Cruise Report
C.S.S. PARIZEAU Cruise 95-034
to Scotian Shelf and Georges Bank

US GLOBEC

NW ATLANTIC / GEORGES BANK STUDY

Nov. 24 - Dec. 3, 1995
<table>
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<th>Local Cruise Designation:</th>
<th>95-034</th>
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<tr>
<td>Vessel:</td>
<td>C.S.S. <em>Parizeau</em></td>
</tr>
<tr>
<td>Dates:</td>
<td>24 Nov.-3 Dec. 1995</td>
</tr>
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<td>Area:</td>
<td>Southwest Nova Scotia/Georges Bank</td>
</tr>
<tr>
<td>Responsible Agency:</td>
<td>Ocean Sciences Division, Scotia-Fundy Region, DFO</td>
</tr>
<tr>
<td>Ship's Master:</td>
<td>Capt. W. English</td>
</tr>
</tbody>
</table>

**Scientific Personnel:**

- P.C. Smith: Ocean Sciences
- M. Scoiney: Ocean Sciences
- P. d'Entremont: Ocean Sciences
- R. Boyce: Ocean Sciences
- D. Gregory: Ocean Sciences
- B. Nickerson: Ocean Sciences
- L. Bellefontaine: Ocean Sciences
- M.J. Graca: Harding Scientific
- D. Williams: Dalhousie U.
- C. Hannah: Oceadyne Environmental Consultants
1. PURPOSE

The scientific objectives of this cruise were:

1) long term monitoring of the major inflows to the Gulf of Maine, namely the surface inflow from the Scotian Shelf off Cape Sable and the deep inflow of slope water through Northeast Channel,
2) determining the seasonal hydrographic properties along the eastern boundary of the Gulf of Maine, and
3) measuring the hydrographic structure over Truxton Swell and in Jordan Basin (if possible) in order to determine the extent of slope water penetration into Jordan Basin.

The activities planned for the cruise period include:

1) replacement of moorings off Cape Sable (C2) and in Northeast Channel (NECE,NECW),
2) performance of a CTD survey along the eastern boundary of the Gulf of Maine, including Browns Bank, Northeast Channel, Georges Basin and Truxton Swell, and
3) performance of repeated ADCP transects across Northeast Channel over at least one tidal cycle.

2. NATURE OF DATA GATHERED

During this cruise, a total of five current meter moorings and eight guard buoys were recovered at three sites in the Gulf of Maine (C2, NECW, NECE; see Figure 1a and Table 1a). The bottom portion of a sixth current meter mooring (#1188) was also recovered; the float and instrument had been recovered by a fisherman. One guard buoy was also missing from that site; it had been reported adrift off Great South Channel in October, 1995.

In addition, a total of 54 CTD stations (Fig.1b, Table 2) were occupied along:

1) a section from the 50 m isobath off Cape Sable to the outer edge of Browns Bank (Fig.3),
2) two sections across Northeast Channel from Browns to Georges Bank (Figs.4,5),
3) three shorter sections across the mouth of Northeast Channel, in Georges Basin and on Truxton Swell (Figs.6,7,8),
4) a section following the 200 m isobath on the eastern side of the Channel and extended out into the slope water (Fig.9),
5) a section across the outer Scotian Shelf off Shelburne (Fig.10), and
6) at each mooring site.

The quality of the CTD temperature and salinity measurements is quite acceptable (Table 2a), although there were some problems with mismatched time constants for measurements of strongly interleaving water masses. Oxygen samples were drawn from up to 9 depths at each station, providing a reasonable distribution of the dissolved oxygen field. The Beckman and YSI
dissolved oxygen sensors both showed a large offsets with respect to the titrated values (Table 2a; Fig.2a–d). After rejection of a significant number of outliers, stable calibrations were obtained by linear regression of uptrace readings against titrated values (Table 2b). Downtraces from both O₂ sensors showed persistent problems: the YSI sensor exhibited occasional noise, spikes, and positive surface layer offsets; the Beckman sensor showed persistent negative surface layer offsets. Therefore it is recommended that the O₂ uptraces rather than downtraces be archived. In addition, roughly 170 oxygen isotope samples were collected throughout the water column at even numbered stations (Fig.1b) for Dr. Robert Houghton of Lamont-Doherty Earth Observatory. Nutrient samples were collected throughout the water column as well at virtually all stations.

Twelve repeated ADCP transects (Table 3) were run over the duration of the cruise along the mooring/CTD line in Northeast Channel (Fig.1b) in order to monitor the inflow/outflow over an M2 tidal cycle. A total of ~32 hrs was devoted to straight-run transects, with an additional 18 hrs spent on the CTD and mooring lines. Only processed (averaged) data were collected over the entire cruise and stored as 5-min averaged data files. During the final transect (#11; Table 3), a test of the ADCP transducer alignment error and amplification factor showed that these values were acceptably small (Table 3a.)

3. PROGRAM SUMMARY

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4. MOORING OPERATIONS

The recovery of five instrument moorings and one partial mooring at three sites (C2, NECE, and NECW; Table 1a, Appendix B) was completed without incident. Using differential GPS positioning with AGCNAV and transponding with the release, it was possible to locate and retrieve all of the moorings quickly. The partial mooring (#1188 at NECWA) consisted of just backup buoyancy (BUB) and the release; the upper portion of the mooring had been returned by a fisherman in September. The wire lead above the BUB appears to have been hit with something sharp and parted. Otherwise, all the returning moorings were in excellent shape. There were minor amounts of hair growth on the instruments at the 20 and 50m levels, but the conductivity cells and rotors were clean. There were no obvious instrument malfunctions; each had the expected number of words in memory.

One of the original nine guard buoys was missing from the NECW site. Those that returned showed the normal signs of wear after a 5-6 month deployment. The bottom chain had some pitting and corrosion, especially at the welds of the individual links. Also, some of the bushings installed on the shackles under the buoys in June showed significant wear and several on NECE and NECW buoys had begun to allow minor amounts of wear (1/8") between the shackle pin and the hoop under the buoy. The recovery operation itself was hampered by the tangling of the bottom chain on the NECE moorings only. The resulting large clump at the base of these moorings had to be lifted separately with the crane. Also, on those moorings which didn't tangle, it was found that the 1 1/2" chain at the very bottom would not pass through the block in the A-frame and had to be lifted separately.

The placement of the new moorings (Table 1, Appendix A) was relatively straightforward. Using the DGPS positions from previous deployments, it was possible to relocate the moorings in those precise locations with the help of AGCNAV. The sound speed correction for the ELCAN sounder on the bridge was:

true depth = 97533* sounding + 5m (keel depth).

The only mishap during deployment was the parting of a swivel under the float on the NECE mooring (#1210, Table 1) which caused the upper current meter and SeaCat to fall a short distance to the deck. The swivel was apparently missing a retention clip, but should have been dead weight tested (to 1000 lbs.) before use.

Two new types of guard buoy moorings were deployed at each site, along with one of conventional style (see Appendix A). The standard type ("A") uses oval rings, each of which must be welded, to connect the various types of tackle (e.g. chain, nylon braid). New type "B" replaces the rings with connecting links which do not require welding; type "C" uses rings, but replaces the bottom chain assembly with nylon braid, supported by two small trawl floats to keep it from chafing on the anchor. The new guard buoy reflectors also featured rounded edges, rather than the previous pointed corners. Attempts to measure any differences in range between the new and old reflectors were frustrated by highly variable seastate conditions, but it appeared that both types were able to achieve a 5 nm range in moderate-to-high seas. At the start of the trip, when the seastate was low, the old reflectors at C2 were detected at a range of 12-13 nm.

Problems:
(1) In future, all swivels must strength tested (to at least 1000 lbs) prior to use in the...
moorings.

(2) A new means of mounting the bottom pressure gauges in the anchor should be investigated. The present method involving taping the lanyard to the release casing is clumsy and slightly dangerous.

(3) The positions of moorings in the AGCNAV waypoint file should be designated by mooring number (e.g. 1188), not the site name (e.g. NECWA).

(4) To facilitate the recovery of three guard buoys at a time, three empty barrels should be brought along in future to hold the tackle.

5. HYDROGRAPHIC MEASUREMENTS

Hydrographic and chemical measurements were made at a total of 54 stations (Table 2) using a Seabird 9/11 Plus system, equipped with either a Beckman (CTD15-17,26-54) or a SBE 23 Y Yellow Springs Instruments (YSI; CTD1-12,18-25) dissolved oxygen sensor. A second YSI sensor was substituted for CTD13,14, but it gave no good data and was replaced with the Beckman sensor at CTD15. The data were logged on a 33 Mhz 486 PC and post-processed between stations using SEABIRD’s software. Once processed, the data were transferred to the VAX over the network for final tape backup to EXABYTE.

The performance of both O₂ sensors was less than satisfactory. The downtraces from the YSI probe began to show noise, spikes and unrealistic positive surface layer (~30m) offsets at CTD11 and 12, which continued to a lesser extent at CTD18-25. The downtraces from the Beckman sensor consistently showed unreasonably low values in the surface layer. However, both sensors appeared to recover to realistic values in the surface layer on the uptraces. This resulted in the acceptable calibrations (Table 2b; see Section 5b below) derived by comparing the uptrace observations to the titrations.

5a. Processing

The processing and data transfer to the VAX was initiated by a single command at the end of the station. This command, called PROCESS, starts a batch job that sequentially passes the data through a number of programs. Most were from SEABIRD’s SEASOFT package. A few were custom written at BIO. The following is a summary of the processing procedure:

(1) Convert raw frequency data to binary pressure, temperature and conductivity using SEABIRD’s DATCNV program.

(2) Split the file into the up and down traces using SEABIRD’s SPLIT program.

(3) Check downcast for and mark any ‘wild’ data points with SEABIRD’s WILDEDIT program.

(4) Filter downcast conductivity and temperature using SEABIRD’s FILTER program. This is a low pass filter and we used a time constant of 0.045 seconds for conductivity and 0.15 seconds for temperature.

(5) Mark downcast scans where the CTD is moving less than the minimum velocity of 0.10 m/s using SEABIRD’s LOOPEDIT program.

(6) Align downcast pressure, temperature and conductivity using SEABIRD’s ALIGNCTD program by advancing the conductivity signal by 0.01 sec.
(7) Apply the thermal mass correction for the conductivity cell using SEABIRD's CELLM program.
(8) Bin average downcast data to 1.0 m intervals using SEABIRD's BINAVG program.
(9) Compute downcast salinity, potential density (Sigma-0), potential temperature, dissolved oxygen, and depth using SEABIRD's DERIVE program.
(10) Convert the downcast from binary to ASCII using SEABIRD's TRANS program.
(11) Convert downcast to ODF format using PCS program SEAOEF.
(12) Create IGOS message using PCS program ODF_IGOS.
(13) Prepare batch and command files to transfer the data to the VAX and create the input for SEABIRD's ROSSSUM program using our customized MAKEFILE program.
(14) Check for bottles, then use ROSSSUM to create the rosette summary file.
(15) Convert the resulting BTL file to a format suitable for ingestion into Quattro PRO (.QAT file) using our customized QPROBTL program.
(16) Use the command file from step (12) to perform the FTP transfer of the raw binary and processed data to the VAX.
(17) Copy Quattro, downcast, and ODF files to appropriate directories and clean up.

Plots and status info displayed by the SEASAVE program during the acquisition are discarded when the program terminates. The post-processing plotting was not included in the batch job because SEABIRD's SEAPLOT program requires interactive operator attention.

5b. Calibration

At the base of each CTD cast two rosette bottles were tripped, one of which carried a pair of digital thermometers. Salinity samples were drawn from each of the two bottles and analyzed onboard with an Guildline AutoSal salinometer. The comparison of these standards against the SeaBird CTD (Table 2a below) shows that, after the removal of several obvious outliers, the offset in temperature is negligible, but that for salinity is significantly different from zero. Nevertheless, the standard deviations about the offsets are small, so the calibrations for both T and S are considered generally acceptable. However, some problems with mismatch of the SeaBird sensor time constants were evident from apparent density inversions which occurred in regions of exceptionally high vertical gradients of T and S, such as the interleaving zone at the mouth of Northeast Channel (see Figs 8,9 below). Removal of these features requires reprocesing with iterative adjustment of the sensors' individual time constants, which has not yet been undertaken. Away from these frontal regions, the accuracies implied by Table 2a are assumed to apply.

In addition, dissolved oxygen samples were collected from rosette bottles tripped over the entire water column and analyzed on board with the automated titration unit borrowed from Marine Chemistry. Comparisons between the Beckman and YSI measurements and bottle samples revealed that both sensors have significant offsets with respect to the titrated values (Table 2a). The overall mean differences between uptrace sensor readings and titrated values suggests that the Beckman sensor was somewhat more stable than the YSI on this cruise. However, part of the observed variance may be due to titration errors, since titrated replicate samples showed a standard deviation of 0.46 ml/l. In order to provide the best O2 calibrations, significant outliers (based on replicate statistics) were excluded from the linear regression analysis.
of titrated uptrace sensor values. Thus, the effective calibrations for the two sensors (Table 2b; Figs.2a-d) indicate high correlation and low standard error for both YSI and Beckman instruments.

Problems:
(1) An attempt should be made to minimize the density inversions in the interleaving regions by iterative adjustment of the sensor temperature and conductivity time constants.
(2) Because of problems with noise and surface layer offsets in the downtraces for both YSI and Beckman O2 sensors, it is recommended that the dissolved oxygen uptraces, rather than downtraces, be archived.

5c. Sections
CTD sections 1-VI (Figs. 3-10) depict hydrographic conditions, 1) along the eastern boundary of the Gulf of Maine, 2) across the sill in Northeast Channel, 3) down the western flank of Browns Bank, 4) along Tronox Swell, 5) across the mouth of Northeast Channel, 6) along the 200 m isobath on the eastern side of the Channel, and 7) across the outer Scotian Shelf off Shelburne, respectively. Section Ia (Fig.3) shows a sharp demarcation in surface water properties at CTD10-11, where the surface salinity rises by roughly 0.5 in the offshore direction. Below the surface layer there is evidence for intrusion of warmer, saltier waters at CTD7-9, probably supplied by the upwelling current along the northern flank of Browns Bank. At the outermost stations (CTD11,12), the presence of slope water is evident along the edge of Northeast Channel.

Two versions of Section Ib were run in Northeast Channel along the mooring/ADCP line. The first (Section Ib1; CTD13-17) was occupied just prior to the first large storm of the cruise on 26 Nov.; the second (Section Ib2; CTD18-25) was occupied just after the storm had passed. The water mass structure on Section Ib1 (Fig.4; section completed with CTD 18-19) was dramatically different from that on Section Ib2 (Fig.5). Before the storm (Fig.4), warm (>14°C), salty (>35) slope water was found on the eastern side of the Channel, pressed against the flank of Browns Bank. After the storm (Fig.5), however, most of the slope water was missing, and that remaining had shifted to the centre of the Channel (CTD21). These changes are clearly seen by comparing the T,S properties on the two sections (Fig.4d vs. 5d).

A qualitative explanation for this phenomenon may be found in the numerical model results of Greenberg, et al. (1995), which indicate that the effect of strong NE winds on 26 Nov. would be strong onshore Ekman transport compensated by deep seaward transport in Northeast Channel. Moreover, the model’s seaward transport appears to be associated with a cross-channel component toward Georges Bank at the mooring line section. Thus it is plausible that the warm salty slope water was pushed across and out of Northeast Channel by the wind-driven transport, but such an hypothesis clearly requires further testing.

Section II (Fig.6) shows properties similar to those found on Section Ib2, but not Section Ib1. This is consistent with the notion that the replacement water on Section Ib2 comes from the onshore region. Salinities in excess of 35.0 are found at depth in Georges Basin (CTD38,39), but temperatures near the 200m isobath barely exceed 11°C.

Section III (Fig.7) along Tronox Swell depicts the transition from well-mixed waters off SW Nova Scotia to the well-layered structure in the central Gulf of Maine. The freshest water is found in the east (CTD30,31), isolated by a fairly sharp tidal front between CTD31 and 32.
Distinct evidence for a slope water intrusion is found at CTD23, where the salinity just reaches 35.0 near the bottom and warm temperatures (>25°C) persist throughout the water column. Further west, the cold intermediate layer is found at CTD36,37, where salinities do not exceed 34.5.

Section IV (Fig.8), across the mouth of Northeast Channel to Georges Bank, shows strong interleaving between coastal and Gulf Stream (T>16°C, S>35.5) water masses on the eastern side off Browns Bank. The latter is most probably the source region for the slope water intrusion found on Section IB1 (Fig.4), where its properties had already been diluted by mixing with shelf waters. On the other side, the well-mixed waters found on Georges Bank (e.g. CTD44) are considerably more saline than those off SW Nova Scotia or on Browns Bank.

Section V (Fig.9) extends from the offshore region through the eastern side of Northeast Channel to Truxton Swell, roughly along the 200m isobath. All stations on this line were occupied after the passage of the major storm and its attendant changes on 26 Nov. The offshore region is characterized by a strong front at the mouth of the Channel and interleaving of water masses. Within the Channel and through Georges Basin, the continuity of waters with salinity >35.0 suggests that a major intrusion of slope water has occurred in recent months, in spite of occasional countervailing transports. Evidence for this event will be sought from the current meter data.

Finally, Section VI (Fig.10) shows that the properties near the Scotian Shelf break off Shelburne differ from those off Northeast Channel (T<12°C in deep water), but that the surface waters on the shelf are similar to those found off SW Nova Scotia. In particular, the near-surface temperatures and salinities at CTD53,54 are very close to those at CTD2-9. This suggests that: 1) these two water masses have a common origin, and 2) the warmer, saltier waters found on the outer half of Browns Bank come from the Gulf of Maine or offshore. The fate of the freshwater on this section is still an open question.

References:


6. ADCP TRANSECTS

The RDI ADCP was run continuously over the cruise in the bottom track mode. The velocity measurements were made in 100 4-m bins below the transducer depth (4.9 m). In the standard acquisition mode, 10-ping ensembles were averaged over 5 minutes to create processed profiles of velocity, beam intensity, etc. The RDI system appeared to work well over the cruise.

Eleven primary transects (Table 3) formed the repeated ADCP section across the Channel, including CTD Sections IB1 and IB2 and the transits during mooring operations. On these transects, only the averaged processed data were collected. A total of 32 hrs was devoted to straight-run transects, with an additional 18 hrs spent on the CTD and mooring lines (transects
1-3). Some of the transects (9,10) were incomplete due to operational constraints. The transects in Table 3 show indications of strong vertical shear in the water column and will form the basis for the removal of the semidiurnal tidal signal from the records. They also showed layers of high backscatter extending from Georges Bank out into Northeast Channel at bank depths (C.Hamah, pers. comm.). These features ought to be investigated in future.

A calibration of the transducer alignment and amplification factor was conducted shortly after leaving B/N, on the straight run down to SW Nova Scotia. The results (Table 3a) show that both these quantities are negligibly different from their design values of 0 deg. and 1.00, respectively.

Acknowledgements:
We are greatly indebted to the officers and crew of the C.S.S. Parizeau for their skilled assistance and friendly cooperation, which was vital to the success of this mission. We also thank the Department of Oceanography at Dalhousie University for their encouragement of student participation in our field work. The help is greatly appreciated.
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TABLE 2a. Temperature and Salinity Calibration Results for Parizeau 95034

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<td>Beckman-Titration(15-17)</td>
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TABLE 2b. Dissolved Oxygen Regression Results for Parizeau 95034

$Y = aX + b \quad (Y=\text{titration}, X=\text{sensor})$

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<th>SENSOR</th>
<th>NO. SAMPLES</th>
<th>$a \pm a$</th>
<th>$b$(ml/l)</th>
<th>$\pm Y$(ml/l)</th>
<th>$r^2$</th>
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<td>Beckman(15-17)</td>
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<td>Beckman(26-54)</td>
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### TABLE 3 Primary ADCP Transects During Parizeau 95-034

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<th>TO (Lat./Long.)</th>
<th>COMMENTS</th>
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### TABLE 3a. Straight Run RDI Calibrations for Parizeau 95-034

**DATE:** 1 December, 1995

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FIGURE CAPTIONS:

Figure 1  a) Mooring sites, and b) CTD positions and ADCP transects for C.S.S. Parizeau Cruise 95-034, 24 Nov.-3 Dec. 1995

Figure 2 Calibration data for the (a,c) YSI and (b,d) Beckman dissolved oxygen sensors. Titrated values from rosette bottle samples are plotted against upracthe values from the sensors at the same depth. Bold lines through the points are linear regressions of titrated on sensor values (Table 2b). Dashed and dotted lines represent calibrations from data other than those plotted.

Figure 3 Hydrographic section 1a (CTD2-13) from Cape Sable to the offshore edge of Browns Bank.
   (a) temperature,  
   (b) salinity,  
   (c) sigma-t, and  
   (d) temperature vs. salinity.  
   (e) station map

Figure 4 Hydrographic section 1b (CTD13-19) across Northeast Channel at the mooring line.
   (a) temperature,  
   (b) salinity,  
   (c) sigma-t, and  
   (d) temperature vs. salinity.  
   (e) station map

Figure 5 Hydrographic section 1b (CTD18-25) across Northeast Channel at the mooring line.
   (a) temperature,  
   (b) salinity,  
   (c) sigma-t, and  
   (d) temperature vs. salinity.  
   (e) station map

Figure 6 Hydrographic section II (CTD38-41) on the western flank of Browns Bank.
   (a) temperature,  
   (b) salinity,  
   (c) sigma-t, and  
   (d) temperature vs. salinity.  
   (e) station map

Figure 7 Hydrographic section III (CTD30-37) along Truxton Swell.
   (a) temperature,
(b) salinity,
(c) sigma-θ, and
(d) temperature vs. salinity.
(e) station map

Figure 8 Hydrographic section IV (CTD27,29,44-48) across the mouth of Northeast Channel and Northeast Peak.
(a) temperature,
(b) salinity,
(c) sigma-θ, and
(d) temperature vs. salinity.
(e) station map

Figure 9 Hydrographic section V (CTD33,39,43,42,23,27,29,49-50) along the slope water inflow axis from Truxton Swell to the slope water, roughly along the 200m isobath.
(a) temperature,
(b) salinity,
(c) sigma-θ, and
(d) temperature vs. salinity.
(e) station map

Figure 10 Hydrographic section VI (CTD51-54) across the Scotian Shelf break off Shelburne.
(a) temperature,
(b) salinity,
(c) sigma-θ, and
(d) temperature vs. salinity.
(e) station map
Fig. 1. a) Mooring sites, and b) CTD positions and ADCP transects for C.S.S. Parizeau Cruise 95-034, 24 Nov. 3 Dec. 1995.
Fig. 2. Calibration data for (a,c) YSI and (b,d) Beckman dissolved oxygen sensors. Titrated values from rosette bottle samples are plotted against in-situ values from the sensors at the same depth. Bold lines through the points are linear regressions of titrated on sensor values (Table 2b). Dashed and dotted lines represent calibrations from data other than those plotted.
Fig. 3. Hydrographic section Ia (CTD 2-13) from Cape Sable to the offshore edge of Browns Bank.
Fig. 4. Hydrographic section Ib1 (CTD 13-19) across Northeast Channel at the mooring line.
Fig. 5. Hydrographic section Ib2 (CTD 18-25) across Northeast Channel at the mooring line.
Fig. 6. Hydrographic section II (CTD 38-41) on the western flank of Browns Bank.
Fig. 7. Hydrographic section III (CTD 30-37) along Truxton Swell.
Fig. 8. Hydrographic section IV (CTD 27,29,44-48) across the mouth of Northeast Channel and Northeast Peak.
Fig. 9. Hydrographic section V (CTD 33,39,42,43,23,27,29,49,50) along the slope water inflow axis from Truxton Swell to the slope water, roughly along the 200m isobath.
Fig. 10. Hydrographic section VI (CTD 51-54) across the Scotian Shelf break off Shelburne.
APPENDIX A  Diagrams for Moorings Deployed During C.S.S. Prowler Cruise 95-034
MOORING #1205  C2A  P. SMITH  GLOBEC  NOVEMBER 1995

LIGHT
FAIREY FLOAT

2 M 3/16" JACKETED WIRE

27 METERS
AANDERAA RCM 7127

83 M 3/16" JACKETED WIRE

2 GLASS BUB PACKAGES

723A ACOUSTIC RELEASE
503401

1/2 M 5/8" GALVANIZED CHAIN

115 METERS
2 - WHEEL ANCHOR
MOORING # 1206  C2  GLOBEC  P. SMITH  NOVEMBER 1995

LIGHT
FAIREY FLOAT
2 M 3/16" JACKETED WIRE

45 METERS
AANDERAA RCM 3569

49 M 3/16" JACKETED WIRE

95 METERS
AANDERAA RCM 5001

6.5 M 3/16" JACKETED WIRE

2 GLASS BUS PACKAGES

723A ACOUSTIC RELEASE 100808

1/2 M 5/8" GALVANIZED CHAIN

AANDERAA TIDE GAUGE 821

2 - WHEEL ANCHOR

105 METERS
MOORING # 1207  NECWA  P. SMITH  GLOBEC  NOVEMBER 1995

LIGHT
FAIREY FLOAT

2 M 3/16" JACKETED WIRE

22 METERS
SEACAT 16-03
163625-595

23 METERS
AANDERAA RCM 7131

184 M 3/16" JACKETED WIRE

2 GLASS BUB PACKAGES

723A ACOUSTIC RELEASE
107302

1/2 M 5/8" GALVANIZED CHAIN

211 METERS
2-WHEEL ANCHOR
MOORING # 1208  NECW  P. SMITH  GLOBEC  NOVEMBER  1995

LIGHT
FAIREY FLOAT
2M 3/16" JACKETED WIRE
AANDERAA RCM 7137

50 M 3/16" JACKETED WIRE

100 METERS
AANDERAA RCM 6401

49 M 3/16" JACKETED WIRE

150 METERS
AANDERAA RCM 6407

19 M 3/16" JACKETED WIRE
2 STREAMLINED VINYL PACKAGES
19 M 3/16" JACKETED WIRE

192 METERS
AANDERAA RCM 7124

16 M 3/16" JACKETED WIRE
2 GLASS SUB PACKAGES

723 A ACOUSTIC RELEASE
204704

1/2 M 5/8" GALVANIZED CHAIN
AANDERAA TIDE GAUGE 1271

2 - WHEEL ANCHOR MINIMUM 1500 LBS.

212 METERS
MOORING # 1209  NECEA  P. SMITH  GLOBEC  NOVEMBER 1995

LIGHT
FAIREY FLOAT

2M 3/16" JACKETED WIRE

23 METERS
SEACAT 16-03
163925-359

24 METERS
AANDERAA RCM 4208

184 M 3/16" JACKETED WIRE

5M SWIVEL

2 GLASS BUS PACKAGES

723A ACOUSTIC RELEASE
50X101

1/2 M 5/8" GALVANIZED CHAIN

212 METERS
2 - WHEEL ANCHOR
MOORING # 1210  NECE  P. SMITH  GLOBEC  NOVEMBER  1995

LIGHT
FAIREY FLOAT
2M 3/16" JACKETED WIRE

40 METERS
SEACAT 16-03
163925-365

50 METERS
AANDERAA RCM 9507
50 M 3/16" JACKETED WIRE

101 METERS
AANDERAA RCM 7551
49 M 3/16" JACKETED WIRE

151 METERS
AANDERAA RCM 8897
19 M 3/16" JACKETED WIRE
2 STREAMLINED VINYL PACKAGES
19 M 3/16" JACKETED WIRE

193 METERS
AANDERAA RCM 5359
16 M 3/16" JACKETED WIRE
2 GLASS BUB PACKAGES
723 A ACOUSTIC RELEASE
402908
1/2 M 5/8" GALVANIZED CHAIN
AANDERAA TIDE GAUGE 334

213 METERS
2 - WHEEL ANCHOR MINIMUM 1500 LBS.
GUARD BUOY WITH BALLAST "K"  
1 1/2" PINNED D-SHACKLE WITH BUSHING  
3/4" CONNECTING LINK  
2 FEET 1/4" GALVANIZED CHAIN  
1/2" CONNECTING LINK  
WILFRO SWIVEL  
1" GALVANIZED PINNED SHACKLE  
1/2" CONNECTING LINK  
3 FEET 3/8" GALVANIZED CHAIN  
1/2" CONNECTING LINK  
100 FEET 1/2" GALVANIZED CHAIN  
1/2" CONNECTING LINK  
2 - 2 1/4" NEWCO THIMBLE  
78 METERS 3/4" 2 IN 1 NYLON BRAIDED ROPE  
2 - 2 1/4" NEWCO THIMBLE  
1/2" CONNECTING LINK  
180 FEET 5/8" GALVANIZED CHAIN  
3/4" CONNECTING LINK  
5 FEET 1 1/2" CHAIN  
3/4" CONNECTING LINK  
1" PINNED GALVANIZED SHACKLE  
QUAD GUARD BUOY ANCHOR  

135 METERS
GUARD BUOY MOORING 1205C C2 P. SMITH GLOBEC NOV 1995

GUARD BUOY WITH BALLAST "Q"
1 1/2" PINNED D-SHACKLE WITH BUSHING

6" OVAL RING (3/4" STOCK)
2 FEET 5/8" GALVANIZED CHAIN
4" OVAL RING (5/8" STOCK)
1" GALVANIZED PINNED SHACKLE

WILFRO SWIVEL
1" GALVANIZED PINNED SHACKLE
4" OVAL RING (5/8" STOCK)
3 FEET 5/8" GALVANIZED CHAIN
4" OVAL RING (5/8" STOCK)
100 FEET 1/2" GALVANIZED CHAIN
4" OVAL RING (5/8" STOCK)
4" OVAL RING (5/8" STOCK)
2 1/2" - 2 3/4" NEWCO THIMBLE

135 METERS 7/8" NYLON/WEFT 2 IN 1 BRAIDED ROPE

2 TRAWL FLOATS - TO BE SECURED TIGHTLY
1 METER ABOVE ANCHOR

2 1/2" - 2 3/4" NEWCO THIMBLE
1" GALVANIZED PINNED SHACKLE

QUAD GUARD BUOY ANCHOR

95 METERS
GUARD BUOY WITH BALLAST "A"

1 1/2" PINNED D-SHACKLE WITH BUSHING

6" OVAL RING (3/4" STOCK)

2 FEET 5/8" GALVANIZED CHAIN

4" OVAL RING (5/8" STOCK)

1" GALVANIZED PINNED SHACKLE

WILFRO SWIVEL

1" GALVANIZED PINNED SHACKLE

4" OVAL RING (5/8" STOCK)

3 FEET 5/8" GALVANIZED CHAIN

4" OVAL RING (5/8" STOCK)

100 FEET 1/2" GALVANIZED CHAIN

4" OVAL RING (5/8" STOCK)

4" OVAL RING (5/8" STOCK)

2 - 2 1/4" NEWCO THIMBLE

170 METERS 3/4" 2 IN 1 NYLON BRAIDED ROPE

2 - 2 1/4" NEWCO THIMBLE

4" OVAL RING (3/4" STOCK)

150 FEET 5/8" GALVANIZED CHAIN

6" OVAL RING (3/4" STOCK)

5 FEET 1 1/2" CHAIN

6" ROUND RING (1" STOCK)

1" GALVANIZED PINNED SHACKLE

QUAD GUARD BUOY ANCHOR

217 METERS
GUARD BUOY WITH BALLAST "O"

1 1/2" PINNED D-SHACKLE WITH BUSHING

3/4" CONNECTING LINK

2 FEET 5/8" GALVANIZED CHAIN

1/2" CONNECTING LINK

WILFRO SWIVEL

1" GALVANIZED PINNED SHACKLE

1/2" CONNECTING LINK

3 FEET 5/8" GALVANIZED CHAIN

1/2" CONNECTING LINK

100 FEET 1/2" GALVANIZED CHAIN

1/2" CONNECTING LINK

2 - 2 1/4" NEWCO THIMBLE

170 METERS 3/4" 2 IN 1 NYLON BRAIDED ROPE

2 - 2 1/4" NEWCO THIMBLE

1/2" CONNECTING LINK

150 FEET 5/8" GALVANIZED CHAIN

3/4" CONNECTING LINK

6 FEET 1 1/2" CHAIN

3/4" CONNECTING LINK

1" PINNED GALVANIZED SHACKLE

QUAD GUARD BUOY ANCHOR
GUARD BUOY MOORING 1207C NECW P. SMITH GLOBEC NOV 1995

GUARD BUOY WITH BALLAST "L"

1 1/2" PINNED D-SHACKLE WITH BUSHING

6" OVAL RING (3/4" STOCK)

2 FEET 5/8" GALVANIZED CHAIN

4" OVAL RING (5/8" STOCK)

1" GALVANIZED PINNED SHACKLE

WALFRO SWIVEL

1" GALVANIZED PINNED SHACKLE

4" OVAL RING (5/8" STOCK)

3 FEET 5/8" GALVANIZED CHAIN

4" OVAL RING (5/8" STOCK)

100 FEET 1/2" GALVANIZED CHAIN

4" OVAL RING (5/8" STOCK)

4" OVAL RING (5/8" STOCK)

2 1/2" - 2 3/4" NEWCO THIMBLE

285 METERS 7/8" NYLON/MFP 2 to 1 BRAIDED ROPE

2 TRAWL FLOATS - TO BE SECURED TIGHTLY

1 METER ABOVE ANCHOR

2 1/2" - 2 3/4" NEWCO THIMBLE

1" GALVANIZED PINNED SHACKLE

QUAD GUARD BUOY ANCHOR

214 METERS
GUARD BUOY WITH BALLAST "P"

1 1/2" PINNED D-SHACKLE WITHOUT BUSHING

6" OVAL RING (3/4" STOCK)

2 FEET 5/8" GALVANIZED CHAIN

4" OVAL RING (5/8" STOCK)

1" GALVANIZED PINNED SHACKLE

WILFRO SWIVEL

1" GALVANIZED PINNED SHACKLE

4" OVAL RING (5/8" STOCK)

3 FEET 5/8" GALVANIZED CHAIN

4" OVAL RING (5/8" STOCK)

100 FEET 1/2" GALVANIZED CHAIN

4" OVAL RING (5/8" STOCK)

2 - 1/4" NEWCO THIMBLE

170 METERS 3/4" 2 IN 1 NYLON BRAIDED ROPE

2 - 1/4" NEWCO THIMBLE

4" OVAL RING (5/8" STOCK)

4" OVAL RING (5/8" STOCK)

150 FEET 5/8" GALVANIZED CHAIN

6" OVAL RING (3/4" STOCK)

5 FEET 1 1/2" CHAIN

6" ROUND RING (1" STOCK)

1" GALVANIZED PINNED SHACKLE

QUAD GUARD BUOY ANCHOR

212 METERS
GUARD BUOY WITH BALLAST "R"

1 1/2" PINNED D-SHACKLE WITH BUSHING

3/4" CONNECTING LINK

2 FEET 5/8" GALVANIZED CHAIN

1/2" CONNECTING LINK

WILFRO SWIVEL

1" GALVANIZED PINNED SHACKLE

1/2" CONNECTING LINK

3 FEET 5/8" GALVANIZED CHAIN

1/2" CONNECTING LINK

100 FEET 1/2" GALVANIZED CHAIN

1/2" CONNECTING LINK

2 - 2 1/4" NEWCO THIMBLE

170 METERS 3/4" 2 IN 1 NYLON BRAIDED ROPE

2 - 2 1/4" NEWCO THIMBLE

1/2" CONNECTING LINK

180 FEET 5/8" GALVANIZED CHAIN

3/4" CONNECTING LINK

5 FEET 1 1/2" CHAIN

3/4" CONNECTING LINK

1" PINNED GALVANIZED SHACKLE

QUAD GUARD BUOY ANCHOR

216 METERS
GUARD BUOY WITH BALLAST "N"

1 1/2" PINNED D-SHACKLE WITH BUSHING

6" OVAL RING (3/4" STOCK)

2 FEET 5/8" GALVANIZED CHAIN

4" OVAL RING (5/8" STOCK)

1" GALVANIZED PINNED SHACKLE

WILFRO SWIVEL

1" GALVANIZED PINNED SHACKLE

4" OVAL RING (5/8" STOCK)

3 FEET 5/8" GALVANIZED CHAIN

4" OVAL RING (5/8" STOCK)

100 FEET 1/2" GALVANIZED CHAIN

4" OVAL RING (5/8" STOCK)

4" OVAL RING (5/8" STOCK)

2 1/2" - 2 3/4" NEWCO THIMBLE

255 METERS 7/8" NYLON/MFP 2 in 1 BRAIDED ROPE

2 TRAWL FLOATS - TO BE SECURED TIGHTLY

1 METER ABOVE ANCHOR

2 1/2" - 2 3/4" NEWCO THIMBLE

1" GALVANIZED PINNED SHACKLE

QUAD GUARD BUOY ANCHOR

216 METERS
APPENDIX B  Diagrams for Moorings Recovered During C.S.S.Parizeau Cruise 95-034
MOORING # 1188 SMITH GLOBEC NECWA JUNE 1995

LIGHT & BEACON

FAIREY FLOAT

2 M 1/4" JACKETED WIRE

AANDERAA RCM 4600

184 M 1/4" JACKETED WIRE

2 GLASS BUB PACKAGES

723A ACOUSTIC RELEASE 501004

1/2 M 5/8" GALVANIZED CHAIN

2 - WHEEL ANCHOR

26 METERS

4600

214 METERS
MOORING # 1189  SMITH GLOBEC  NECW  JUNE 1995

53 METERS
LIGHT & BEACON
FAREY FLOAT
2M 1/4" JACKETED WIRE
AANDERAA RCM 9355
50 M 1/4" JACKETED WIRE

104 METERS
AANDERAA RCM 4996
49 M 1/4" JACKETED WIRE

154 METERS
AANDERAA RCM 5358
19 M 1/4" JACKETED WIRE
2 STREAMLINED VINYL PACKAGES
18 M 1/4" JACKETED WIRE
AANDERAA RCM 6404
16 M 1/4" JACKETED WIRE
2 GLASS BUB PACKAGES
723 A ACOUSTIC RELEASE
504301
1/2 M 5/8" GALVANIZED CHAIN
AANDERAA TIDE GAUGE 336

216 METERS
2-WHEEL ANCHOR MINIMUM 1500 LBS.
MOORING # 1190  SMITH GLOBEC  NECEA  JUNE 1995

LIGHT & BEACON

FAIREY FLOAT

2 M 1/4" JACKETED WIRE

AANDERAA RCM 7138

184 M 1/4" JACKETED WIRE

2 GLASS BUB PACKAGES

723A ACOUSTIC RELEASE 504401

1/2 M 5/8" GALVANIZED CHAIN

2 - WHEEL ANCHOR

23 METERS

211 METERS
LIGHT & BEACON
FAIRELY FLOAT
2M 1/4" JACKETED WIRE
AANDERAA RCM 7522
50 M 1/4" JACKETED WIRE

102 METERS
AANDERAA RCM 7122
49 M 1/4" JACKETED WIRE

152 METERS
AANDERAA RCM 3300
19 M 1/4" JACKETED WIRE
2 STREAMLINED VINYL PACKAGES
19 M 1/4" JACKETED WIRE

194 METERS
AANDERAA RCM 4406
16 M 1/4" JACKETED WIRE
2 GLASS BAG PACKAGES
723A ACOUSTIC RELEASE 1004006
1/2 M 5/8" GALVANIZED CHAIN
AANDERAA TIDE GAUGE 343

214 METERS
2 - WHEEL ANCHOR MINIMUM 1500 LBS.
MOORING # 1192 SMITH GLOBEC C2A JUNE 1995

LIGHT & BEACON
FAIRY FLOAT
2 M 1/4" JACKETED WIRE

26 METERS
AANDERAA RCM 7680
154 M 1/4" JACKETED WIRE

2 GLASS BUB PACKAGES
723A ACOUSTIC RELEASE
409001

1/2 M 5/8" GALVANIZED CHAIN

114 METERS
2-WHEEL ANCHOR
MOORING # 1193  SMITH GLOBEC  C2  JUNE 1995

LIGHT & BEACON
FAIREY FLOAT
2 M 1/4" JACKETED WIRE

SWIVEL
AANDERAA RCM 714
49 M 1/4" JACKETED WIRE

SWIVEL
AANDERAA RCM 2663
6.5 M 1/4" JACKETED WIRE
2 GLASS BUS PACKAGES

2663
723A ACOUSTIC RELEASE

SWIVEL
1/2 M 5/8" GALVANIZED CHAIN
AANDERAA TIDE GAUGE 109

2 M 1/4" JACKETED WIRE

109 METERS
WHEEL ANCHOR