK

Sensors 31617 and 31623 both have high current drain and are probably flooded - at least 4 sensors which have been mounted on the buoys as sea surface temperature sensors have flooded, maybe this represents a low pressure problem with the Morrison seal?

1555 - CTD at LT13

1718 - CTD at LT14

1852 - CTD at LT15

Monday - 14 April 1997 (JD104)

CTD section from Atlantic to Crest east of Long Term Southern flank Section

Wind Down, Foggy

0624 - CTD at M18

0733 - CTD at M17

0855 - CTD at M16

Fog clearing, wind 12-15 kts, 6' swell with 2' chop

1000 - CTD at M15

1107 - CTD at M14

1216 - CTD at M13

1615 - CTD at M12

1413 - CTD at M11

1504 - CTD at M10

1554 - CTD at NE02

Tuesday - 15 April 1997 (JD105)

0214 - Deploy Southern Flank Science Mooring at 40° 57.979 N x 67° 19.139 W

0250 - 1 hour yo-yo by Southern Flank Mooring

0630 - Rigging for Ron Schlitz mooring deployment

0920 - Deploy Ron Schlitz mooring 1Y with 1 VACM at 12 meters depth east of the Great South Channel at 40° 49.005' N x 69° 09.000' W.

Head for WHOI

19:30 - At WHOI dock, offloading hand equipment

Wednesday - 16 April 1997 (JD106)

0730 - Offload rest of GLOBEC equipment, start loading CMO gear

1230 - CMO Leg III underway