OCS Study
MMS 96-0004

Instrument Performance and Data Quality Control Analyses for the Physical Oceanography Field Program Offshore North Carolina

Author

Science Applications International Corporation

Prepared under MMS Contract
14-35-0001-30599
by
Science Applications International Corporation
Raleigh, North Carolina 27605

Published by

U.S. Department of the Interior
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CITATION

Suggested citation:

Science Applications International Corporation. 1996. Instrument Performance and Data Quality Control Analyses for the Physical Oceanography Field Program Offshore North Carolina. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 96-0004. 115 pp.

ABSTRACT

The purpose of this document is to summarize data gathering efforts during the second twelve months of the *Physical Oceanographic Field Program Offshore North Carolina* funded under Minerals Management Service Contract 14-35-0001-30599. No data products as such are included in this document, but rather a summary of the data collected and the quality control results is provided. Details on mooring design and the specifications of moored instruments were provided in the first Annual Progress Report and are not repeated here. A detailed analysis of instrument and mooring performance during the field program is presented along with calibration results for all CTD data. A brief description of flora and fauna observed on and near the various moorings is included as well.

Data products were provided to the individual investigators throughout the program for use in developing the Final Synthesis Report.

ACKNOWLEDGEMENT

The project team at SAIC in Raleigh wish to acknowledge the support and encouragement so generously offered by Dr. Robert E. Miller during his tenure as Contracting Officer's Technical Representative during the bulk of the Program, including all the field work.

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I. INTRODUCTION

1.1 Overview

The field activities of the Physical Oceanographic Field Program Offshore North Carolina were initiated in February 1992 and completed in February 1994. During this period, twenty-three current meter moorings were maintained at fifteen different locations off the coast of North Carolina and a total of fifty-one (51) current meter levels were maintained and rotated on a quarterly or semi-annual basis. In addition, quarterly hydrographic surveys (CTD casts) were made along a standard grid within the study area and both drogued and undrogued ARGOS-tracked drifters were deployed at five shelf locations during each survey. Meteorological data, water level data and satellite imagery data were also acquired in support of this program. Two nearshore studies were completed using Davis-type GPS drifters. This document summarizes the location, quality and quantity of all of these observations. An earlier annual report in 1993 presented the mooring designs, descriptions of the data logging instruments, and data processing procedures. These issues are not discussed again in the present document.

1.2 Operations Summary

The M/V SEAWARD EXPLORER was utilized for the initial mooring deployment cruise in February 1992, for all four cruises in 1993 and the final cruise in February 1994. In April, August and November 1992 the R/V CAPE HENLOPEN served as a platform for field activities. Special Event Surveys were conducted during the August and November 1992 cruises while aboard the R/V CAPE HENLOPEN. The M/V SEA DRAGON was used for Nearshore Drifter Studies in June and September 1993.

The NC State Ports Authority in Morehead City, NC served as a mobilization point for all current measurement and offshore hydrographic efforts. Two different sites in Rodanthe, NC served as shore support stations for the tracking of GPS drifters during the Nearshore Drifter Studies. Access to the ocean area off Rodanthe was through Oregon Inlet via Roanoke Sound.

II. LOCATION OF FIELD OBSERVATIONS

2.1 Introduction

The figures and tables presented in this chapter document the locations and types of field measurements made or acquired during the program. The actual data acquisition associated with each cruise is summarized in Table 2.1-1. Additional data were acquired from government agencies which routinely and continuously collect certain parameters as part of their public mission. These type data include coastal and offshore meteorological data and coastal water level data.

2.2 CTD Station Locations

The CTD stations occupied during the Quarterly Surveys are presented in Figures 2.2-1 through 2.2-8. These locations are also presented in tabular form in Table 2.2-1 through 2.2-8. The stations occupied during the Nearshore Studies are presented in Figures 2.2-9 and 2.2-10 and in the corresponding tables (Tables 2.2-9 and 2.2-10, respectively).

2.3 Drifter Deployment Sites

Aanderaa (Draper) ARGOS drifters (with holey sock drogues) were deployed during Quarterly cruises at five locations on the shelf (see Figure 2.3-1 and Table 2.3-1). Position 3 was used only once. In addition, a number of Aanderaa oil tracking drifters (without drogues) were deployed at these same sites. These latter drifters were provided by MMS and were deployed but not tracked as part of this program.

Brightwater GPS drifters and Technocean ARGOS drifters were deployed during the Nearshore Studies at the sites identified in Tables 2.3-2 and 2.3-3. These locations are shown in Figures 2.3-2 and 2.3-3, respectively. Both are Davis-type drifters.

2.4 Current Meter Mooring Locations

Figure 2.4-1 shows the mooring locations and Table 2.4-1a through 2.4-1f tabularizes them. This table also presents the specific instrument type, serial number and measurement level for each quarterly deployment over the two year study.

2.5 Meteorological and Water Level Stations

Figure 2.5-1 shows the locations of the meteorological and water level stations utilized in this study. Table 2.5-1 provides the locations of the NWS and NDBC meteorological stations, and Table 2.5-2 provides locations for the National Ocean Survey (NOS) sea-level recording stations.

Table 2.1-1 Cruise data acquisition summaries.

Cruise Number	Cruise ID	Dates	CTD Casts	ADCP Data	Drifter Deployments	Moorings Serviced
I	SE9208	15-28 February 1992	0	No	0	23
II	CH9222	28 April-10 May 1992	52	Yes	5	16
III	CH9234	19 August-5 Sept. 1992	91	Yes	10	23
IV	CH9313	3-13 November 1992	76	Yes	10	17
V	SE9301	2-18 February 1993	16	No	10	18
VI	SE9303	1-12 May 1993	65	No	10	20
VII	SE9309	18-29 August 1993	65	No	10	21
VIII	SE9316	28 Oct.-10 Nov. 1993	44	No	12	17
IX	SE9401	7-22 February 1994	4	No	0	16
NEARSHORE I	SD9301	8-18 June 1993	86	No	17	0
NEARSHORE II	SD9302	10-23 September 1993	88	No	13	0

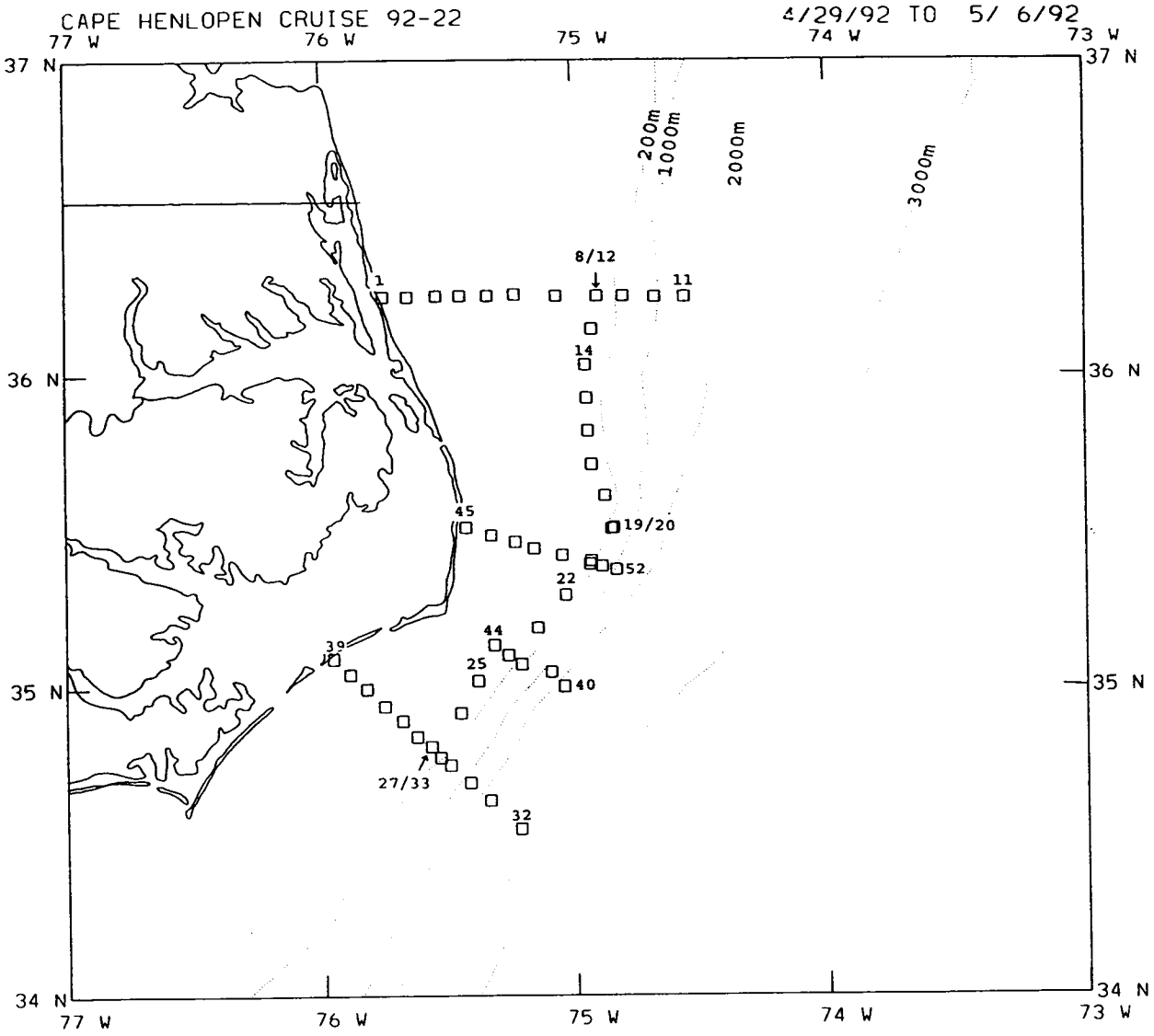


Figure 2.2-1 CTD stations occupied during Cruise II (CH9222): 28 April-10 May 1992.

Table 2.2-1a Listing of CTD stations, dates, locations and water depths for Cruise II (CH9222).

II	CRUISE CH9222 (28 April-10 May 1992)				
Station No.	Date (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Water Depth (m)
1	04/29/92	13.4	36° 14.9′	75° 45.3′	14
2	04/29/92	14.2	36° 14.9′	75° 39.4′	26
3	04/29/92	15.1	36° 15.1′	75° 32.8′	28
4	04/29/92	16.1	36° 15.0′	75° 26.9′	29
5	04/29/92	17.2	36° 15.1′	75° 20.5′	33
6	04/29/92	18.2	36° 15.2′	75° 14.0′	30
7	04/29/92	19.4	36° 15.1′	75° 04.0′	41
8	04/29/92	20.8	36° 15.1′	74° 54.0′	63
9	04/29/92	21.6	36° 15.0′	74° 47.9′	115
10	04/29/92	22.8	36° 14.8′	74° 40.4′	1124
11	04/30/92	0.3	36° 14.8′	74° 33.3′	1445
12	05/02/92	2.7	36° 15.1′	74° 54.0′	63
13	05/02/92	3.7	36° 08.7′	74° 55.4′	64
14	05/02/92	4.7	36° 02.1′	74° 56.9′	61
15	05/02/92	5.7	35° 55.6′	74° 56.8′	65
16	05/02/92	6.7	35° 49.3′	74° 56.4′	63
17	05/02/92	7.7	35° 42.9′	74° 55.7′	60
18	05/02/92	8.7	35° 36.9′	74° 52.5′	64
19	05/02/92	9.7	35° 30.5′	74° 50.9′	61
20	05/03/92	0.1	35° 30.8′	74° 50.5′	64
21	05/03/92	1.7	35° 24.4′	74° 56.0′	61
22	05/03/92	3.8	35° 17.7′	75° 02.2′	63
23	05/03/92	6.5	35° 11.5′	75° 09.0′	69
24	05/03/92	9.2	35° 06.0′	75° 16.0′	68
25	05/03/92	11.6	35° 01.1′	75° 23.2′	65
26	05/03/92	13.5	34° 55.0′	75° 27.5′	61
27	05/03/92	15.2	34° 48.5′	75° 34.5′	61
28	05/03/92	15.8	34° 46.5′	75° 32.4′	129
29	05/03/92	16.3	34° 44.9′	75° 30.1′	300
30	05/03/92	17.3	34° 41.6′	75° 25.5′	1140
31	05/03/92	19.2	34° 38.2′	75° 20.8′	2287
32	05/03/92	22.1	34° 32.5′	75° 13.5′	2844
33	05/04/92	2.5	34° 48.6′	75° 34.5′	57

Table 2.2-1b Listing of CTD stations, dates, locations and water depths for Cruise II (CH9222).

II	CRUISE CH9222 (28 April-10 May 1992)				
Station No.	Date (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Water Depth (m)
34	05/04/92	3.4	34° 50.6′	75° 38.0′	45
35	05/04/92	4.5	34° 53.5′	75° 41.2′	36
36	05/04/92	5.3	34° 56.3′	75° 45.5′	25
37	05/04/92	6.0	34° 59.6′	75° 49.5′	24
38	05/04/92	6.7	35° 02.5′	75° 53.5′	22
39	05/04/92	7.5	35° 05.4′	75° 57.3′	9
40	05/05/92	22.5	35° 00.2′	75° 02.8′	2000
41	05/06/92	0.7	35° 03.0′	75° 05.9′	354
42	05/06/92	1.7	35° 04.4′	75° 12.8′	132
43	05/06/92	2.6	35° 06.0′	75° 16.0′	128
44	05/06/92	3.6	35° 08.1′	75° 19.5′	26
45	05/06/92	8.1	35° 30.8′	75° 25.9′	13
46	05/06/92	8.9	35° 29.2′	75° 20.0′	24
47	05/06/92	9.9	35° 27.9′	75° 14.3′	30
48	05/06/92	10.8	35° 26.8′	75° 09.7′	33
49	05/06/92	11.8	35° 25.4′	75° 03.0′	34
50	05/06/92	12.8	35° 23.8′	74° 56.3′	66
51	05/06/92	16.1	35° 23.4′	74° 53.3′	349
52	05/06/92	16.8	35° 22.7′	74° 49.9′	932

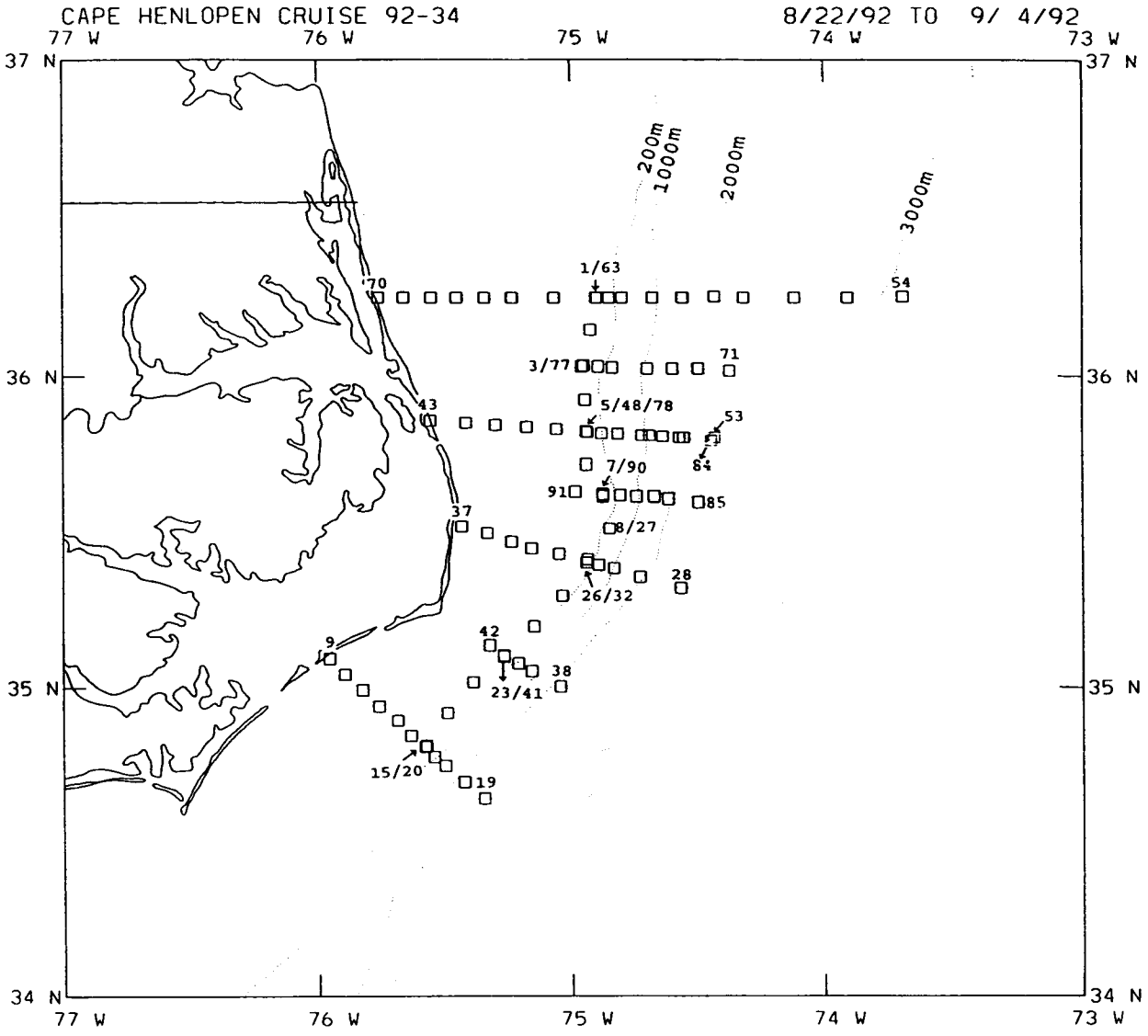


Figure 2.2-2 CTD stations occupied during Cruise III (CH9234): 19 August-5 September 1992.

Table 2.2-2a Listing of CTD stations, dates, locations and water depths for Cruise III (CH9234).

III	CRUISE CH9234 (19 August-5 September 1992)				
Station No.	Date (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Water Depth (m)
1	08/23/92	0.5	36° 14.8′	74° 53.9′	57
2	08/23/92	1.3	36° 08.7′	74° 55.5′	62
3	08/23/92	2.1	36° 01.8′	74° 57.5′	54
4	08/23/92	2.9	35° 55.4′	74° 56.8′	65
5	08/23/92	3.7	35° 49.3′	74° 56.5′	62
6	08/23/92	4.6	35° 42.9′	74° 56.4′	57
7	08/23/92	5.3	35° 36.7′	74° 52.5′	62
8	08/23/92	6.1	35° 30.5′	74° 51.0′	60
9	08/26/92	10.8	35° 05.4′	75° 57.2′	11
10	08/26/92	11.4	35° 02.4′	75° 53.4′	23
11	08/26/92	12.1	34° 59.5′	75° 49.4′	25
12	08/26/92	14.9	34° 56.2′	75° 45.4′	26
13	08/26/92	15.6	34° 53.4′	75° 40.9′	36
14	08/26/92	16.2	34° 50.5′	75° 38.0′	45
15	08/26/92	16.7	34° 48.4′	75° 34.4′	56
16	08/26/92	20.7	34° 46.5′	75° 32.5′	124
17	08/26/92	21.2	34° 44.8′	75° 29.9′	303
18	08/26/92	22.3	34° 41.5′	75° 25.4′	1148
19	08/26/92	23.9	34° 38.3′	75° 20.8′	2298
20	08/28/92	5.2	34° 48.5′	75° 34.3′	57
21	08/28/92	6.4	34° 54.9′	75° 29.4′	62
22	08/28/92	7.7	35° 00.9′	75° 23.2′	67
23	08/28/92	8.9	35° 06.0′	75° 16.0′	68
24	08/28/92	10.1	35° 11.6′	75° 08.9′	62
25	08/28/92	11.1	35° 17.5′	75° 02.2′	68
26	08/28/92	12.2	35° 24.0′	74° 56.4′	58
27	08/28/92	13.2	35° 30.5′	74° 50.9′	62
28	08/28/92	16.6	35° 19.0′	74° 34.1′	2532
29	08/28/92	20.4	35° 21.3′	74° 43.8′	1991
30	08/28/92	22.8	35° 22.9′	74° 49.9′	784
31	08/29/92	0.3	35° 23.6′	74° 53.5′	317
32	08/29/92	1.2	35° 24.5′	74° 56.3′	58
33	08/29/92	2.6	35° 25.6′	75° 02.9′	36

Table 2.2-2b Listing of CTD stations, dates, locations and water depths for Cruise III (CH9234).

III	CRUISE CH9234 (19 August-5 September 1992)				
Station No.	Date (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Water Depth (m)
34	08/29/92	4.2	35° 26.8′	75° 09.5′	34
35	08/29/92	5.5	35° 28.0′	75° 14.2′	31
36	08/29/92	6.6	35° 29.6′	75° 19.8′	23
37	08/29/92	7.4	35° 30.9′	75° 25.9′	13
38	08/31/92	0.9	35° 00.1′	75° 02.7′	2345
39	08/31/92	3.2	35° 03.1′	75° 09.4′	375
40	08/31/92	4.0	35° 04.5′	75° 12.7′	122
41	08/31/92	4.5	35° 05.9′	75° 16.0′	66
42	08/31/92	5.1	35° 08.0′	75° 19.5′	24
43	08/31/92	10.3	35° 51.5′	75° 33.3′	12
44	08/31/92	11.2	35° 51.0′	75° 24.9′	26
45	08/31/92	11.9	35° 50.7′	75° 17.9′	29
46	08/31/92	12.6	35° 50.2′	75° 10.6′	33
47	08/31/92	13.3	35° 49.7′	75° 03.4	38
48	08/31/92	14.0	35° 49.2′	74° 56.3′	65
49	08/31/92	14.5	35° 48.9′	74° 52.7′	114
50	08/31/92	15.0	35° 48.7′	74° 48.8′	1083
51	09/01/92	1.8	35° 48.5′	74° 41.4′	1414
52	09/01/92	3.2	35° 48.0′	74° 34.4′	1636
53	09/01/92	4.8	35° 48.2′	74° 26.1′	2056
54	09/01/92	9.7	36° 15.0′	73° 41.8′	3000
55	09/01/92	12.7	36° 14.9′	73° 54.6′	2830
56	09/01/92	14.9	36° 14.9′	74° 07.1′	2494
57	09/01/92	17.0	36° 14.8′	74° 19.0′	2068
58	09/01/92	18.8	36° 15.0′	74° 26.1′	1974
59	09/01/92	20.3	36° 14.9′	74° 33.6′	1433
60	09/01/92	21.8	36° 14.9′	74° 40.6′	1130
61	09/01/92	23.1	36° 14.9′	74° 48.0′	109
62	09/01/92	23.6	36° 14.9′	74° 51.1′	84
63	09/02/92	0.1	36° 14.9′	74° 54.0′	62
64	09/02/92	1.0	36° 14.9′	75° 04.0′	41
65	09/02/92	2.0	36° 14.9′	75° 14.0′	30

Table 2.2-2c Listing of CTD stations, dates, locations and water depths for Cruise III (CH9234).

III	CRUISE CH9234 (19 August-5 September 1992)				
Station No.	Date (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Water Depth (m)
66	09/02/92	2.7	36° 14.9′	75° 20.5′	34
67	09/02/92	3.4	36° 14.9′	75° 27.0′	32
68	09/02/92	4.1	36° 14.9′	75° 33.0′	27
69	09/02/92	4.8	36° 14.9′	75° 39.5′	25
70	09/02/92	5.4	36° 14.9′	75° 45.5′	15
71	09/03/92	12.4	36° 01.0′	74° 22.4′	2068*
72	09/03/92	13.6	36° 01.4′	74° 30.0′	1974*
73	09/03/92	14.6	36° 01.3′	74° 35.9′	1433*
74	09/03/92	15.5	36° 01.4′	74° 41.9′	1130*
75	09/03/92	16.5	36° 01.6′	74° 50.2′	100
76	09/03/92	17.0	36° 01.8′	74° 53.6′	84
77	09/03/92	17.4	36° 02.0′	74° 56.9′	61
78	09/03/92	21.6	35° 49.3′	74° 56.4′	64
79	09/03/92	22.1	35° 49.0′	74° 52.7′	107
80	09/03/92	22.6	35° 48.9′	74° 48.8′	720*
81	09/03/92	23.5	35° 48.5′	74° 43.1′	1440*
82	09/04/92	0.4	35° 48.3′	74° 38.3′	1080*
83	09/04/92	1.4	35° 48.0′	74° 33.4′	1512*
84	09/04/92	2.3	35° 47.5′	74° 26.9′	1980*
85	09/04/92	5.1	35° 35.7′	74° 29.9′	1908*
86	09/04/92	6.1	35° 36.3′	74° 36.9′	2038*
87	09/04/92	6.8	35° 36.7′	74° 40.4′	1670*
88	09/04/92	7.6	35° 36.7′	74° 44.5′	1130*
89	09/04/92	8.2	35° 36.9′	74° 48.5′	360
90	09/04/92	8.7	35° 37.2′	74° 52.5′	64
91	09/04/92	9.4	35° 37.5′	74° 59.0′	48

* = Depth from chart.

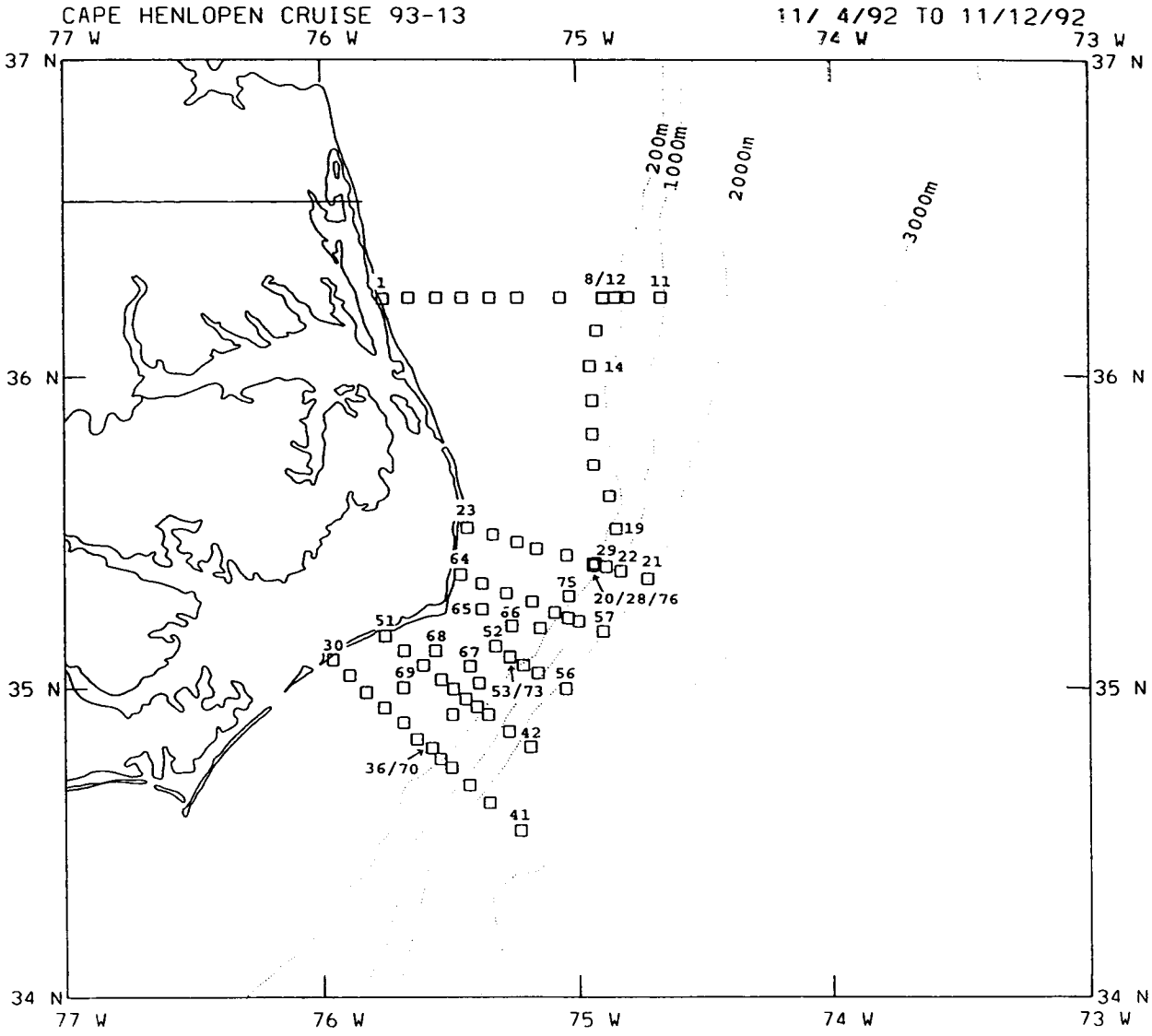


Figure 2.2-3 CTD stations occupied during Cruise IV (CH9313): 3-13 November 1992.

Table 2.2-3a Listing of CTD stations, dates, locations and water depths for Cruise IV (CH9313).

IV	CRUISE CH9313 (3-13 November 1992)				
Station No.	Date (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Water Depth (m)
1	11/04/92	15.7	36° 14.9′	75° 45.5′	15
2	11/04/92	16.3	36° 15.0′	75° 39.5′	25
3	11/04/92	16.9	36° 15.0′	75° 33.0′	27
4	11/04/92	17.6	36° 15.0′	75° 27.0′	33
5	11/04/92	18.5	36° 15.1′	75° 20.5′	33
6	11/04/92	19.3	36° 15.1′	75° 14.0′	30
7	11/05/92	1.9	36° 15.0′	75° 03.9′	40
8	11/05/92	3.1	36° 15.0′	74° 53.8′	61
9	11/05/92	3.5	36° 15.0′	74° 50.9′	85
10	11/05/92	4.0	36° 15.0′	74° 47.9′	113
11	11/05/92	4.8	36° 15.0′	74° 40.4′	1138
12	11/06/92	2.8	36° 14.9′	74° 53.8′	63
13	11/06/92	3.7	36° 08.8′	74° 55.5′	59
14	11/06/92	4.7	36° 02.0′	74° 57.0′	59
15	11/06/92	5.7	35° 55.5′	74° 56.5′	66
16	11/06/92	6.7	35° 49.1′	74° 56.4′	62
17	11/06/92	7.5	35° 42.8′	74° 56.1′	57
18	11/06/92	8.4	35° 36.8′	74° 52.5′	62
19	11/06/92	9.3	35° 30.5′	74° 50.9′	59
20	11/06/92	10.6	35° 23.6′	74° 56.4′	64
21	11/06/92	13.3	35° 21.0′	74° 43.8′	2000
22	11/06/92	15.0	35° 22.5′	74° 50.0′	1040
23	11/07/92	5.2	35° 30.7′	75° 25.9′	11
24	11/07/92	5.8	35° 29.4′	75° 20.0′	23
25	11/07/92	6.4	35° 27.9′	75° 14.3′	30
26	11/07/92	6.9	35° 26.7′	75° 09.7′	34
27	11/07/92	7.6	35° 25.4′	75° 02.7′	36
28	11/07/92	8.3	35° 23.9′	74° 56.0′	64
29	11/07/92	8.7	35° 23.3′	74° 53.3′	424
30	11/08/92	19.7	35° 05.4′	75° 57.5′	8
31	11/08/92	20.2	35° 02.4′	75° 53.5′	22
32	11/08/92	20.8	34° 59.3′	75° 49.5′	25
33	11/08/92	21.6	34° 56.2′	75° 45.5′	27
34	11/08/92	22.3	34° 53.4′	75° 41.0′	36
35	11/08/92	22.9	34° 50.4′	75° 38.0′	45

Table 2.2-3b Listing of CTD stations, dates, locations and water depths for Cruise IV (CH9313).

IV	CRUISE CH9313 (3-13 November 1992)				
Station No.	Date (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Water Depth (m)
36	11/08/92	23.7	34° 48.5′	75° 34.4′	58
37	11/09/92	0.2	34° 46.4′	75° 32.4′	126
38	11/09/92	0.7	34° 44.7′	75° 29.9′	311
39	11/09/92	1.8	34° 41.4′	75° 25.7′	1119
40	11/09/92	3.0	34° 37.9′	75° 20.9′	2269
41	11/09/92	5.1	34° 32.5′	75° 13.7′	2852
42	11/09/92	8.7	34° 48.8′	75° 11.3′	2250*
43	11/09/92	10.0	34° 51.9′	75° 16.3′	592*
44	11/09/92	11.1	34° 54.9′	75° 21.2′	196
45	11/09/92	11.6	34° 56.4′	75° 23.7′	99
46	11/09/92	12.2	34° 57.9′	75° 26.3′	66
47	11/09/92	12.8	34° 59.9′	75° 29.2′	45
48	11/09/92	13.3	35° 01.6′	75° 32.1′	34
49	11/09/92	14.1	35° 04.4′	75° 36.4′	26
50	11/09/92	14.8	35° 07.2′	75° 40.8′	20
51	11/09/92	15.5	35° 09.9′	75° 45.2′	14
52	11/09/92	18.3	35° 08.0′	75° 19.4′	23
53	11/09/92	18.9	35° 05.9′	75° 16.0′	64
54	11/09/92	19.4	35° 04.4′	75° 12.8′	126
55	11/09/92	20.0	35° 02.9′	75° 09.5′	370
56	11/09/92	20.9	34° 59.9′	75° 02.9′	2317
57	11/10/92	0.0	35° 10.8′	74° 54.0′	2034*
58	11/10/92	1.0	35° 12.6′	74° 59.8′	369
59	11/10/92	1.5	35° 13.4′	75° 02.4′	140
60	11/10/92	2.1	35° 14.5′	75° 05.5′	66
61	11/10/92	3.0	35° 16.5′	75° 10.9′	30
62	11/10/92	3.8	35° 18.3′	75° 16.7′	24
63	11/10/92	4.6	35° 20.1′	75° 22.4′	23
64	11/10/92	5.3	35° 21.9′	75° 27.4′	15
65	11/10/92	6.3	35° 15.1′	75° 22.4′	18
66	11/10/92	7.2	35° 11.8′	75° 15.6′	20
67	11/10/92	8.3	35° 04.2′	75° 25.3′	26
68	11/10/92	9.1	35° 07.1′	75° 33.5′	20
69	11/10/92	10.2	35° 00.2′	75° 41.0′	25
70	11/11/92	3.8	34° 48.6′	75° 34.3′	59

Table 2.2-3c Listing of CTD stations, dates, locations and water depths for Cruise IV (CH9313).

IV	CRUISE CH9313 (3-13 November 1992)				
Station No.	Date (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Water Depth (m)
71	11/11/92	4.7	34° 55.0′	75° 29.5′	59
72	11/12/92	5.7	35° 01.0′	75° 23.3′	65
73	11/12/92	6.6	35° 06.6′	75° 16.0′	67
74	11/12/92	7.6	35° 11.5′	75° 08.9′	64
75	11/12/92	8.6	35° 17.5′	75° 02.3′	64
76	11/12/92	9.6	35° 24.0′	74° 56.4′	57

* = Depth from chart.

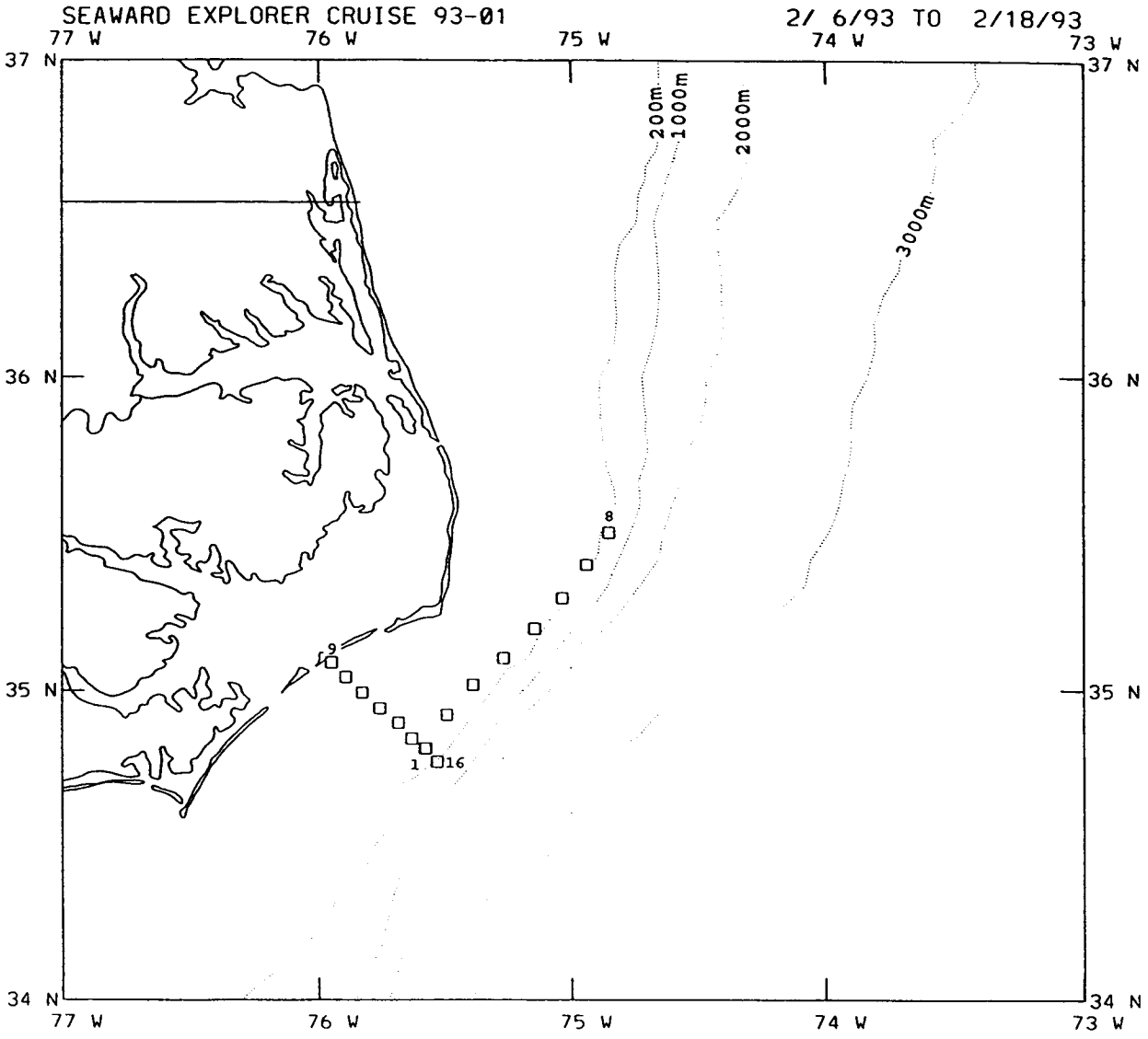


Figure 2.2-4 CTD stations occupied during Cruise V (SE9301): 2-18 February 1993.

Table 2.2-4 Listing of CTD stations, dates, locations and water depths for Cruise V (SE9301).

V	CRUISE SE9301 (2-18 February 1993)				
Station No.	Date (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Water Depth (m)
1	02/06/93	6.6	34°48.6′	75°34.7′	57
2	02/06/93	7.8	34°54.9′	75°29.7′	65
3	02/06/93	8.7	35°01.0′	75°23.3′	66
4	02/06/93	9.6	35°06.1′	75°16.0′	68
5	02/06/93	10.7	35°11.7′	75°08.7′	65
6	02/06/93	11.8	35°17.5′	75°02.3′	68
7	02/06/93	12.8	35°24.1′	74°56.6′	59
8	02/07/93	3.4	35°30.1′	74°51.2′	61
9	02/18/93	6.2	35°05.3′	75°57.4′	10
10	02/18/93	6.8	35°02.3′	75°53.3′	23
11	02/18/93	7.4	34°59.3′	75°49.3′	24
12	02/18/93	8.0	34°56.2′	75°45.3′	27
13	02/18/93	8.6	34°53.3′	75°40.6′	38
14	02/18/93	9.4	34°50.4′	75°38.0′	43
15	02/18/93	10.0	34°48.4′	75°34.3′	57
16	02/18/93	10.7	34°46.3′	75°32.3′	125

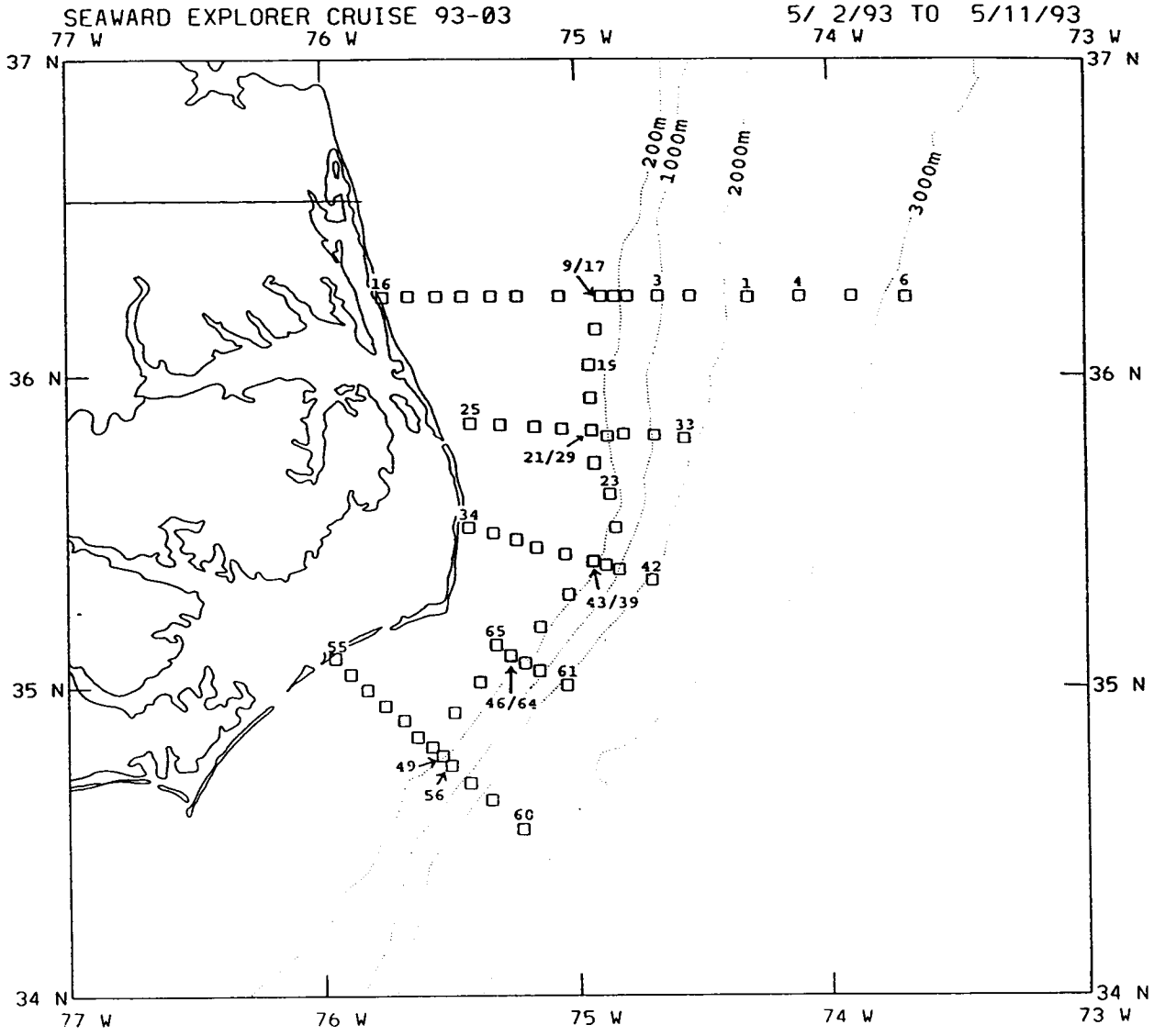


Figure 2.2-5 CTD stations occupied during Cruise VI (SE9303): 1-12 May 1993.

Table 2.2-5a Listing of CTD stations, dates, locations and water depths for Cruise VI (SE9303).

VI	CRUISE SE9303 (1-12 May 1993)				
Station No.	Date (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Water Depth (m)
1	05/02/93	2242	36°14.9′	74°19.0′	2044
2	05/03/93	0230	36°14.8′	74°33.6′	1425
3	05/03/93	0426	36°14.9′	74°40.5′	1125
4	05/03/93	1713	36°15.0′	74°07.0′	2110
5	05/03/93	1949	36°15.0′	73°54.5′	2770
6	05/03/93	2224	36°14.9′	73°41.8′	3053
7	05/06/93	0241	36°14.8′	74°48.0′	114
8	05/06/93	0310	36°14.9′	74°50.9′	86
9	05/06/93	0340	36°15.1′	74°53.9′	62
10	05/06/93	0455	36°15.0′	75°04.0′	42
11	05/06/93	0610	36°14.9′	75°13.7′	28
12	05/06/93	0658	36°15.0′	75°20.4′	30
13	05/06/93	0745	36°15.0′	75°27.0′	29
14	05/06/93	0835	36°15.0′	75°33.0′	28
15	05/06/93	0955	36°15.0′	75°39.5′	27
16	05/06/93	1035	36°15.0′	75°45.6′	16
17	05/07/93	0258	36°15.0′	74°53.9′	62
18	05/07/93	0408	36°08.8′	74°55.5′	60
19	05/07/93	0530	36°02.0′	74°57.0′	60
20	05/07/93	0637	35°55.6′	74°56.7′	65
21	05/07/93	0736	35°49.6′	74°56.5′	63
22	05/07/93	0836	35°43.0′	74°56.0′	60
23	05/07/93	0940	35°36.8′	74°52.5′	63
24	05/07/93	1039	35°30.5′	74°50.9′	63
25	05/08/93	0354	35°50.9′	75°25.1′	30
26	05/08/93	0449	35°50.8′	75°18.0′	33
27	05/08/93	0536	35°50.3′	75°10.8′	37
28	05/08/93	0624	35°49.8′	75°03.5′	40
29	05/08/93	0714	35°49.3′	74°56.5′	63
30	05/08/93	0747	35°49.0′	74°52.8′	103

Table 2.2-5b Listing of CTD stations, dates, locations and water depths for Cruise VI (SE9303).

IV	CRUISE SE9303 (1-12 May 1993)				
Station No.	Date (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Water Depth (m)
31	05/08/93	0830	35°48.8′	74°49.0′	1050
32	05/08/93	1018	35°48.5′	74°41.5′	1417
33	05/08/93	1228	35°48.0′	74°34.5′	1658
34	05/09/93	0038	35°30.7′	75°25.7′	21
35	05/09/93	0128	35°29.5′	75°19.9′	29
36	05/09/93	0210	35°28.1′	75°14.3′	33
37	05/09/93	0401	35°26.8′	75°09.8′	35
38	05/09/93	0451	35°25.5′	75°03.0′	39
39	05/09/93	0536	35°24.0′	74°56.5′	56
40	05/09/93	0640	35°23.3′	74°53.4′	312
41	05/09/93	0718	35°22.6′	74°50.2′	815
42	05/09/93	0931	35°20.4′	74°42.6′	2015
43	05/10/93	0200	35°24.2′	74°56.1′	62
44	05/10/93	0310	35°17.4′	75°02.3′	68
45	05/10/93	0421	35°11.5′	75°09.2′	65
46	05/10/93	0524	35°06.0′	75°16.1′	68
47	05/10/93	0623	35°01.0′	75°23.3′	65
48	05/10/93	0726	34°55.0′	75°29.5′	62
49	05/10/93	0832	34°48.4′	75°34.4′	60
50	05/10/93	0916	34°50.5′	75°38.0′	45
51	05/10/93	0955	34°53.5′	75°41.0′	36
52	05/10/93	1036	34°56.3′	75°45.6′	27
53	05/10/93	1115	34°59.6′	75°49.5′	24
54	05/10/93	1151	35°02.5′	75°53.6′	22
55	05/10/93	1230	35°05.5′	75°57.2′	9
56	05/11/93	0149	34°46.8′	75°32.1′	129
57	05/11/93	0222	34°44.7′	75°29.9′	307
58	05/11/93	0336	34°41.6′	75°25.4′	1170
59	05/11/93	0825	34°38.5′	75°20.8′	2223
60	05/11/93	1325	34°32.6′	75°13.6′	2760
61	05/11/93	1715	35°00.3′	75°02.6′	2390
62	05/11/93	2207	35°03.1′	75°09.4′	365
63	05/11/93	2300	35°04.5′	75°12.8′	122
64	05/11/93	2347	35°05.9′	75°16.1′	69
65	05/12/93	0021	35°08.1′	75°19.6′	26

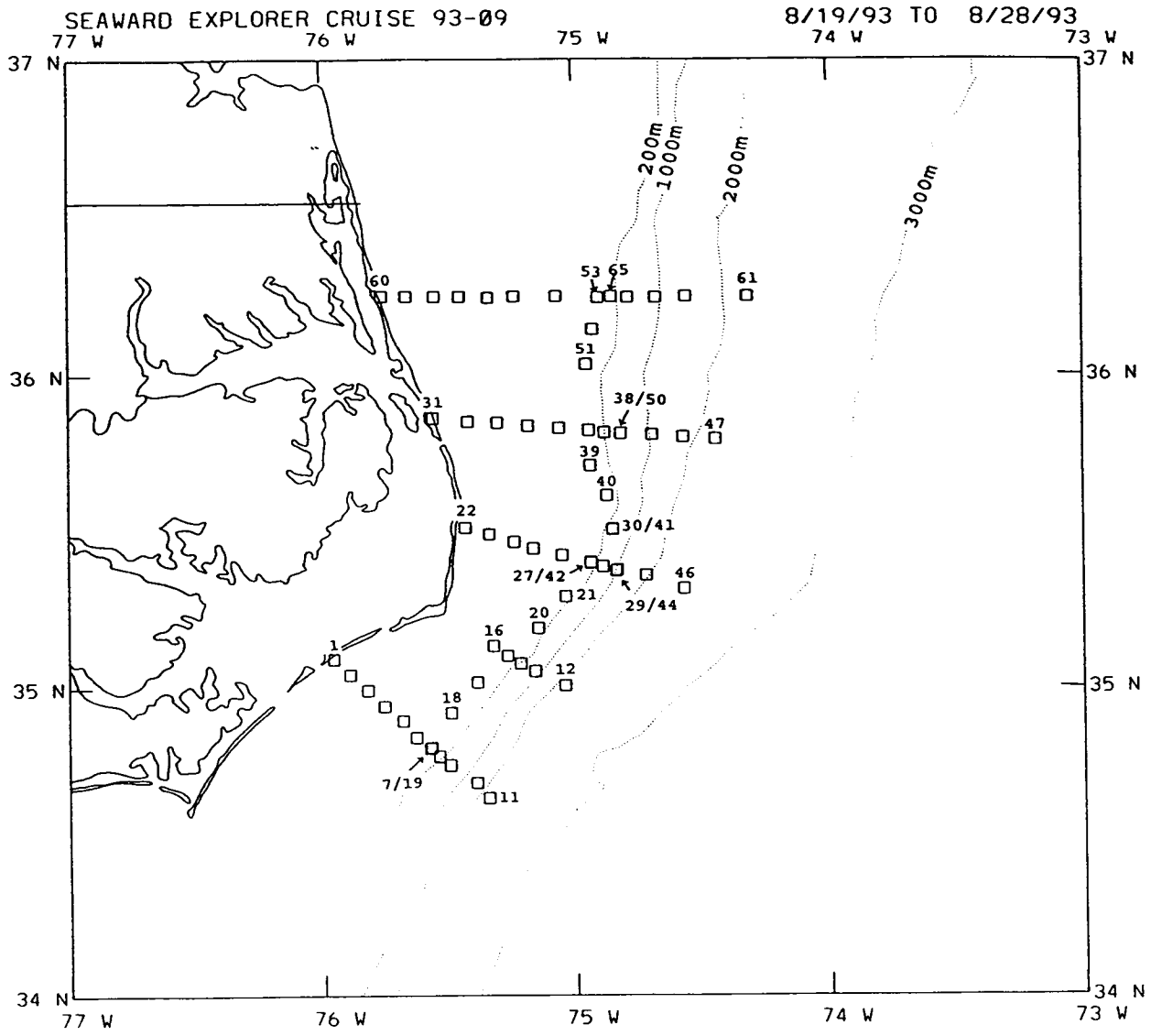


Figure 2.2-6 CTD stations occupied during Cruise VII (SE9309): 18-29 August 1993.

Table 2.2-6a Listing of CTD stations, dates, locations and water depths for Cruise VII (SE9309).

VII	CRUISE SE9309 (18-29 August 1993)				
Station No.	Date (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Water Depth (m)
1	08/19/93	0500	35°05.4′	75°57.5′	9
2	08/19/93	0600	35°02.3′	75°53.5′	22
3	08/19/93	0650	34°59.4′	75°49.4′	23
4	08/19/93	0733	34°56.2′	75°45.5′	25
5	08/19/93	0820	34°53.5′	75°41.0′	36
6	08/19/93	0900	34°50.5′	75°37.9′	46
7	08/19/93	0947	34°48.4′	75°34.9′	60
8	08/19/93	1028	34°46.6′	75°32.4′	127
9	08/19/93	1107	34°44.9′	75°29.9′	307
10	08/19/93	1222	34°41.5′	75°25.6′	1190
11	08/19/93	1557	34°38.6′	75°20.8′	2208
12	08/22/93	0108	35°00.4′	75°02.4′	1931
13	08/22/93	0430	35°03.1′	75°09.4′	355
14	08/22/93	0547	35°04.3′	75°12.4′	122
15	08/22/93	0630	35°06.1′	75°16.0′	67
16	08/22/93	0707	35°08.1′	75°19.5′	25
17	08/22/93	0819	35°00.9′	75°23.3′	66
18	08/22/93	0932	34°55.0′	75°29.5′	62
19	08/22/93	1042	34°48.3′	75°34.4′	59
20	08/22/93	2043	35°11.7′	75°08.5′	67
21	08/22/93	2154	35°17.5′	75°02.2′	65
22	08/23/93	0213	35°30.8′	75°26.0′	14
23	08/23/93	0315	35°29.5′	75°20.0′	23
24	08/23/93	0359	35°28.0′	75°14.2′	30
25	08/23/93	0442	35°26.7′	75°09.7′	34

Table 2.2-6b Listing of CTD stations, dates, locations and water depths for Cruise VII (SE9309).

VII	CRUISE SE9309 (18-29 August 1993)				
Station No.	Date (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Water Depth (m)
26	08/23/93	0607	35°25.4′	75°02.8′	36
27	08/23/93	0702	35°24.0′	74°56.4′	58
28	08/23/93	0733	35°23.3′	74°53.4′	280
29	08/23/93	0834	35°22.5′	74°50.1′	843
30	08/23/93	0953	35°30.5′	74°51.0′	60
31	08/24/93	0200	35°51.6′	75°33.4′	12
32	08/24/93	0259	35°51.0′	75°25.0′	25
33	08/24/93	0350	35°50.8′	75°18.0′	28
34	08/24/93	0437	35°50.2′	75°10.6′	33
35	08/24/93	0536	35°49.8′	75°03.4′	38
36	08/24/93	0623	35°49.2′	74°56.4′	64
37	08/24/93	0657	35°49.0′	74°52.7′	105
38	08/24/93	0731	35°48.8′	74°48.9′	880
39	08/24/93	0939	35°42.8′	74°56.1′	61
40	08/24/93	1037	35°36.8′	74°52.4′	65
41	08/24/93	1134	35°30.4′	74°51.0′	61
42	08/25/93	0352	35°24.1′	74°56.4′	60
43	08/25/93	0429	35°23.3′	74°53.4′	305
44	08/25/93	0516	35°22.5′	74°50.2′	830
45	08/25/93	0721	35°21.7′	74°43.2′	2000
46	08/25/93	1045	35°19.0′	74°34.3′	2532
47	08/26/93	0328	35°47.6′	74°26.8′	2000
48	08/26/93	0547	35°48.0′	74°34.5′	1640
49	08/26/93	0739	35°48.5′	74°41.6′	1125
50	08/26/93	0940	35°48.9′	74°48.0′	900
51	08/27/93	0135	36°02.0′	74°57.0′	60
52	08/27/93	0233	36°08.0′	74°55.5′	62
53	08/27/93	0327	36°15.0′	74°54.0′	61
54	08/27/93	0432	36°15.0′	75°04.0′	43

Table 2.2-6c Listing of CTD stations, dates, locations and water depths for Cruise VII (SE9309).

VII	CRUISE SE9309 (18-29 August 1993)				
Station No.	Date (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Water Depth (m)
55	08/27/93	0540	36°15.0′	75°14.0′	30
56	08/27/93	0626	36°14.9′	75°20.5′	33
57	08/27/93	0715	36°15.0′	75°27.0′	33
58	08/27/93	0800	36°15.0′	75°33.0′	27
59	08/27/93	0846	36°14.9′	75°39.5′	25
60	08/27/93	1000	36°15.0′	75°45.5′	16
61	08/28/93	1500	36°15.0′	74°18.9′	2050
62	08/28/93	1718	36°15.1′	74°33.5′	1470
63	08/28/93	1903	36°14.9′	74°40.5′	1150
64	08/28/93	2027	36°14.9′	74°47.0′	113
65	08/28/93	2056	36°15.0′	74°50.9′	87

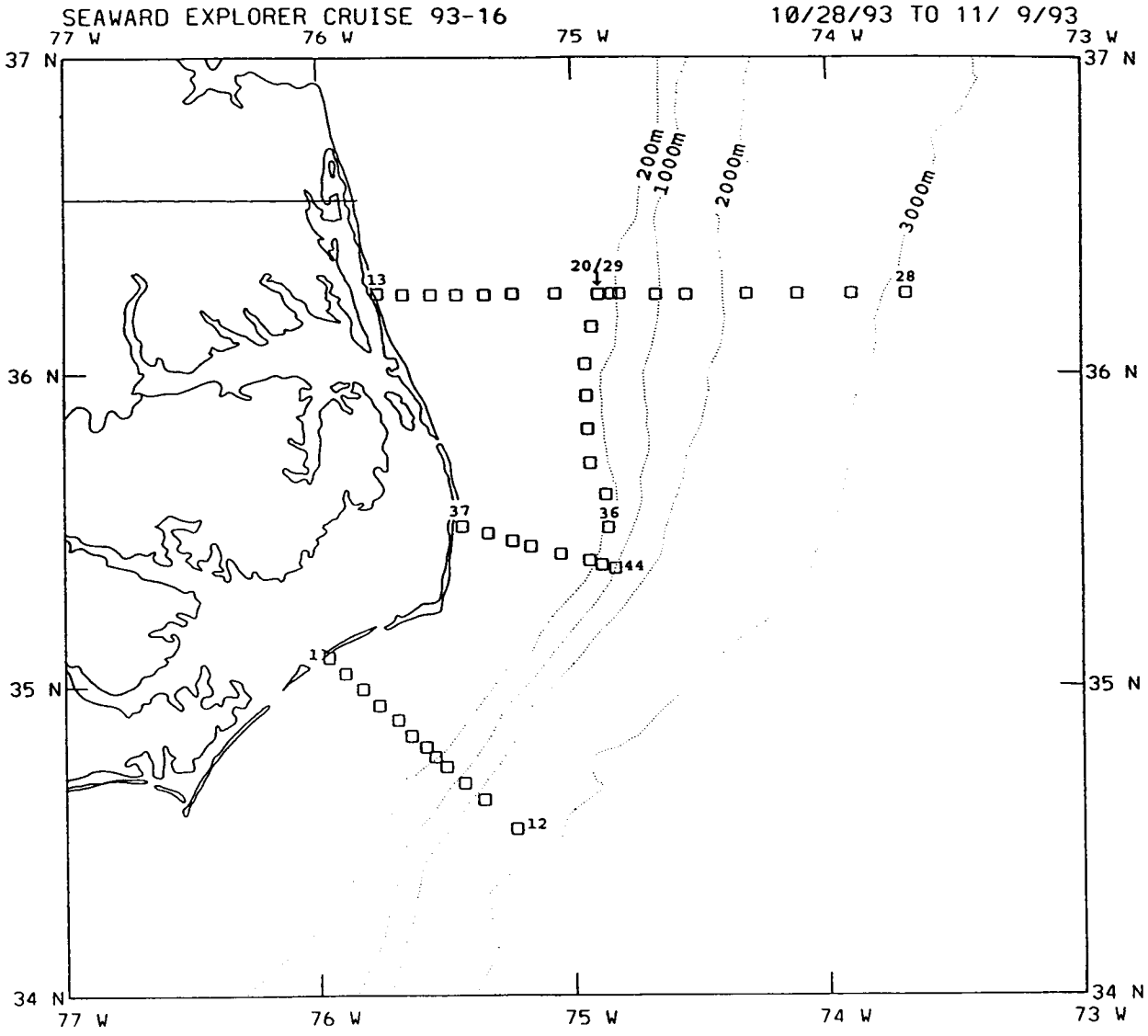


Figure 2.2-7 CTD stations occupied during Cruise VIII (SE9316): 28 October-10 November 1993.

Table 2.2-7a Listing of CTD stations, dates, locations and water depths for Cruise VIII (SE9316).

VIII	CRUISE SE9316 (28 October - 10 November 1993)				
Station No.	Date (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Water Depth (m)
1	10/28/93	2344	35°05.5′	75°57.5′	9
2	10/29/93	0022	35°02.5′	75°53.5′	23
3	10/29/93	0058	34°59.5′	75°49.5′	22
4	10/29/93	0135	34°56.3′	75°45.5′	28
5	10/29/93	0212	34°53.5′	75°41.0′	34
6	10/29/93	0248	34°50.5′	75°38.0′	45
7	10/29/93	0320	34°48.5′	75°34.4′	54
8	10/29/93	0349	34°46.5′	75°32.4′	111
9	10/29/93	0427	34°45.1′	75°29.4′	304
10	10/29/93	0541	34°41.4′	75°25.7′	1163
11	10/29/93	0714	34°37.9′	75°20.9′	2250
12	10/29/93	0910	34°32.4′	75°13.6′	2870
13	10/31/93	0542	36°15.0′	75°45.5′	14
14	10/31/93	0625	36°14.9′	75°39.4′	26
15	10/31/93	0708	36°14.9′	75°32.9′	24
16	10/31/93	0755	36°14.9′	75°26.9′	33
17	10/31/93	0850	36°15.0′	75°20.4′	34
18	10/31/93	0947	36°15.0′	75°13.9′	30
19	10/31/93	1107	36°15.0′	75°04.0′	41
20	11/03/93	0058	36°15.0′	74°54.0′	63
21	11/03/93	0132	36°15.1′	74°50.8′	89
22	11/03/93	0200	36°15.0′	74°48.0′	109
23	11/03/93	0250	36°15.0′	74°40.5′	1124
24	11/03/93	0412	36°15.0′	74°33.4′	1433
25	11/03/93	0609	36°14.9′	74°18.9′	2068
26	11/03/93	0808	36°15.0′	74°06.9′	2494
27	11/03/93	0944	36°15.0′	73°54.3′	2830
28	11/03/93	1132	36°15.5′	73°40.6′	3000
29	11/05/93	0702	36°15.0′	74°53.9′	61
30	11/05/93	0754	36°08.7′	74°55.5′	60

Table 2.2-7b Listing of CTD stations, dates, locations and water depths for Cruise VIII (SE9316).

VIII	CRUISE SE9316 (28 October - 10 November 1993)				
Station No.	Date (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Water Depth (m)
31	11/05/93	0845	36°02.4′	74°57.0′	54
32	11/05/93	0935	35°55.4′	74°56.8′	65
33	11/05/93	1025	35°49.2′	74°56.9′	63
34	11/05/93	1120	35°43.0′	74°56.0′	60
35	11/05/93	1327	35°36.7′	74°52.5′	62
36	11/05/93	1633	35°30.8′	74°50.6′	63
37	11/09/93	0707	35°30.7′	75°26.0′	13
38	11/09/93	0758	35°29.5′	75°20.0′	24
39	11/09/93	0841	35°28.0′	75°14.3′	31
40	11/09/93	0913	35°26.9′	75°09.8′	33
41	11/09/93	1001	35°25.5′	75°03.0′	33
42	11/09/93	1045	35°24.2′	74°56.3′	57
43	11/09/93	1116	35°23.4′	74°53.4′	200
44	11/09/93	1207	35°22.5′	74°50.2′	909

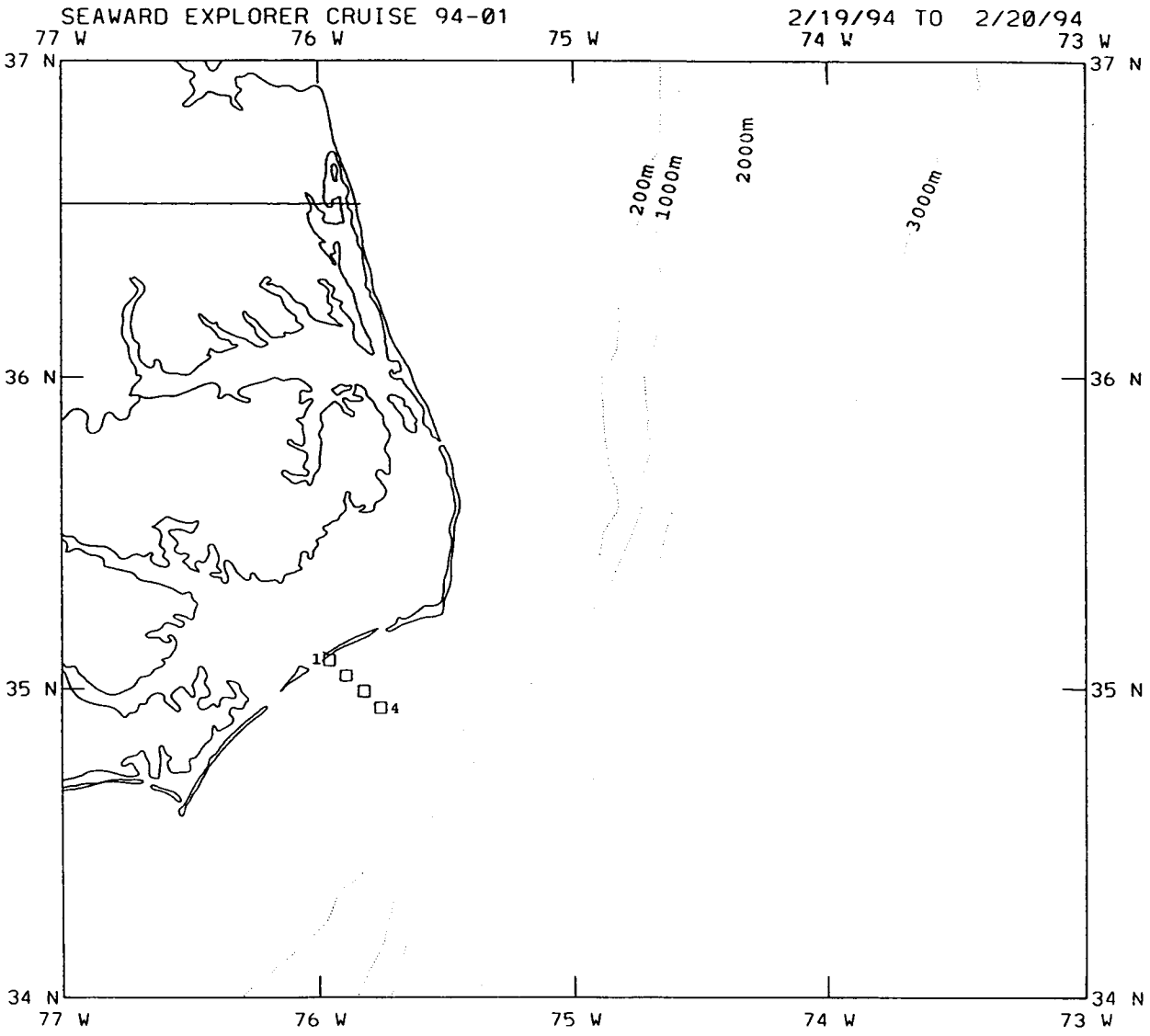


Figure 2.2-8 CTD stations occupied during Cruise IX (SE9401): 7-22 February 1994.

Table 2.2-8 Listing of CTD stations, dates, locations and water depths for Cruise IX (SE9401).

IX	CRUISE SE9401 (7-22 February 1994)				
Station No.	Date (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Water Depth (m)
1	02/19/94	1616	35°05.5'	75°57.5'	9
2	02/19/94	1725	35°02.5'	75°53.5'	23
3	02/19/94	1820	34°59.5'	75°49.4'	24
4	02/19/94	1946	34°56.3'	75°45.5'	25

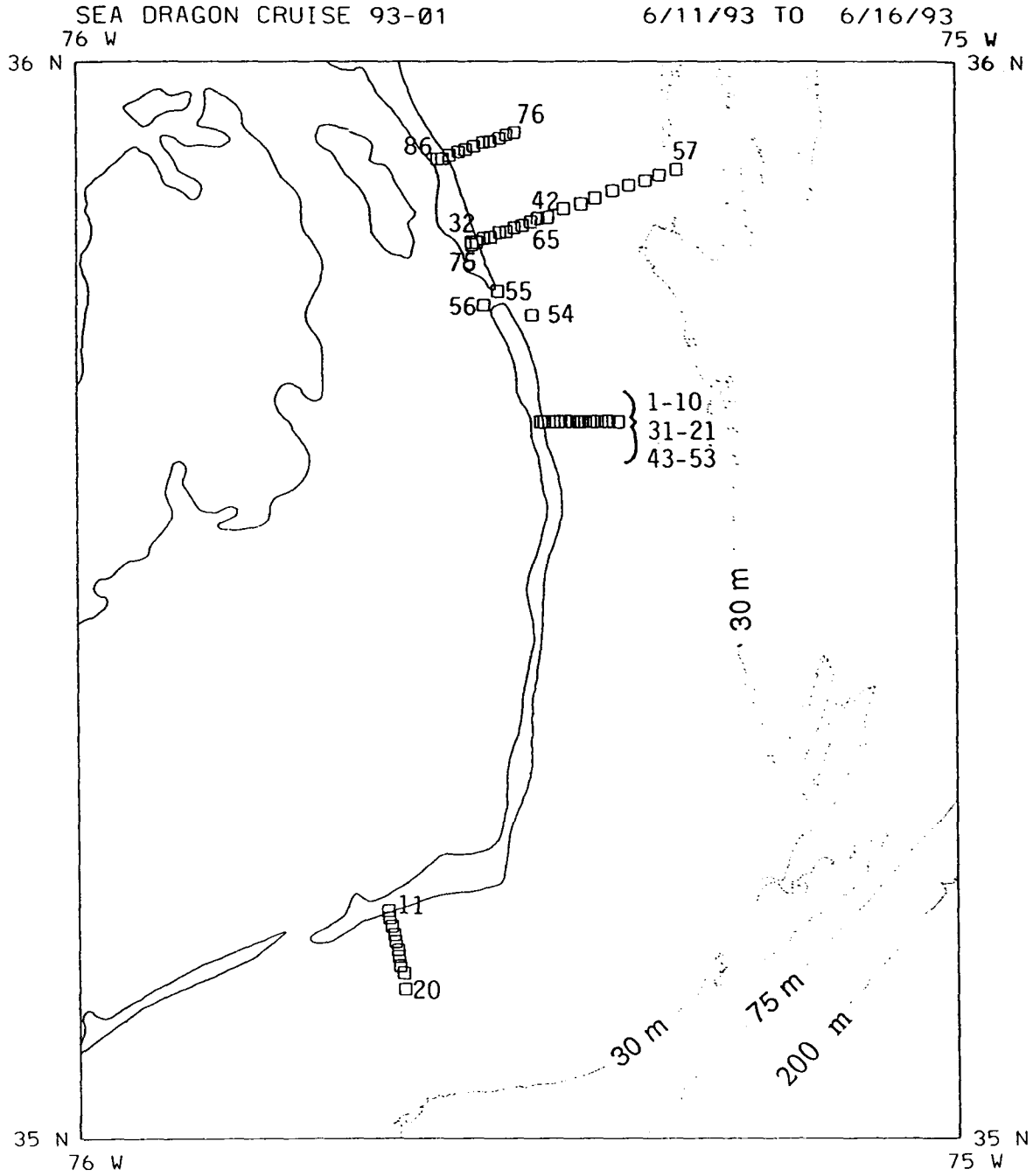


Figure 2.2-9 CTD stations occupied during Nearshore Study I (SD9301): 8-18 June 1993.

Table 2.2-9a Listing of CTD stations, dates, locations and water depths for Nearshore Drifter Study I (SD9301).

NEARSHORE I	CRUISE SD9301 (9-17 June 1993)				
Station No.	Date (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Water Depth (m)
1	06/11/93	1835	35°40.00′	75°27.95′	8.8
2	06/11/93	1840	35°40.00′	75°27.40′	18.2
3	06/11/93	1842	35°40.00′	75°26.85′	18.8
4	06/11/93	1845	35°40.00′	75°26.30′	19.0
5	06/11/93	1850	35°40.00′	75°25.75′	21.4
6	06/11/93	1854	35°40.00′	75°25.20′	21.9
7	06/11/93	1858	35°40.00′	75°24.65′	24.5
8	06/11/93	1903	35°40.00′	75°24.10′	25.9
10	06/11/93	1911	35°40.00′	75°23.00′	28.2
11	06/13/93	1613	35°12.83′	75°38.90′	10.2
12	06/13/93	1617	35°12.40′	75°38.78′	13.0
13	06/13/93	1621	35°11.94′	75°38.65′	14.6
14	06/13/93	1625	35°11.48′	75°38.51′	15.2
15	06/13/93	1629	35°11.05′	75°38.41′	14.4
16	06/13/93	1633	35°10.61′	75°38.30′	14.8
17	06/13/93	1636	35°10.18′	75°38.18′	16.2
18	06/13/93	1639	35°09.70′	75°38.08′	17.2
19	06/13/93	1643	35°09.28′	75°37.94′	18.7
20	06/13/93	1648	35°08.84′	75°37.80′	19.2
21	06/14/93	1923	35°40.00′	75°23.00′	28.4
22	06/14/93	1935	35°40.00′	75°23.55′	28.3
23	06/14/93	1940	35°40.00′	75°24.10′	25.4
24	06/14/93	1945	35°40.00′	75°24.65′	23.8
25	06/14/93	1948	35°40.00′	75°25.20′	22.6
26	06/14/93	1953	35°40.00′	75°25.75′	20.8
27	06/14/93	1957	35°40.00′	75°26.30′	18.7
28	06/14/93	2001	35°40.00′	75°26.85′	18.9
29	06/14/93	2004	35°40.00′	75°27.40′	18.0
30	06/14/93	2008	35°40.00′	75°27.95′	7.2
31	06/14/93	2012	35°40.00′	75°28.25′	9.3
32	06/15/93	1935	35°49.89′	75°33.03′	7.7
33	06/15/93	1938	35°49.97′	75°32.73′	11.5
34	06/15/93	1943	35°50.16′	75°32.15′	14.9
35	06/15/93	1947	35°50.32′	75°31.66′	15.5

Table 2.2-9b Listing of CTD stations, dates, locations and water depths for Nearshore Drifter Study I (SD9301).

NEARSHORE I	CRUISE SD9301 (9-17 June 1993)				
Station No.	Date (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Water Depth (m)
36	06/15/93	1951	35°50.48′	75°31.09′	18.5
37	06/15/93	1955	35°50.62′	75°30.56′	20.6
38	06/15/93	1958	35°50.79′	75°30.02′	20.9
39	06/15/93	2002	35°50.94′	75°29.47′	21.1
40	06/15/93	2005	35°51.10′	75°28.92′	19.6
41	06/15/93	2009	35°51.28′	75°28.39′	21.8
42	06/15/93	2013	35°51.43′	75°27.82′	20.1
43	06/15/93	2134	35°40.00′	75°28.25′	8.8
44	06/15/93	2137	35°40.00′	75°27.95′	7.4
45	06/15/93	2139	35°40.00′	75°27.40′	18.3
46	06/15/93	2143	35°40.00′	75°26.85′	18.5
47	06/15/93	2145	35°40.00′	75°26.30′	18.5
48	06/15/93	2148	35°40.00′	75°25.75′	21.6
49	06/15/93	2153	35°40.00′	75°25.20′	23.0
50	06/15/93	2156	35°40.00′	75°24.65′	23.8
51	06/15/93	2159	35°40.00′	75°24.10′	25.6
52	06/15/93	2203	35°40.00′	75°23.55′	27.9
53	06/15/93	2206	35°40.00′	75°23.00′	27.7
54	06/15/93	2240	35°45.86′	75°28.78′	22.9
55	06/15/93	2258	35°47.25′	75°31.22′	5.3
56	06/15/93	2303	35°46.46′	75°32.20′	9.1
57	06/16/93	1515	35°54.01′	75°18.94′	30.6
58	06/16/93	1519	35°53.70′	75°20.06′	28.4
59	06/16/93	1525	35°53.40′	75°21.10′	21.4
60	06/16/93	1529	35°53.08′	75°22.20′	19.2
61	06/16/93	1535	35°52.75′	75°23.30′	23.0
62	06/16/93	1540	35°52.42′	75°24.50′	26.3
63	06/16/93	1546	35°52.10′	75°25.54′	25.4
64	06/16/93	1551	35°51.78′	75°26.67′	21.8
65	06/16/93	1557	35°51.43′	75°27.82′	19.1
66	06/16/93	1600	35°51.28′	75°28.39′	21.3
67	06/16/93	1603	35°51.10′	75°28.92′	17.6
68	06/16/93	1607	35°50.94′	75°29.47′	21.6

Table 2.2-9c Listing of CTD stations, dates, locations and water depths for Nearshore Drifter Study I (SD9301).

NEARSHORE I	CRUISE SD9301 (9-17 June 1993)				
Station No.	Date (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Water Depth (m)
69	06/16/93	1610	35°50.79′	75°30.02′	20.6
70	06/16/93	1614	35°50.62′	75°30.56′	20.1
71	06/16/93	1616	35°50.48′	75°31.09′	16.8
72	06/16/93	1619	35°50.32′	75°31.66′	14.7
73	06/16/93	1623	35°50.16′	75°32.15′	14.4
74	06/16/93	1626	35°49.97′	75°32.73′	10.0
75	06/16/93	1630	35°49.89′	75°33.03′	6.7
76	06/16/93	1712	35°56.13′	75°29.95′	22.2
77	06/16/93	1715	35°55.98′	75°30.55′	23.6
78	06/16/93	1719	35°55.79′	75°31.10′	22.7
79	06/16/93	1723	35°55.63′	75°31.65′	15.4
80	06/16/93	1725	35°55.50′	75°32.22′	16.7
81	06/16/93	1728	35°55.30′	75°32.78′	15.7
82	06/16/93	1732	35°55.11′	75°33.35′	17.9
83	06/16/93	1735	35°54.95′	75°33.90′	20.2
84	06/16/93	1738	35°54.78′	75°34.50′	17.5
85	06/16/93	1742	35°54.64′	75°35.03′	14.2
86	06/16/93	1745	35°54.57′	75°35.31′	7.8

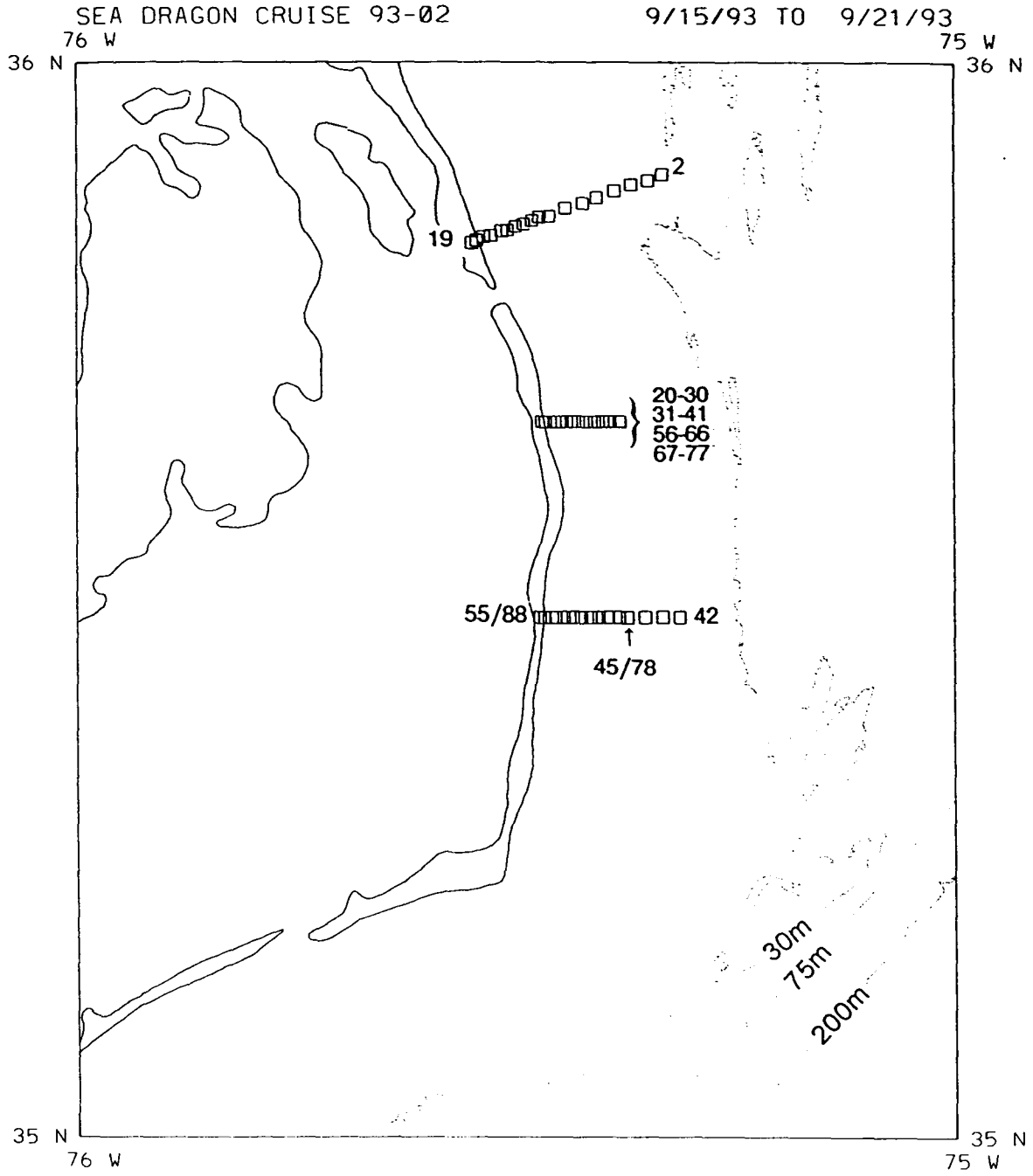


Figure 2.2-10 CTD stations occupied during Nearshore Study II (SD9302): 10-23 September 1993.

Table 2.2-10a Listing of CTD stations, dates, locations and water depths for Nearshore Drifter Study II (SD9302).

NEARSHORE II	CRUISE SD9302 (13-22 September 1993)				
Station No.	Date (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Water Depth (m)
1	09/15/93	1526	35°54.01′	75°18.94′	27.4
2	09/15/93	1542	35°53.70′	75°20.06′	29.4
3	09/15/93	1522	35°53.40′	75°21.10′	20.5
4	09/15/93	1559	35°53.08′	75°22.20′	18.5
5	09/15/93	1107	35°52.75′	75°23.30′	22.5
6	09/15/93	1613	35°52.42′	75°24.50′	26.3
7	09/15/93	1621	35°52.10′	75°25.54′	25.1
8	09/15/93	1627	35°51.78′	75°26.67′	21.5
9	09/15/93	1635	35°51.43′	75°27.82′	18.1
10	09/15/93	1639	35°51.28′	75°28.39′	19.0
11	09/15/93	1644	35°51.10′	75°28.92′	17.2
12	09/15/93	1649	35°50.94′	75°29.47′	20.8
13	09/15/93	1653	35°50.79′	75°30.02′	20.0
14	09/15/93	1658	35°50.62′	75°30.56′	19.6
15	09/15/93	1703	35°50.48′	75°31.09′	17.1
16	09/15/93	1707	35°50.32′	75°31.66′	13.0
17	09/15/93	1711	35°50.16′	75°32.15′	13.9
18	09/15/93	1714	35°49.97′	75°32.73′	10.1
19	09/15/93	1727	35°49.89′	75°33.03′	6.7
20	09/16/93	1804	35°40.00′	75°28.25′	9.1
21	09/16/93	1810	35°40.00′	75°27.95′	6.4
22	09/16/93	1815	35°40.00′	75°27.40′	16.7
23	09/16/93	1820	35°40.00′	75°26.85′	17.3
24	09/16/93	1825	35°40.00′	75°26.30′	17.9
25	09/16/93	1830	35°40.00′	75°25.75′	20.0
26	09/16/93	1834	35°40.00′	75°25.20′	21.5
27	09/16/93	1839	35°40.00′	75°24.65′	22.7
28	09/16/93	1844	35°40.00′	75°24.10′	23.6
29	09/16/93	1849	35°40.00′	75°23.55′	26.6
30	09/16/93	1854	35°40.00′	75°23.00′	26.6
31	09/17/93	1522	35°40.00′	75°28.25′	7.7
32	09/17/93	1527	35°40.00′	75°27.95′	6.8
33	09/17/93	1531	35°40.00′	75°27.40′	18.4

Table 2.2-10b Listing of CTD stations, dates, locations and water depths for Nearshore Drifter Study II (SD9302).

NEARSHORE II	CRUISE SD9302 (13-22 September 1993)				
Station No.	Date (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Water Depth (m)
34	09/17/93	1536	35°40.00'	75°26.85'	18.5
35	09/17/93	1541	35°40.00'	75°26.30'	18.5
36	09/17/93	1544	35°40.00'	75°25.75'	21.0
37	09/17/93	1549	35°40.00'	75°25.20'	22.7
38	09/17/93	1554	35°40.00'	75°24.65'	23.7
39	09/17/93	1559	35°40.00'	75°24.10'	24.9
40	09/17/93	1604	35°40.00'	75°23.55'	28.0
41	09/17/93	1609	35°40.00'	75°23.00'	27.2
42	09/18/93	1552	35°29.00'	75°18.85'	26.0
43	09/18/93	1603	35°29.00'	75°20.08'	24.6
44	09/18/93	1609	35°29.00'	75°21.28'	21.3
45	09/18/93	1616	35°29.00'	75°22.50'	21.9
46	09/18/93	1621	35°29.00'	75°23.12'	21.0
47	09/18/93	1626	35°29.00'	75°23.80'	20.5
48	09/18/93	1630	35°29.00'	75°24.40'	20.5
49	09/18/93	1635	35°29.00'	75°24.98'	20.0
50	09/18/93	1639	35°29.00'	75°25.60'	18.2
51	09/18/93	1644	35°29.00'	75°26.20'	16.6
52	09/18/93	1649	35°29.00'	75°26.80'	15.5
53	09/18/93	1653	35°29.00'	75°27.40'	14.6
54	09/18/93	1656	35°29.00'	75°28.10'	9.5
55	09/18/93	1659	35°29.00'	75°28.40'	6.7
56	09/18/93	1740	35°40.00'	75°28.25'	8.6
57	09/18/93	1745	35°40.00'	75°27.95'	6.8
58	09/18/93	1749	35°40.00'	75°27.40'	18.3
59	09/18/93	1753	35°40.00'	75°26.85'	18.3
60	09/18/93	1756	35°40.00'	75°26.30'	18.1
61	09/18/93	1800	35°40.00'	75°25.75'	21.4
62	09/18/93	1803	35°40.00'	75°25.20'	22.3
63	09/18/93	1807	35°40.00'	75°24.65'	23.2
64	09/18/93	1811	35°40.00'	75°24.10'	24.9
65	09/18/93	1817	35°40.00'	75°23.55'	27.3
66	09/18/93	1822	35°40.00'	75°23.00'	26.9

Table 2.2-10c Listing of CTD stations, dates, locations and water depths for Nearshore Drifter Study II (SD9302).

NEARSHORE II	CRUISE SD9302 (13-22 September 1993)				
Station No.	Date (GMT)	Time (GMT)	Latitude (N)	Longitude (W)	Water Depth (m)
67	09/20/93	2023	35°40.00'	75°28.25'	8.3
68	09/20/93	2026	35°40.00'	75°27.95'	6.6
69	09/20/93	2029	35°40.00'	75°27.40'	17.6
70	09/20/93	2034	35°40.00'	75°26.85'	18.4
71	09/20/93	2037	35°40.00'	75°26.30'	18.3
72	09/20/93	2041	35°40.00'	75°25.75'	20.9
73	09/20/93	2045	35°40.00'	75°25.20'	22.2
74	09/20/93	2050	35°40.00'	75°24.65'	23.9
75	09/20/93	2055	35°40.00'	75°24.10'	24.8
76	09/20/93	2100	35°40.00'	75°23.55'	27.0
77	09/20/93	2105	35°40.00'	75°23.00'	27.2
78	09/21/93	1840	35°29.00'	75°22.50'	22.2
79	09/21/93	1846	35°29.00'	75°23.12'	21.3
80	09/21/93	1851	35°29.00'	75°23.80'	21.3
81	09/21/93	1856	35°29.00'	75°24.40'	20.4
82	09/21/93	1902	35°29.00'	75°24.98'	20.2
83	09/21/93	1907	35°29.00'	75°25.60'	18.7
84	09/21/93	1911	35°29.00'	75°26.20'	16.8
85	09/21/93	1916	35°29.00'	75°26.80'	16.1
86	09/21/93	1921	35°29.00'	75°27.40'	13.9
87	09/21/93	1926	35°29.00'	75°28.10'	10.2
88	09/21/93	1930	35°29.00'	75°28.40'	7.7

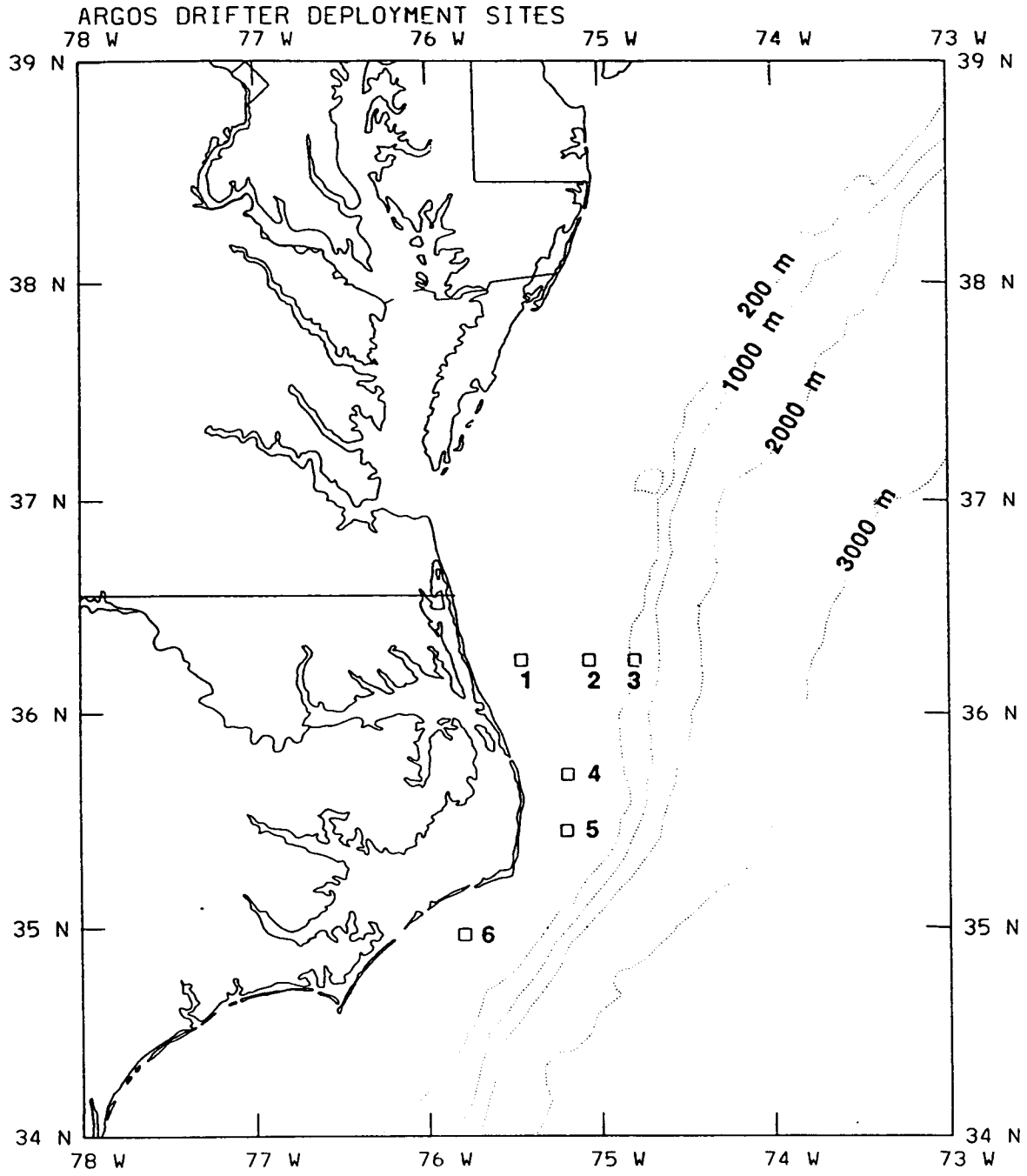


Figure 2.3-1 Aanderaa ARGOS drifter deployment sites.

Table 2.3-1 Quarterly deployment sites for Aanderaa (Draper) 2.5m holey sock drogued ARGOS drifters.

Map Position	Latitude	Longitude
1	36°14.9'N	75°27.3'W
2	36°14.8'N	75°04.2'W
3	36°15.0'N	74°47.9'W
4	35°42.8'N	75°11.6'W
5	35°26.9'N	75°11.8'W
6	34°57.8'N	75°47.5'W

Table 2.3-2 Nearshore Study deployment sites for Brightwaters Davis-type GPS drifters.

Map Position	Latitude	Longitude	Distance Offshore
7	35°40.00'N	75°27.95'W	0.5 nm
8	35°40.00'N	75°27.40'W	1.0 nm
9	35°40.00'N	75°26.85'W	1.5 nm
10	35°40.00'N	75°26.30'W	2.0 nm

Table 2.3-3 Nearshore Study deployment sites for Technocean Davis-type ARGOS drifters.

Map Position	Latitude	Longitude	Distance Offshore
8	35°40.00'N	75°27.40'W	1.0 nm
9	35°40.00'N	75°26.85'W	1.5 nm
10	35°40.00'N	75°26.30'W	2.0 nm
11	35°40.00'N	75°25.75'W	2.5 nm
12	35°40.00'N	75°24.10'W	4.0 nm
13	35°40.00'N	75°23.00'W	5.0 nm
14	35°43.58'N	75°28.72'W	0.75 nm

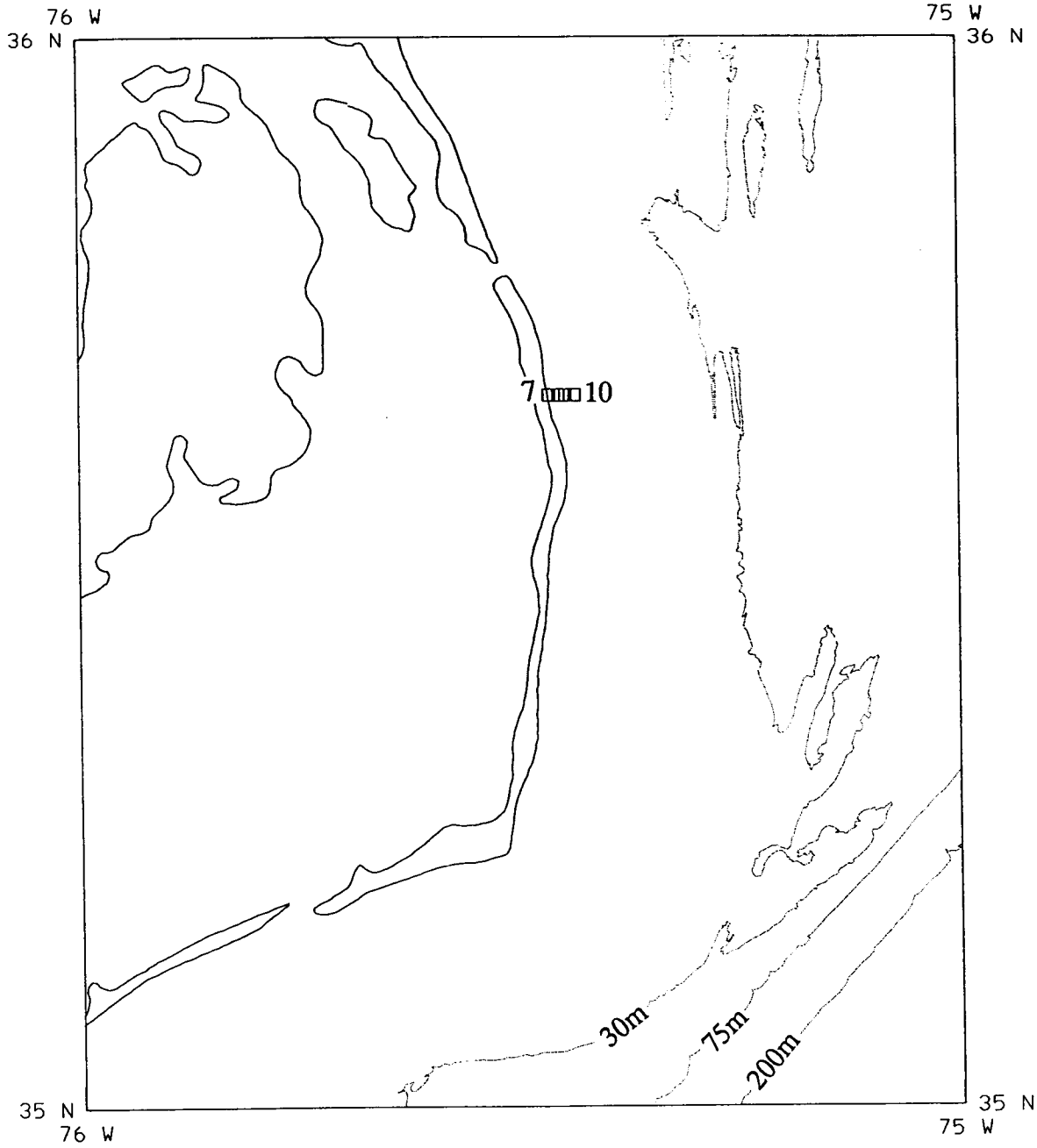


Figure 2.3-2 Brightwaters Davis-type GPS drifter deployment sites.

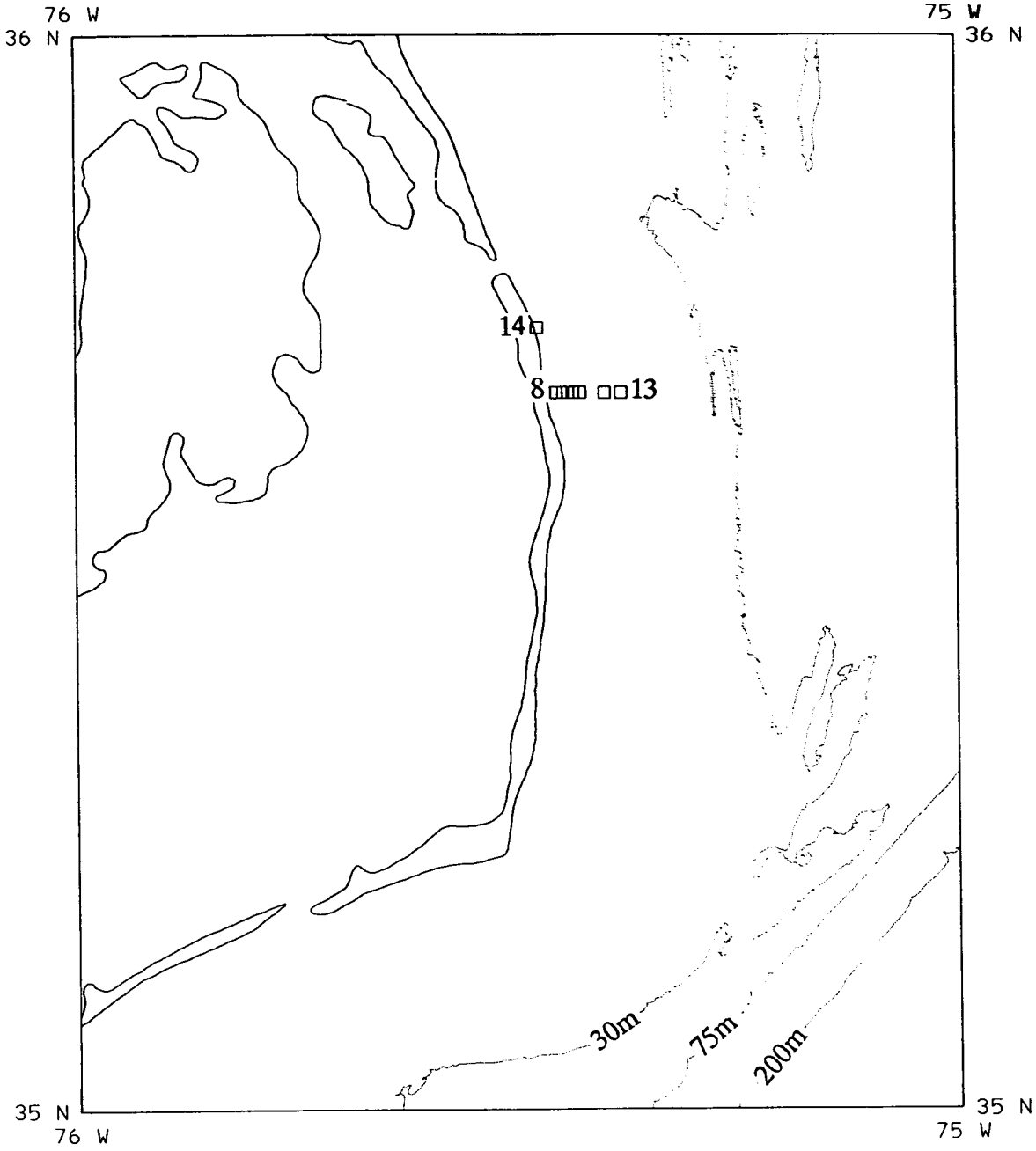


Figure 2.3-3 Technocean Davis-type ARGOS drifter deployment sites.

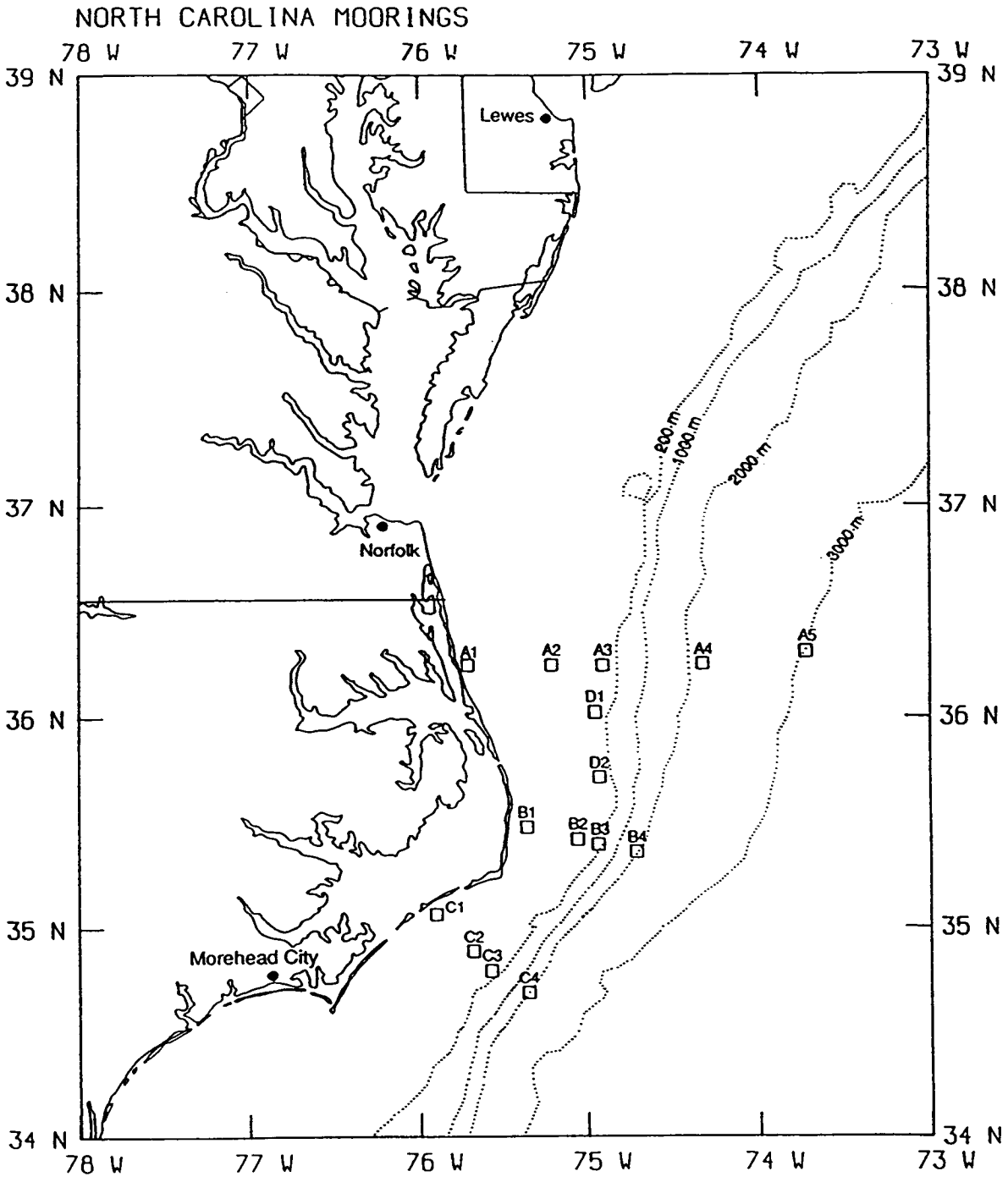


Figure 2.4-1 Current meter mooring locations.

Table 2.4-1a Compilation of location, type, serial number and depth of current meters.

MOORING	DEPTH (M)	LATITUDE/ LONGITUDE	INSTRUMENT TYPE, SERIAL NUMBER AND DEPTH			
			INITIAL DEPLOYMENT (February 1992)	SECOND DEPLOYMENT (April-May 1992)	THIRD DEPLOYMENT (August-September 1992)	FOURTH DEPLOYMENT (November 1992)
A1	22	36°14.7'N 75°42.5'W	IO 08111747 (5m) IO 08161758 (16m)	IO 08161754 (5m) IO 08111747 (16m)	IO 08161758 (5m) IO 08111746 (16m)	IO 08111747 (5m) IO 08111748 (16m)
A2	35	36°14.7'N 75°12.4'W	IO 08161754 (5m)	IO 08161756 (5m)	IO 08161754 (5m)	IO 08111746 (5m)
		36°14.9'N 75°12.4'W	GO 455 (20m) GO 445 (30m)	GO 455 (20m) GO 460 (30m)	GO 445 (20m) GO 448 (30m)	GO 458 (20m) GO 446 (30m)
A3	60	36°14.6'N 74°54.4'W	IO 08111750 (5m)	IO 08111750 (5m)	IO 08111751 (5m)	IO 08161758 (5m)
		36°14.8'N 74°54.5'W	GO 449 (30m) GO 453 (55m)	NOT ROTATED (30m) NOT ROTATED (55m)	NOT ROTATED (30m) NOT ROTATED (55m)	
		36°14.3'N 74°54.5'W		GO 256 (30m)	GO 444 (30m) GO 450 (55m)	GO 445 (30m) GO 448 (55m)
A4	2020	36°15.1'N 74°19.6'W	GO 438 (100m) GO 380 (300m) GO 126 (800m) GO 201 (1200m) AA 7582 (1900m)	NOT ROTATED (100m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m)	GO 438 (100m) GO 380 (300m) GO 126 (800m) GO 201 (1200m) AA 7582 (1900m)	NOT ROTATED (100m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m)
A5	3000	36°18.3'N 73°43.7'W	GO 283 (60m) GO 291 (300m) GO 332 (800m) GO 377 (1200m) AA 10535 (1900m) AA 10527 (2900m)	NOT ROTATED (60m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m) NOT ROTATED (2900m)	GO 441 (60m) GO 291 (300m) GO 283 (800m) GO 377 (1200m) AA 10535 (1900m) AA 10527 (2900m)	NOT ROTATED (60m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m) NOT ROTATED (2900m)
B1	21	35°28.9'N 75°21.4'W	IO 08161753 (5m) IO 08161759 (14m)	IO 08161753 (5m) IO 08161759 (14m)	IO 08161759 (5m) IO 08161753 (14m)	IO 08111751 (5m) IO 08161753 (14m)
B2	35	35°25.1'N 75°03.4'W	IO 08111757 (5m)	IO 08111751 (5m)	IO 08111750 (5m)	IO 08161749 (5m)
		35°25.3'N 75°03.2'W	GO 447 (20m) GO 448 (30m)	GO 451 (20m) GO 452 (30m)	GO 451 (20m) GO 452 (30m)	GO 451 (20m) GO 452 (30m)

Table 2.4-1b Compilation of location, type, serial number and depth of current meters.

MOORING	DEPTH (M)	LATITUDE/ LONGITUDE	INSTRUMENT TYPE, SERIAL NUMBER AND DEPTH			
			FIFTH DEPLOYMENT (February 1993)	SIXTH DEPLOYMENT (May 1993)	SEVENTH DEPLOYMENT (August 1993)	EIGHTH DEPLOYMENT (Oct.-Nov. 1993)
A1	22	36°14.7'N 75°42.5'W	IO 08161753 (5m) IO 08111748 (16m)	I0 08161755 (5m) I0 08111747 (14m)	I0 07801745 (5m) I0 08111747 (14m)	I0 07801745 (5m) I0 08111750 (14m)
A2	35	36°14.7'N 75°12.4'W 36°14.9'N 75°12.4'W	IO 08111747 (5m) GO 449 (20m) GO 446 (30m)	I0 08161753 (5m) GO 449 (20m) GO 446 (30m)	I0 08161753 (5m) GO 445 (20m) GO 448 (30m)	I0 08111747 (5m) GO 445 (20m) GO 448 (30m)
A3	60	36°14.6'N 74°54.4'W 36°14.8'N 74°54.5'W 36°14.3'N 74°54.5'W	IO 08161758 (5m) GO 445 (30m) GO 448 (55m)	I0 08111748 (5m) GO 445 (30m) GO 448 (55m)	I0 08161755 (5m) GO 449 (30m) GO 446 (55m)	I0 08161753 (5m) GO 446 (30m) GO 291 (55m)
A4	2020	36°15.1'N 74°19.6'W	NOT ROTATED (100m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m)	GO 438 (100m) GO 280 (300m) GO 328 (800m) GO 201 (1200m) AA 7582 (1900m)	GO 438 (100 m) GO 280 (300 m) GO 328 (800 m) GO 201 (1200m) AA 7582 (1900m)	NOT ROTATED (100m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m)
A5	3000	36°18.3'N 73°43.7'W	NOT ROTATED (60m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m) NOT ROTATED (2900m)	GO 283 (60m) GO 291 (300m) GO 379 (800m) GO 332 (1200m) AA 10535 (1900m) AA 10527 (2900m)	NOT ROTATED (60m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m) NOT ROTATED (2900m)	
B1	21	35°28.9'N 75°21.4'W	IO 08161749 (5m) IO 07801744 (14m)	I0 08161749 (5m) I0 07801744 (14m)	I0 08111746 (5m) I0 08161758 (14m)	I0 08161755 (5m) I0 07801744 (14m)
B2	35	35°25.1'N 75°03.4'W 35°25.3'N 75°03.2'W	IO 08111751 (5m) GO 451 (20m) GO 452 (30m)	I0 08161758 (5m) GO 451 (20m) GO 452 (30m)	I0 08111750 (5m) GO 451 (20m) GO 452 (30m)	I0 08111746 (5m) GO 451 (20m) GO 452 (30m)

Table 2.4-1c Compilation of location, type, serial number and depth of current meters.

MOORING	DEPTH (M)	LATITUDE/ LONGITUDE	INSTRUMENT TYPE, SERIAL NUMBER AND DEPTH			
			INITIAL DEPLOYMENT (February 1992)	SECOND DEPLOYMENT (April-May 1992)	THIRD DEPLOYMENT (August-September 1992)	FOURTH DEPLOYMENT (November 1992)
B3	61	35°23.8'N 74°56.5'W	IO 08111748 (5m)	IO 08111748 (5m)	GO 460 (8m)	NOT ROTATED (8m)
		35°24.0'N 74°56.4'W	GO 256 (30m) GO 450 (55m)	GO 444 (30m) GO 450 (55m)	GO 440 (30m) GO 455 (55m)	GO 440 (30m) GO 455 (55m)
		35°23.5'N 74°56.8'W				
B4	2000	35°21.6'N 74°43.0'W	GO 280 (100m) GO 379 (300m) GO 331 (800m) GO 195 (1200m) AA 7528 (1900m)	NOT ROTATED (100m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m)	GO 443 (100m) GO 280 (300m) GO 332 (800m) GO 127 (1200m) AA 7528 (1900m)	NOT ROTATED (100m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m)
C1	20	35°03.8'N 75°54.3'W	IO 07801744 (5m) IO 07801745 (14m)	IO 07801744 (5m) IO 07801745 (14m)	IO 07801744 (5m) IO 08161757 (14m)	IO 07801744 (5m) IO 08161757 (14m)
C2	35	34°53.5'N 75°40.8'W	IO 08161757 (5m)	IO 08161757 (5m)	IO 07801745 (5m)	IO 07801745 (5m)
		34°53.4'N 75°40.5'W	GO 322 (20m) GO 444 (30m)	GO 447 (20m) GO 459 (30m)	GO 447 (20m) GO 459 (30m)	GO 447 (20m) GO 459 (30m)
C3	61	34°47.8'N 75°34.6'W	IO 08111749 (5m)	NOT ROTATED (5m)	IO 08111749 (5m) GO 256 (9m)	IO 08161752 (5m)
		34°48.0'N 75°34.4'W	GO 439 (30m) GO 446 (55m)	NOT ROTATED (30m) NOT ROTATED (55m)	GO 439 (30m) GO 454 (55m)	GO 439 (30m) GO 454 (55m)
C4	2000	34°41.5'N 75°21.0'W	GO 281 (100m) GO 335 (300m) GO 328 (800m) GO 153 (1200m) AA 10533 (1900m)	NOT ROTATED (100m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m)	GO 281 (100m) GO 328 (300m) GO 153 (800m) GO 195 (1200m) AA 10533 (1900m)	NOT ROTATED (100m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m)

Table 2.4-1d Compilation of location, type, serial number and depth of current meters.

MOORING	DEPTH (M)	LATITUDE/ LONGITUDE	INSTRUMENT TYPE, SERIAL NUMBER AND DEPTH			
			FIFTH DEPLOYMENT (February 1993)	SIXTH DEPLOYMENT (May 1993)	SEVENTH DEPLOYMENT (August 1993)	EIGHTH DEPLOYMENT (Oct.-Nov. 1993)
B3	61	35°23.8'N 74°56.5'W	IO 08161756 (5m)	I0 08161756 (5m)	I0 08111749 (5m)	NOT ROTATED (5m)
		35°24.0'N 74°56.4'W		GO 337 (30m) GO 322 (55m)		
		35°23.5'N 74°56.8'W	GO 458 (30m) GO 378 (55m)	NOT ROTATED (30m) NOT ROTATED (55m)	GO 458 (30m) GO 378 (55m)	GO 458 (30m) GO 378 (55m)
B4	2000	35°21.6'N 74°43.0'W	GO 443 (100m) GO 281 (300m) GO 335 (800m) GO 127 (1200m) AA 7528 (1900m)	NOT ROTATED (100m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m)	G0 443 (100m) GO 281 (300m) GO 331 (800m) GO 127 (1200m) AA 7528 (1900m)	NOT ROTATED (100m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m)
C1	20	35°03.8'N 75°54.3'W	IO 08161754 (5m) IO 08161757 (14m)	I0 08161754 (5m) I0 08161757 (5m)	I0 08161754 (5m)	I0 08111748 (5m)
C2	35	34°53.5'N 75°40.8'W	IO 08111750 (5m)	I0 08111750 (5m)	I0 08111748 (5m)	I0 08161754 (5m)
		34°53.4'N 75°40.5'W	GO 447 (20m) GO 459 (30m)	GO 447 (20m) GO 459 (30m)	GO 447 (20m) GO 459 (30m)	GO 447 (20m) GO 459 (30m)
C3	61	34°47.8'N 75°34.6'W		I0 08111746 (5m)		
		34°48.0'N 75°34.4'W	GO 439 (30m) GO 454 (55m)	GO 439 (30m) GO 454 (55m)	GO 439 (30m) GO 454 (55m)	GO 439 (30m) GO 454 (55m)
C4	2000	34°41.5'N 75°21.0'W	GO 442 (100m) GO 331 (300m) GO 153 (800m) GO 195 (1200m) AA 10533 (1900m)	NOT ROTATED (100m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m)	GO 442 (100m) GO 380 (300m) GO 153 (800m) GO 126 (1200m) AA 10533 (1900m)	NOT ROTATED (100m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m)

Table 2.4-1e Compilation of location, type, serial number and depth of current meters.

MOORING	DEPTH (M)	LATITUDE/ LONGITUDE	INSTRUMENT TYPE, SERIAL NUMBER AND DEPTH			
			INITIAL DEPLOYMENT (February 1992)	SECOND DEPLOYMENT (April-May 1992)	THIRD DEPLOYMENT (August-September 1992)	FOURTH DEPLOYMENT (November 1992)
D1	61	36°01.6'N 74°57.2'W	IO 08161752 (5m)	IO 08161752 (5m)	IO 08161752 (5m)	IO 08161755 (5m)
		36°01.5'N 74°57.1'W	GO 451 (30m) GO 452 (55m)	GO 475 (30m) GO 458 (55m)	GO 457 (30m) GO 331 (55m)	GO 457 (30m) GO 453 (55m)
D2	60	35°42.9'N 74°56.0'W	IO 08161755 (5m)	IO 08161755 (5m)	IO 08161755 (5m)	IO 08161759 (5m)
		35°42.5'N 74°55.8'W	GO 378 (30m) GO 454 (55m)	GO 322 (30m) GO 378 (55m)	GO 322 (30m) GO 378 (55m)	NOT ROTATED (30m) NOT ROTATED (55m)
		35°43.3'N 74°55.7'W				GO 444 (30m) GO 450 (55m)

AA = Aanderaa RCM-5/8 or RCM-8 current meter
GO = General Oceanics Mk1 or Mk2 current meter
IO = InterOcean S4 current meter

Table 2.4-1f Compilation of location, type, serial number and depth of current meters.

MOORING	DEPTH (M)	LATITUDE/ LONGITUDE	INSTRUMENT TYPE, SERIAL NUMBER AND DEPTH			
			FIFTH DEPLOYMENT (February 1993)	SIXTH DEPLOYMENT (May 1993)	SEVENTH DEPLOYMENT (August 1993)	EIGHTH DEPLOYMENT (Oct.-Nov. 1993)
D1	61	36°01.6'N 74°57.2'W	NOT ROTATED (5m)	IO 07801745 (5m)	IO 08161759 (5m)	NOT ROTATED (5m)
		36°01.5'N 74°57.1'W	GO 444 (30m) GO 450 (55m)	GO 444 (30m) GO 450 (55m)	GO 444 (30m) GO 450 (55m)	GO 444 (30m) GO 450 (55m)
D2	60	35°42.9'N 74°56.0'W	NOT ROTATED (5m)	IO 08161759 (5m)	IO 07801744 (5m)	IO 08161757(5m)
		35°43.2'N 74°56.0'W	GO 457 (30m) GO 453 (55m)	GO 457 (30m) GO 453 (55m)	GO 457 (30m) GO 453 (55m)	GO 457 (30m) GO 453 (55m)
		35°42.5'N 74°55.8'W				

AA = Aanderaa RCM-5/8 or RCM-8 current meter
GO = General Oceanics Mk1 or Mk2 current meter
IO = InterOcean S4 current meter

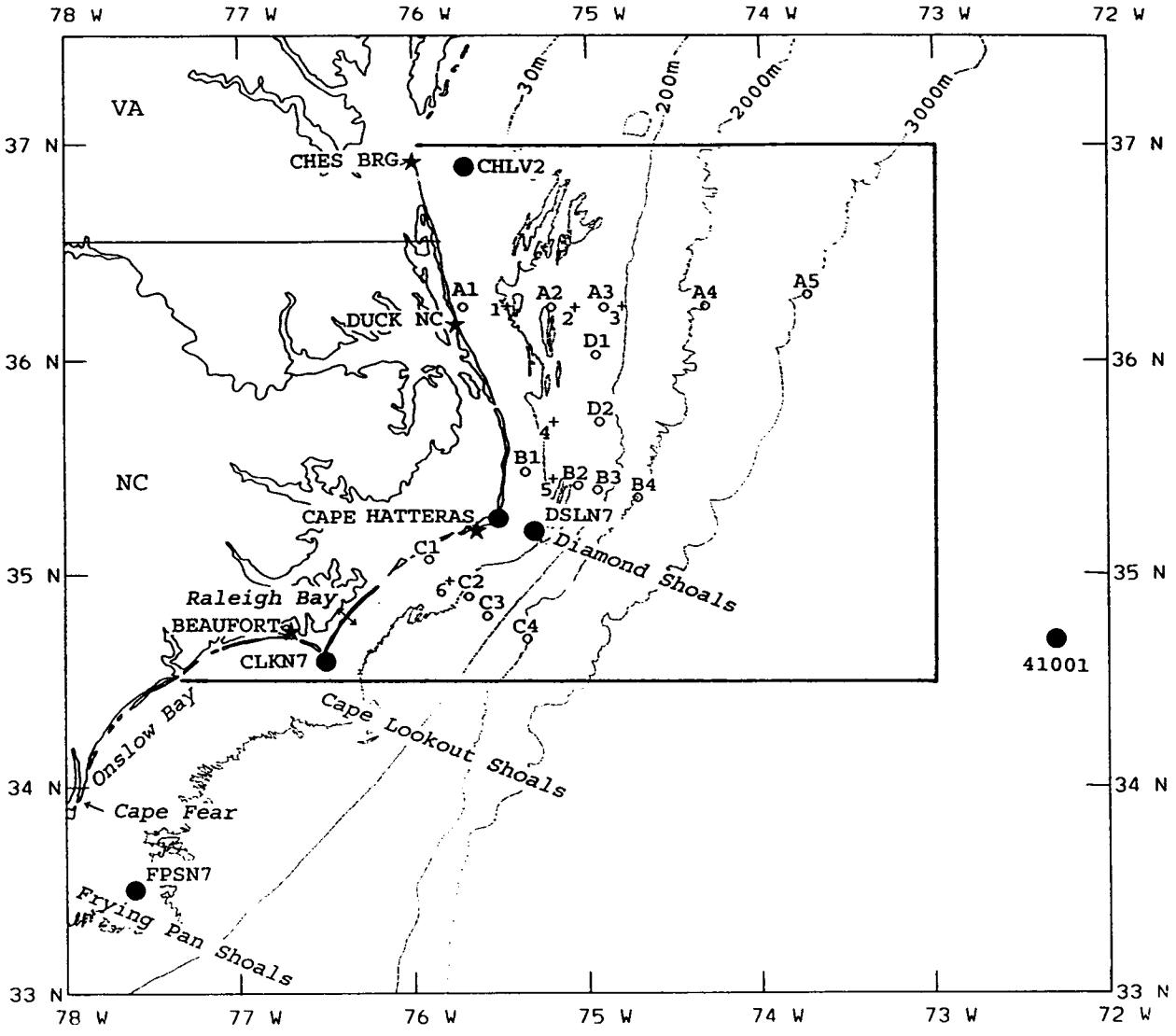


Figure 2.5-1 Location of meteorological (●) and water level (★) stations utilized in this study.

Table 2.5-1 Summary of the six (6) meteorological stations from which data were utilized in support of the NC Field Program (see Figure 2.5-1).

Location	Latitude	Longitude	Source
Chesapeake Light, VA (CHLV2)	36°54.0'N	75°42.0'W	NDBC (C-MAN)
Cape Hatteras, NC (93729)	35°15.0'N	75°31.0'W	NWS
Diamond Shoals, NC (DSLN7)	35°12.0'N	75°18.0'W	NDBC (C-MAN)
41001	34°54.0'N	73°00.0'W	NDBC (BUOY)
Cape Lookout, NC (CLKN7)	34°36.0'N	76°30.0'W	NDBC (C-MAN)
Frying Pan Shoals, NC (FPSN7)	33°30.0'N	77°35.0'W	NDBC (C-MAN)

Table 2.5-2 Summary of the four (4) National Ocean Service (NOS) sea-level recording stations from which data were utilized in support of the NC Field Program (see Figure 2.5-1).

Location	Latitude	Longitude	Source
Ches Bay Br Tun, VA (863-8863)	36°58.1'N	76°06.8'W	NOS
Duck, NC (865-1370)	36°11.0'N	75°44.6'W	NOS
Cape Hatteras, NC (865-4400)	35°13.4'N	75°38.1'W	NOS
Duke Marine Lab, NC (865-6483)	34°43.0'N	76°40.4'W	NOS

III. CTD AND CURRENT METER CALIBRATIONS

3.1 CTD Calibrations

Three different Neil Brown Mk IIIB CTDs and a SeaBird SBE-19 SeaCat CTD were used during the field program. SAIC's Neil Brown Mk IIIB was recalibrated at Neil Brown (EG&G) prior to the beginning of the field program (on January 16, 1992) and a 1600 dbar unit belonging to the University of Delaware (used on the R/V CAPE HENLOPEN) was recalibrated twice (on January 27, 1992 and again on October 27, 1992.) Also, a second University of Delaware Mk IIIB CTD (a 3200 decibar unit) was recalibrated on February 10, 1992. The SeaBird SeaCat CTD (used during the Nearshore Study) was recalibrated on October 28, 1992.

During each quarterly cruise, salinity samples were collected at each station. During the Nearshore Studies salinity samples were collected at two or three stations along each line. After each cruise samples were shipped to Texas A&M University where they were run on a Guildline conductive salinometer. The raw CTD data were then compared with salinity samples collected in mixed layers. The results of these intercomparisons for the quarterly cruises are presented in Tables 3.1-1 through 3.1-8 and are summarized in Table 3.1-9. Similar tables for the two Nearshore Studies were not generated due to the absence of mixed layers in the shallow coastal zone. However, it is noted that the observed bottle salinity values did occur within gradients of the meter averaged CTD profiles within a meter of the depth at which the water samples were taken.

A pressure affect on the University of Delaware's shallow (1600 dbar) Neil Brown unit's conductivity head was detected in data for Cruise III (19 August-5 September 1992) aboard the R/V CAPE HENLOPEN. Subsequently, a depth dependent equation was fit to the data and corrected CTD salinities were determined. The results of this fit are shown in Table 3.1-2a. The standard deviation (0.029) in the Cruise II (28 April-10 May 1992) salinity data is high but is not readily explainable. Otherwise, the CTD salinity data, and by inference the temperature data, are of excellent quality for the entire field program.

3.2 Current Meter Calibrations

All current meters used in the program were calibrated at the respective manufacturer's facilities prior to the initiation of the field work. In addition, a small number of instruments (mostly S4s) were periodically recalibrated during the program in conjunction with repairs by the manufacturer at the manufacturer's facilities. All instruments on hand at the conclusion of the field effort were recalibrated before being returned to MMS or the SAIC Service Center. Tables 3.2-1 through 3.2-3 present the dates for these calibrations. The Aanderaa RCM-5/8s and RCM-8s were recalibrated at the Northwest Regional Calibration Center; and the General Oceanics Mk1s and Mk2s, and the InterOcean S4s were recalibrated at their respective manufacturer's facilities.

No calibration problems were detected with any of the Aanderaa current meters. One General Oceanics Mk2 current meter (serial number 459) produced questionable directional data during the field effort (at the 30m level at C2). However, extensive testing of the instrument at General Oceanics following final recovery revealed no detectable problems. Instrument 291 had an intermittent problem with its tilt sensor causing it

Table 3.1-1 CTD salinity calibration data for Cruise II (CH9222).

II CRUISE CH9222 (28 April - 10 May 1992)			
Station/ Depth (db)	Raw CTD Salinity (psu)	*(Bottle) Salinity (psu)	Salinity Difference (psu)
1/2.7	26.948	(1P) 27.064	- 0.116
2/21.6	31.449	(2P) 31.504	- 0.055
3/3.8	32.700	(3P) 32.747	- 0.047
4/24.3	32.850	(4P) 32.896	- 0.046
5/25.4	32.853	(5P) 32.899	- 0.046
6/25.4	32.956	(6P) 32.999	- 0.043
7/35.6	33.126	(7P) 33.167	- 0.041
8/56.0	33.232	(8P) 33.270	- 0.038
9/93.1	33.208	(9P) 33.245	- 0.037
10/36.2	33.176	(10P) 33.214	- 0.038
10/1102.0	34.937	(11P) 34.953	- 0.016
11/1428.1	34.934	(12P) 34.951	- 0.017
12/56.9	33.203	(13P) 33.244	- 0.041
13/60.1	33.258	(14P) 33.295	- 0.037
14/1.2	33.124	(15P) 33.158	- 0.034
15/62.7	34.408	(16P) 34.423	- 0.015
17/56.5	33.295	(18P) 33.334	- 0.039
19/58.8	36.533	(20P) 36.504	0.029
20/2.6	36.390	(21P) 36.380	0.010
21/2.7	36.166	(22P) 36.177	- 0.011
22/3.0	36.407	(23P) 36.401	0.006
24/2.6	36.422	(25P) 36.414	0.008
25/2.6	36.423	(26P) 36.415	0.008
26/2.3	36.417	(27P) 36.408	0.009
27/2.4	36.396	(28P) 36.389	0.007
28/2.2	36.424	(29P) 36.416	0.008
29/3.0	36.395	(30P) 36.384	0.011
30/1099.4	34.949	(31P) 34.975	- 0.026
33/54.0	36.441	(34P) 36.427	0.014
34/43.7	36.429	(35P) 36.419	0.010
35/32.5	36.340	(36P) 36.329	0.011
37/1.2	35.444	(38P) 35.477	- 0.033
38/1.3	35.382	(39P) 35.491	- 0.109
40/3.2	36.270	(41P) 36.246	0.024
41/3.2	36.289	(42P) 36.281	0.008
42/2.9	36.286	(43P) 36.287	- 0.001
43/2.6	36.307	(44P) 36.321	- 0.014
44/2.6	35.561	(45P) 35.601	- 0.040
45/2.0	31.716	(46P) 31.837	- 0.121
46/2.8	31.597	(47P) 31.715	- 0.118
47/2.1	34.006	(48P) 34.069	- 0.063
48/2.4	34.535	(49P) 34.600	- 0.065
49/2.7	34.941	(50P) 34.998	- 0.057
50/2.4	34.202	(51P) 34.269	- 0.067
52/3.4	36.290	(53P) 36.248	0.042

* Bottle salinity samples run at Texas A&M University on May 27, 1992.

Less Stations 1, 2, 38, 45 and 46

$\Delta\tilde{s}$ = -0.018
Std. Dev. = 0.029

Table 3.1-2a CTD salinity calibration data (for shallow unit) for Cruise III (CH9234).

ITI CRUISE CH9234 (19 August - 5 September 1992)			
Station/Depth (db)	Corrected CTD Salinity (psu)	*(Bottle) Salinity (psu)	Salinity Difference (psu)
7/14.7	36.181	(7P) 36.181	0.000
8/15.5	35.813	(8P) 35.818	-0.005
11/4.2	35.997	(10P) 35.998	-0.001
12/5.6	36.030	(11P) 36.031	-0.001
13/8.5	36.008	(12P) 36.011	-0.003
14/10	35.995	(13P) 35.996	-0.001
15/7.9	35.888	(14P) 35.883	0.005
16/10.3	35.958	(15P) 35.965	-0.007
17/273.2	35.117	(16P) 35.128	-0.011
21/15.3	35.891	(20P) 35.904	-0.013
23/58.4	36.196	(22P) 36.204	-0.008
25/8.5	35.923	(24P) 35.927	-0.004
27/18.1	35.951	(26P) 35.941	0.010
32/11.2	35.832	(30P) 35.831	0.001
33/6.9	35.502	(31P) 35.510	-0.008
36/13.1	36.159	(34P) 36.154	0.005
39/23.0	36.035	(37P) 36.055	-0.020
40/11.5	36.022	(38P) 36.015	0.007
42/18.9	36.144	(40P) 36.146	-0.002
44/2.9	30.691	(42P) 30.679	0.012
45/27.8	32.709	(43P) 32.721	-0.012
48/4.9	31.982	(46P) 31.968	0.014
50/1069.1	34.955	(48P) 34.956	-0.001
60/1104.7	34.951	(58P) 34.953	-0.002
63/3.4	32.376	(61P) 32.382	-0.006
64/8.0	31.771	(62P) 31.781	-0.010
65/7.8	31.761	(63P) 31.766	-0.005
66/8.0	31.549	(64P) 31.556	-0.007
68/2.5	31.056	(66P) 31.057	-0.001
69/2.2	30.746	(67P) 30.743	0.003
72/14.6	36.144	(70P) 36.149	-0.005
73/14.5	36.095	(71P) 36.094	0.001
76/2.3	31.555	(74P) 31.557	-0.002
78/3.0	34.749	(76P) 34.744	0.005
82/15.1	36.055	(80P) 36.052	0.003
83/14.8	36.080	(81P) 36.072	0.008
85/499.9	35.069	(83P) 35.072	-0.003
86/25.5	36.099	(84P) 36.102	-0.003
87/499.4	35.009	(85P) 35.009	0.000
88/498.4	35.009	(86P) 35.009	0.000
89/349.2	35.057	(87P) 35.054	0.003

* Bottle salinity samples run at Texas A & M University on September 23, 1992.

$\Delta\bar{S}$ = - 0.002
Std. Dev. = 0.007

Table 3.1-2b CTD salinity calibration data (for deep unit) for Cruise III (CH9234).

III CRUISE CH9234 (19 August - 5 September 1992)			
Station/Depth (db)	Raw CTD Salinity (psu)	*(Bottle) Salinity (psu)	Salinity Difference (psu)
19/8.2	35.902	(18P) 35.911	-0.009
28/8.3	36.183	(27P) 36.193	-0.010
29/10.0	36.186	(28P) 36.183	0.003
38/7.0	36.005	(36P) 36.008	-0.003
54/6.7	36.069	(52P) 36.039	0.030

* Bottle salinity samples run at Texas A & M University on September 23, 1992.

$\Delta\bar{s}$ = -0.002
Std. Dev. = 0.016

Table 3.1-3a CTD salinity calibration data (for deep unit) for Cruise IV (CH9313).

IV CRUISE CH9313 (9-13 November 1992)			
Station/ Depth (db)	Raw CTD Salinity (psu)	*(Bottle) Salinity (psu)	Salinity Difference (psu)
2/5.5	29.986	(2P) 30.012	-0.026
3/20.7	31.905	(3P) 31.915	-0.010
4/27.4	32.165	(4P) 32.176	-0.011
5/25.7	32.327	(5P) 32.336	-0.009
6/26.4	32.573	(6P) 32.584	-0.011
7/18.5	32.811	(7P) 32.822	-0.011
8/23.5	33.476	(8P) 33.479	-0.003
9/53.6	34.024	(9P) 34.032	-0.008
10/70.9	33.978	(10P) 33.987	-0.009
11/1123.0	34.947	(11P) 34.962	-0.015
13/9.4	32.384	(12P) 32.401	-0.017
14/8.2	32.597	(13P) 32.605	-0.008
19/45.6	36.141	(18P) 36.143	-0.002
20/12.3	34.299	(19P) 34.281	0.018
21/4.3	36.268	(20P) 36.266	0.002
23/8.1	31.101	(22P) 31.105	-0.004
25/8.0	31.404	(24P) 31.410	-0.006
27/7.8	32.344	(26P) 32.352	-0.008
29/6.0	36.320	(28P) 36.314	0.006
30/2.0	33.972	(27P) 33.976	-0.004
32/2.0	35.284	(31P) 35.291	-0.007
33/0.0	35.652	(32P) 35.642	0.010
34/2.0	36.266	(33P) 36.267	-0.001
35/2.0	36.294	(34P) 36.295	-0.001
36/2.0	36.264	(35P) 36.266	-0.002
37/8.1	36.225	(36P) 36.225	0.000
39/8.0	36.299	(37P) 36.299	0.000
40/8.0	36.270	(38P) 36.264	0.006
41/6.4	36.325	(39P) 36.321	0.004
42/6.8	36.288	(40P) 36.285	0.003
43/7.1	36.255	(41P) 36.253	0.002
44/7.5	36.254	(42P) 36.255	-0.001
45/8.0	36.262	(43P) 36.263	-0.001
46/8.3	36.269	(44P) 36.272	-0.003
47/8.1	36.264	(45P) 36.265	-0.001
48/7.8	34.939	(46P) 34.941	-0.002
49/8.2	33.082	(47P) 33.070	0.012
50/8.4	33.119	(48P) 33.118	0.001
52/7.8	34.403	(50P) 34.400	0.003
53/8.5	36.258	(51P) 36.259	-0.001
54/6.9	36.272	(52P) 36.272	0.000
55/6.8	36.243	(53P) 36.243	0.000

Table 3.1-3b CTD salinity calibration data (for deep unit) for Cruise IV (CH9313).

IV CRUISE CH9313 (3-13 November 1992)			
Station/ Depth (db)	Raw CTD Salinity (psu)	*(Bottle) Salinity (psu)	Salinity Difference (psu)
56/8.2	36.307	(54P) 36.304	0.003
57/7.8	36.305	(55P) 36.305	0.000
58/7.9	36.264	(56P) 36.262	0.002
59/8.0	36.342	(57P) 36.340	0.002
60/8.0	36.240	(58P) 36.242	-0.002
62/8.1	31.485	(60P) 31.492	-0.007
63/8.1	31.243	(61P) 31.251	-0.008
64/0.3	30.856	(62P) 30.866	-0.010
65/1.0	31.065	(63P) 31.073	-0.008
68/0.6	32.145	(66P) 32.152	-0.007
69/0.3	35.851	(67P) 35.853	-0.002
70/7.8	36.279	(68P) 36.280	-0.001
71/8.9	36.232	(69P) 36.232	0.000
72/7.8	36.252	(70P) 36.253	-0.001
73/8.4	36.227	(71P) 36.227	0.000
74/8.2	36.256	(72P) 36.256	0.000
75/6.4	36.262	(73P) 36.262	0.000
76/7.2	36.256	(74P) 36.255	0.001

* Bottle salinity samples run at Texas A & M University on November 30, 1992.

$\Delta\bar{s}$ = - 0.003
Std. Dev. = 0.007

Table 3.1-4 CTD salinity calibration data for Cruise V (SE9301).

V CRUISE SE9301 (2-18 February 1993)			
Station/ Depth (db)	Raw CTD Salinity (psu)	*(Bottle) Salinity (psu)	Salinity Difference (psu)
1/8.0	36.299	(1P) 36.324	-0.025
2/8.0	36.201	(2P) 36.194	0.007
3/8.0	36.141	(3P) 36.132	0.009
4/8.0	36.233	(4P) 36.241	-0.008
12/8.0	33.995	(11P) 33.991	0.004
14/8.0	36.382	(13P) 36.369	0.013
15/8.0	36.371	(14P) 36.359	0.012
16/8.0	36.377	(15P) 36.365	0.012

* Bottle salinity samples run at Texas A&M University on March 3, 1993.

$\Delta\bar{s}$ = 0.003
Std. Dev. = 0.013

Table 3.1-5 CTD salinity calibration data for Cruise VI (SE9303).

VI	CRUISE SE9303 (1-12 May 1993)		
Station/ Depth (db)	Raw CTD Salinity (psu)	*(Bottle) Salinity (psu)	Salinity Difference (psu)
2/8.0	33.096	(17P) 33.107	-0.011
3/8.0	32.776	(18P) 32.753	0.023
8/2.0	31.968	(23P) 31.978	-0.010
10/8.0	32.585	(25P) 32.590	-0.005
16/8.0	30.341	(31P) 30.347	-0.006
18/8.0	32.336	(33P) 32.351	-0.015
19/8.0	32.491	(34P) 32.490	0.001
22/8.0	31.610	(37P) 31.615	-0.005
29/8.0	31.664	(44P) 31.648	0.016
33/8.0	36.383	(48P) 36.384	-0.001
39/8.0	36.283	(54P) 36.287	-0.004
40/8.0	36.190	(55P) 36.208	-0.018
41/8.0	36.398	(56P) 36.394	0.004
42/8.0	36.400	(57P) 36.399	0.001
43/8.0	35.741	(58P) 35.778	-0.037
44/8.0	36.232	(59P) 36.239	-0.007
45/2.0	36.023	(60P) 36.027	-0.004
46/8.0	35.959	(61P) 35.946	0.013
48/8.0	36.160	(63P) 36.157	0.003
52/8.0	32.626	(67P) 32.609	0.017
56/8.0	36.332	(71P) 36.342	-0.010
57/8.0	36.393	(72P) 36.394	-0.001
60/8.0	36.397	(75P) 36.392	0.005
62/8.0	36.365	(77P) 36.359	0.006
63/8.0	36.379	(78P) 36.375	0.004

* Bottle salinity samples run at Texas A&M University on July 6, 1993.

Less Station 43

$\Delta\bar{s}$ = 0.000
Std. Dev. = 0.010

Table 3.1-6 CTD salinity calibration data for Cruise VII (SE9309).

VII	CRUISE SE9309 (18-29 August 1993)		
Station/ Depth (db)	Raw CTD Salinity (psu)	*(Bottle) Salinity (psu)	Salinity Difference (psu)
2/8.0	35.925	(2P) 35.915	0.010
3/8.0	35.842	(3P) 35.835	0.007
4/8.0	36.047	(4P) 36.032	0.015
5/8.0	36.080	(5P) 36.063	0.017
6/8.0	36.036	(6P) 36.023	0.013
7/8.0	35.749	(7P) 35.738	0.011
8/8.0	35.755	(8P) 35.743	0.012
9/8.0	36.104	(9P) 36.088	0.016
10/8.0	36.099	(10P) 36.083	0.016
11/8.0	36.310	(11P) 36.297	0.013
12/8.0	36.286	(12P) 36.269	0.017
13/8.0	36.179	(13P) 36.079	0.100
14/8.0	36.096	(14P) 36.050	0.046
15/8.0	35.856	(15P) 35.839	0.017
16/8.0	35.710	(16P) 35.719	-0.009
17/8.0	35.883	(17P) 35.871	0.012
18/8.0	36.085	(18P) 36.067	0.018
19/8.0	36.029	(19P) 36.012	0.017
22/8.0	30.966	(22P) 30.925	0.041
23/8.0	31.613	(23P) 31.602	0.011
24/8.0	32.887	(24P) 32.880	0.007
25/8.0	34.334	(25P) 34.291	0.043
26/8.0	35.253	(26P) 35.264	-0.011
27/8.0	35.989	(27P) 35.965	0.024
28/8.0	36.140	(28P) 36.121	0.019
29/8.0	36.231	(29P) 36.210	0.021
30/8.0	35.399	(30P) 35.385	0.014
31/8.0	29.833	(31P) 29.814	0.019
32/8.0	31.795	(32P) 31.782	0.013
33/8.0	31.677	(33P) 31.666	0.011
34/8.0	31.383	(34P) 31.370	0.013
35/8.0	31.710	(35P) 31.693	0.017
36/8.0	31.624	(36P) 31.601	0.023
37/8.0	31.568	(37P) 31.553	0.015
38/8.0	31.830	(38P) 31.817	0.013
39/8.0	32.195	(39P) 32.185	0.010
41/8.0	36.056	(41P) 36.038	0.018
42/8.0	36.024	(42P) 36.027	-0.003
43/8.0	36.061	(43P) 36.040	0.021
44/8.0	36.180	(44P) 36.160	0.020
45/8.0	36.170	(45P) 36.132	0.038
46/8.0	36.287	(46P) 36.267	0.020
47/8.0	36.116	(47P) 36.136	-0.020
48/8.0	36.115	(48P) 36.096	0.019
49/8.0	36.071	(49P) 36.051	0.020
52/8.0	31.332	(52P) 31.337	-0.005
54/8.0	31.326	(54P) 31.327	-0.001
55/8.0	31.715	(55P) 31.724	-0.009
56/8.0	31.732	(56P) 31.726	0.006

* Bottle salinity samples run at Texas A&M University on September 13, 1993.

Less Stations 13, 14, 19 and 22

$\Delta\bar{s}$ = 0.012
Std. Dev. = 0.011

Table 3.1-7 CTD salinity calibration data for Cruise VIII (SE9316).

VIII CRUISE SE9316 (28 October - 9 November 1993)			
Station/ Depth (db)	Raw CTD Salinity (psu)	*(Bottle) Salinity (psu)	Salinity Difference (psu)
1/8	34.963	(P1) 34.955	-0.008
2/8	35.327	(P2) 35.317	-0.010
3/8	35.702	(P3) 35.687	-0.015
4/8	35.710	(P4) 35.710	0.000
5/8	35.753	(P5) 35.736	-0.017
7/8	35.774	(P7) 35.758	-0.016
8/8	35.980	(P8) 35.976	-0.004
9/8	36.077	(P9) 36.058	-0.019
10/8	36.143	(P10) 36.124	-0.019
11/8	36.185	(P11) 36.166	-0.019
12/8	36.027	(P12) 35.980	-0.047
16/8	31.878	(P16) 31.865	-0.013
17/8	32.033	(P17) 32.025	-0.008
18/8	32.199	(P18) 32.189	-0.010
19/8	32.525	(P19) 32.502	-0.023
20/8	33.573	(P20) 33.568	-0.005
21/8	34.063	(P21) 34.055	-0.008
22/8	34.138	(P22) 34.125	-0.013
24/8	33.966	(P24) 33.752	-0.214
25/8	33.787	(P25) 33.789	+0.002
26/8	34.100	(P26) 34.099	-0.001
27/8	35.743	(P27) 35.729	-0.014
28/8	35.884	(P28) 35.866	-0.018
34/8	33.241	(P34) 33.470	+0.229
37/8	32.034	(P37) 32.029	-0.005
38/8	32.158	(P38) 32.160	+0.002
39/8	32.158	(P39) 32.145	-0.013
40/8	32.955	(P40) 32.948	-0.007
42/8	35.979	(P42) 35.966	-0.013
43/8	36.001	(P43) 35.986	-0.015
44/8	35.954	(P44) 35.938	-0.016

* Bottle salinity samples run at Texas A&M University on December 13, 1993.

Less Stations 24 and 34

$\Delta\bar{s}$ = -0.012
Std. Dev. = 0.009

Table 3.1-8 CTD salinity calibration data for Cruise IX (SE9401).

IX	CRUISE SE9401 (7 - 22 February 1994)		
Station/ Depth (db)	Raw CTD Salinity (psu)	*(Bottle) Salinity (psu)	Salinity Difference (psu)
2/8.0	33.866	(2P) 33.873	-0.007
3/8.0	36.401	(3P) 36.410	-0.009
4/8.0	36.370	(4P) 36.391	-0.021

* Bottle salinity samples run at Texas A&M University on April 8, 1994.

$\Delta\bar{S}$ = -0.012
Std. Dev. = 0.008

Table 3.1-9 Summary of quarterly cruise Neil Brown CTD-Bottle Salinity comparisons for salinities run at Texas A&M University during the NC Field Program.

Cruise No.	Cruise ID	Dates	$\Delta\bar{S}$	Std. Dev.
II (Shallow)	CH9222	28 April - 10 May 1992	-0.018	0.029
III (Shallow)	CH9234	19 Aug. - 5 Sept. 1992	-0.002	0.007
III (Deep)	CH9234	19 Aug. - 5 Sept. 1992	-0.002	0.016
IV (Deep)	CH9313	3-13 November 1992	-0.003	0.007
V	SE9301	2-18 February 1993	0.003	0.013
VI	SE9303	1-12 May 1993	0.000	0.010
VII	SE9309	18-29 August 1993	0.012	0.011
VIII	SE9316	28 Oct.- 9 Nov. 1993	-0.012	0.009
IX	SE9401	7-22 February 1994	-0.012	0.008

Table 3.2-1 Dates for InterOcean S4 current meter calibrations during the NC Field Program.

Instrument Serial No.	Initial Calibration	Second Calibration	Third Calibration	Final Calibration
07801744	12/04/91			05/19/94
07801745	12/05/91	03/22/93		05/19/94
08111746	12/05/91	04/08/93		08/23/94
08111747	12/12/91	11/01/92		--------
08111748	12/09/91	10/31/92		05/19/94
08111749	12/09/91			--------
08111750	12/09/91	01/11/93		07/15/94
08111751	12/10/91			--------
08161752	12/10/91			--------
08161753	12/10/91			08/23/94
08161754	12/10/91	01/11/93		--------
08161755	12/09/91			07/15/94
08161756	12/10/91	10/31/92	01/23/93	--------
08161757	12/09/91	10/22/93		08/19/94
08161758	12/11/91			08/19/94
08161759	12/09/91			--------

Note: All calibrations were done at InterOcean.

Table 3.2-2 Dates for Aanderaa RCM-5/8 and RCM-8 current meter calibrations during the NC Field Program.

Instrument Serial Number	Initial Calibration*	Final Calibration**
7528	01/15/92	04/04/94
7582	01/15/92	04/04/94
10527	06/12/91	04/04/94
10533	06/12/91	04/04/94
10535	09/12/91	04/04/94

* = Done at Aanderaa
** = Done at NW Regional Calibration Center

Table 3.2-3a **Dates for General Oceanics cassette drive Mk1 and Mk2 current meter calibrations during the NC Field Program.**

Instrument Serial Number	Initial Calibration*	Final Calibration*
126	01/24/92	03/17/94
127	01/24/92	03/14/94
153	12/18/91	03/17/94
195	12/17/91	03/17/94
201	01/24/92	03/17/94
256	12/19/91	-------
280	12/26/91	04/01/94
281	12/26/91	04/06/94
283	12/26/91	-------
291	12/26/91	08/03/94
322	12/19/91	-------
328	12/19/91	04/01/94
331	12/19/91	05/11/94
332	12/19/91	04/11/94
335	12/20/91	03/28/94
377	01/14/92	-------
378	12/19/91	05/02/94
379	12/20/91	04/06/94
380	12/20/91	04/06/94

* = Done at General Oceanics

Table 3.2-3b Dates for General Oceanics 64k RAM cartridge Mk2 current meter calibrations during the NC Field Program.

Instrument Serial Number	Initial Calibration*	Final Calibration*
438	01/28/92	03/23/94
439	01/30/92	-------
440	01/30/92	-------
441	01/30/92	-------
442	08/30/92	03/24/94
443	01/30/92	03/23/94
444	01/30/92	04/12/94
445	02/04/92	04/13/94
446	01/30/92	04/13/94
447	01/30/92	04/13/94
448	02/03/92	04/13/94
449	01/30/92	04/14/94
450	02/06/92	04/15/94
451	02/03/92	04/15/94
452	02/04/92	04/18/94
453	02/04/92	04/18/94
454	02/04/92	-------
455	02/04/92	-------
457	03/24/92	04/20/94
458	03/24/92	-------
459	03/24/92	03/24/94
460	03/20/92	-------

* = Done at General Oceanics.

to stick. The tilt sensor on this unit was replaced and the current data were discarded. The pressure sensor on instrument 331 was found to be slightly out of calibration but was not replaced and no correction was applied to the data. Finally, two of the InterOcean S4s (serial numbers 08111746 and 08161753) produced large zero current offsets (>2.00 cm/s) in their V_N and V_E components during near-zero current tub tests (at SAIC) and post-deployment calibration checks (at InterOcean). These results are presented in Table 3.2-4. Dr. Peter Hamilton reviewed the last field data for these two instruments and noted that there appears to be no indication that these large offsets affected the data for the last three-month deployments at B2(5m) and A3(5m), respectively. This suggests the possibility that the electrode surfaces of these instruments may have been damaged during the final instrument recoveries. Two electrodes on serial number 08111746 and all four electrodes on serial number 08161753 were replaced before final recalibration.

Table 3.2-4 Post-deployment calibration check (done at InterOcean) for operational S4s at the conclusion of the NC Field Program.

Instrument Serial Number	V_N (cm/s)	V_E (cm/s)	Temp (°C)	Cond (mS/cm)
07801744	-1.8	-2.8	-0.01	-11.00
07801745	-1.4	1.4	-0.03	2.18
08111746	19.0	-3.0	0.00	-0.32
08111748	-0.8	-1.6	-0.16	-0.01
08111750	1.2	0.0	-0.01	-0.01
08161753	-7.0	13.0	-	-
08161755	-2.1	0.2	0.03	-1.42
08161757	-	-	-	-
08161758	-	-	-	-

Note: Near-zero current tub tests were conducted prior to returning each of the above instruments to InterOcean for servicing at the end of the field program. All units except for 08111746 and 08161753 had mean V_Ns and V_Es less than 2.00 cm/s in the tub tests.

IV. INSTRUMENT PERFORMANCE AND DATA RETURN

4.1 Introduction

Generally, the instrument performances for the data acquisition systems used in this program were quite good. The one exception was the early performance of the S4 current meters. Here, a surprising number of interrelated and unrelated problems were encountered requiring a substantial and cooperative effort on the part of the manufacturer in order to be resolved. Details are presented in Section 4.4.2. CTD and drifter performances are discussed in Sections 4.2 and 4.3, respectively. All available and useful meteorological and water level data are identified in time in Section 4.5 and the number of available satellite images are identified in Section 4.6.

4.2 CTD Data

All of the CTD stations occupied have produced useful data though the total number of stations varied from cruise to cruise, primarily due to weather conditions. No CTD data were collected in February 1992, only 16 stations were sampled in February 1993 and only 4 stations were occupied in February 1994. This was due primarily to the need to rotate the current meter moorings in what good weather was available. Table 4.2-1 summarizes the number of CTD stations sampled during each cruise.

4.3 Drifter Data

4.3.1 Aanderaa ARGOS Drifters

Thirty-six Aanderaa (Draper) ARGOS drifters (LCDs) with 2.5 m long holey sock drogues and one meter tethers were deployed at six locations on the shelf. These were considered expendable and no attempt was made to recover them, though three units were returned following recovery in England (1), and France (2). A fourth unit was reported recovered in the Canary Islands but was never returned. One unit was destroyed in the ship's screw during deployment and two others produced no data after deployment. One unit was confirmed to have been picked up after about six days and three others ceased operation while still in the study area 12 to 20 days into their 50, 40 or 30 day transmission schedules. It is unknown whether these latter three drifters were picked up, were run over by other offshore traffic, or simply stopped working. No effort was made to evaluate the drifters' performances once they left the study area. The useful data return in days is summarized in Table 4.3-1.

As noted above, four drifters were recovered many months after they left the study area. The recoveries in England and France were after 14 to 17 months. The recovery in the Canary Islands was after 23 months. The three returned drifters had been recovered without their holey sock drogues attached and with most paint worn away (See Figure 4.3-1).

A small number of drifters (<5) turned on again many months after they had turned off. This was not supposed to happen and resulted in the receipt of some interesting but unnecessary data. The manufacturer interacted with ARGOS to pick up some but not all of the additional ARGOS costs. One example of this on/off/on phenomena is presented in Figure 4.3-2 for the

Table 4.2-1 CTD data acquisition summary for the NC Field Program.

Cruise ID	Dates	Number of CTD Stations	Remarks
SE9208	February 15-28, 1992	0	Mooring deployment only because of weather.
CH9222	April 28-May 10, 1992	52	No CTDs on Line E; Lines A and B shortened due to weather.
CH9234	August 19-September 5, 1992	91	Includes Special Event Survey.
CH9313	November 3-13, 1992	76	Includes Special Event Survey. No CTDs on Line E due to weather.
SE9301	February 2-18, 1993	16	Primarily mooring rotations because of weather.
SE9303	May 1-12, 1993	65	
SE9309	August 18-29, 1993	65	Cruise terminated early to avoid Hurricane Emily. Line A shortened.
SE9316	October 28-November 10, 1993	44	Lines E, F and Line D South of Diamond Shoals not occupied due to weather.
SE9401	February 7-22, 1994	4	Primarily mooring recoveries because of weather.
SD9301	June 10-17, 1993	86	Nearshore Survey 1.
SD9302	September 13-22, 1993	88	Nearshore Survey 2.

Table 4.3-1 **Summary of the number of days of data either south of 37°N or west of 73°W (whichever limit was reached first) from Aanderaa (Draper) ARGOS drogued drifters (LCDs) during the NC Field Program.**

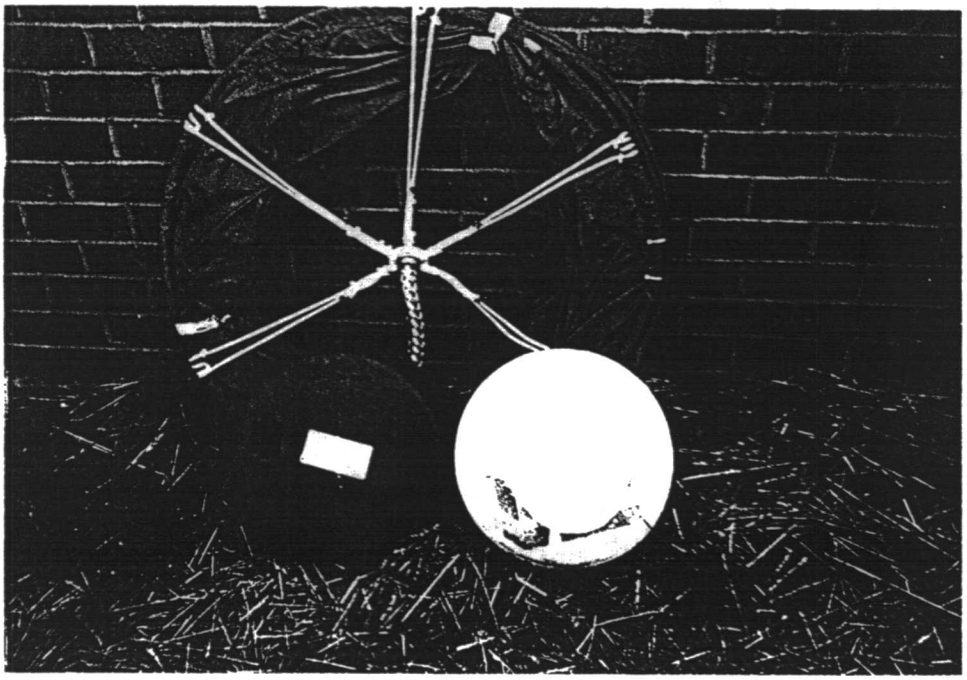
Deployment Location	GMT Date Deployed	Drifter ID	Days South of 37°N	Days West of 73°W
1	09/02/92	3544	21*	21*
	11/04/92	3586	20*	20*
	02/14/93	3592	--	19
	05/06/93	3550	--	11
	08/27/93	3559	--	43
	10/31/93	3776	7	--
2	05/01/92	3535	11	--
	09/02/92	3543	--	15
	11/05/92	3587	7	--
	02/14/93	3594	--	19
	05/06/93	3552	--	17
	08/27/93	3773	--	20
	10/31/93	3777	--	29
3	05/01/92	3536	--	15
4	05/09/92	3539	--	31
	08/31/92	3542	--	10
	11/07/92	3589	--	9
	02/16/93	3595	--	11
	05/08/93	3555	--	14
	08/23/93	3558	--	41
	10/30/93	3775	ND	ND
5	05/06/92	3538	--	21
	08/29/92	3541	--	15
	11/06/92	3588	--	6
	02/11/93	3591	--	6
	05/09/93	3556	--	9
	08/23/93	3557	6**	6**
	11/05/93	3778	--	29
6	05/05/92	3537	19	--
	08/26/92	3540	19	--
	11/08/92	3590	9	--
	02/05/93	3551	12*	12*
	05/12/93	3593	--	4
	08/20/93	3553	ND***	ND***
	08/20/93	3554	ND	ND
	10/29/93	3774	--	30

* Stopped early; unit never left shelf.

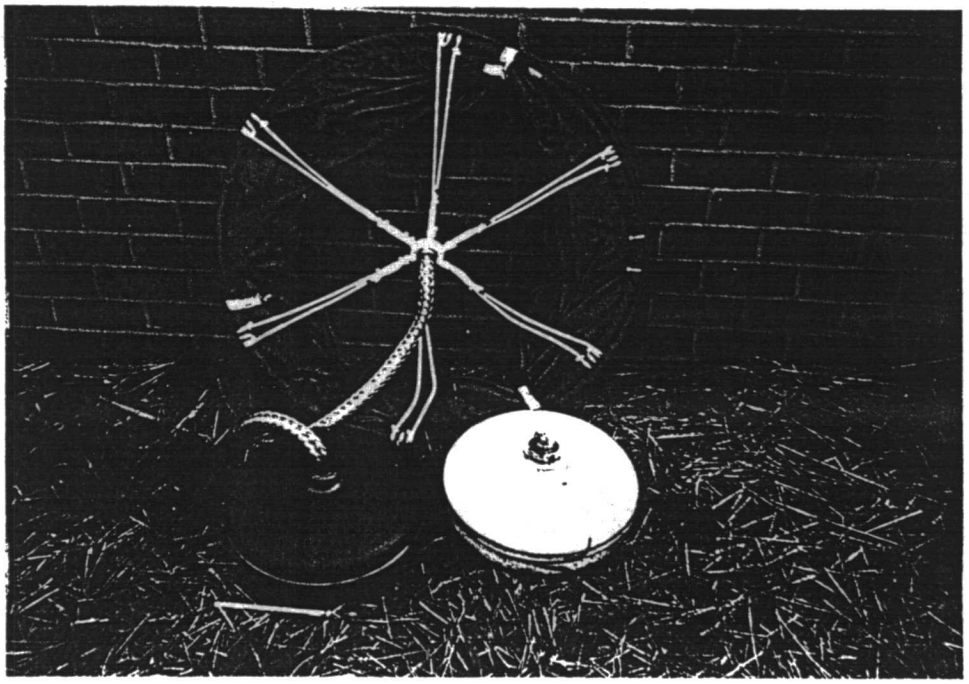
** Stopped early; unit picked up.

*** Unit destroyed as holey sock caught in ship's screw.

ND No Data.



(a)



(b)

Figure 4.3-1 Top (a) and bottom (b) pictures of a recovered Aanderaa drifter compared to an undeployed unit.

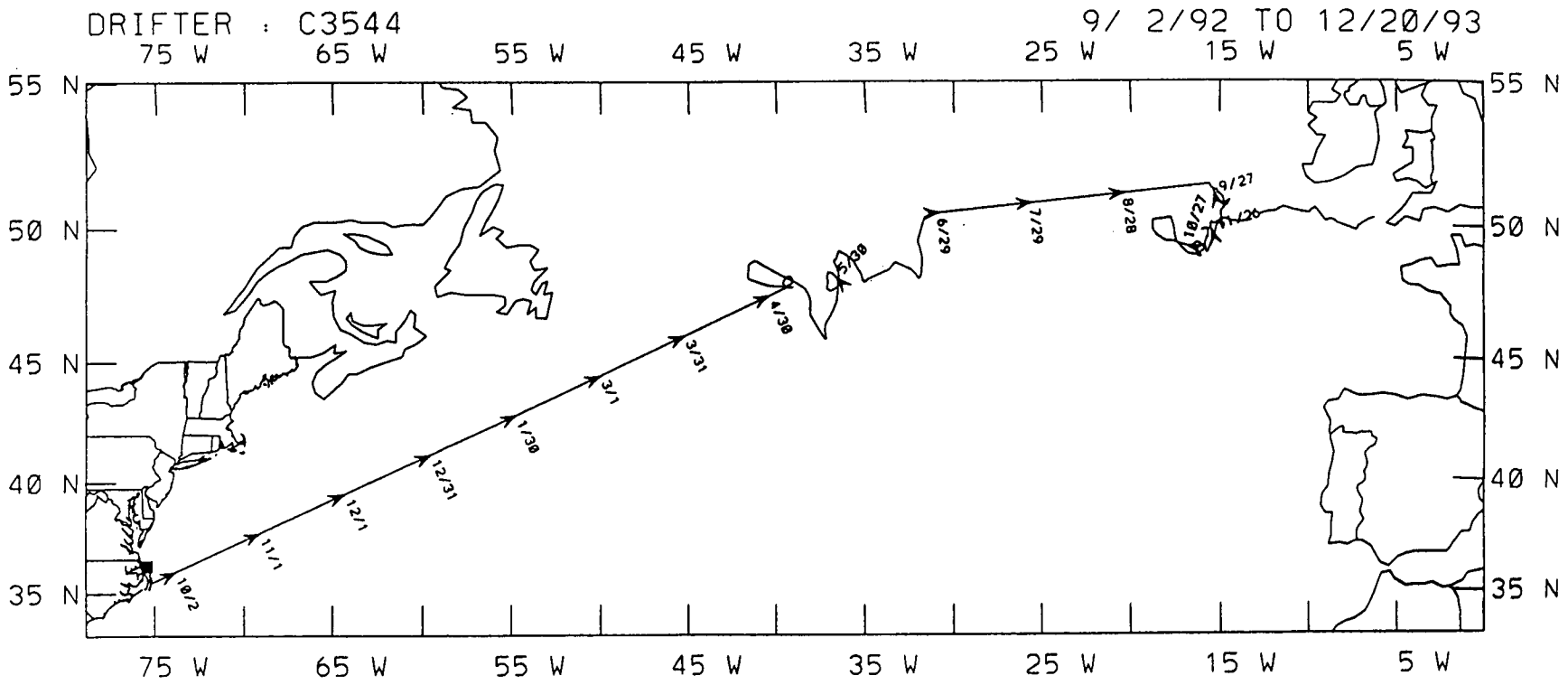


Figure 4.3-2 Drifter track for Aanderaa Drifter 3544 (straight line segments are from when the drifter was not transmitting).

drifter that was recovered off the south coast of England near Cape Cornwall.

4.3.2 Brightwaters Davis-Type GPS Drifters

The Brightwaters Davis-type GPS drifters performed well and produced clean records. Two units, however, had defective GPS mastheads (serial numbers 06 and 07) which failed early in the study. A third unit had reduced telemetry range due to a damaged VHF antenna (serial number 08). This VHF antenna damage occurred during a beaching in heavy surf. In addition, one of the drifter night lights flooded early during the initial Nearshore Study and subsequent deployments of all drifters were made without the light. No instrument electronics compartments flooded and no drifters were lost. Several units took quite a beating, however, coming ashore in heavy surf. This resulted in breakage of some of the fiberglass sail support rods and tearing of some of the sails. These were replaced and the instruments were redeployed. A summary of the data return for these deployments is presented in Table 4.3-2. Drifter serial number 10 was used as a shore station and so is not listed in the table. Drifter serial number 12(13) was a composite assembled from two Brightwaters drifters belonging to Woods Hole.

VHF tracking from shore stations with directional antenna heights on the order of 40-50 feet provided a maximum tracking range of approximately 10 nautical miles. Offshore, with a somewhat lower (20-25 feet) omni-directional antenna, on a 31 foot vessel, a maximum tracking range of three to four nautical miles was obtained. VHF contact with the drifters was supplemented by loosely attaching an 11" diameter Metocean ARGOS sphere (by an eighteen inch length of line) to permit tracking when out of VHF range. No GPS data were lost, however, as the GPS fixes were recorded internally in memory as well as being broadcast over the VHF link. Typical deployments were for less than 48 hours with GPS sampling intervals of 15 minutes. One drifter was deployed for nearly four days.

Under light wind and calm sea conditions the Brightwaters Davis-type GPS drifter tended to maintain a fairly constant separation from the Technocean Davis-type ARGOS drifter. Under higher wind and sea conditions the Brightwaters drifter (which was larger and had greater surface exposure (See Figure 4.3-3)) tended to lead the Technocean drifter and increased separation over time. Two of the Brightwaters drifters which had been deployed 0.5 nautical miles apart at 1.5 and 2.0 nautical miles from shore were found beached together.

4.3.3 Technocean Davis-Type ARGOS Drifters

Five of these drifters were provided by MMS and supplemented the Nearshore Study deployments of Brightwaters drifters along the same onshore-offshore section. All five (see Table 4.3-3) produced useful data. One drifter (14702) came ashore in heavy surf causing breakage of a couple of its sail support rods (see Figure 4.3-4). Otherwise, the drifters performed well and were easy to deploy and recover. The use of an ARGOS Direction Finder, also provided by MMS, was helpful in tracking down these drifters while offshore. Only the damaged 14702 drifter was recovered at the conclusion of the Nearshore Study. No attempt was made to pursue and recover the others though they were frequently tracked down and sighted during offshore operations. These drifters had less windage than the Brightwaters drifters

Table 4.3-2 Summary of Brightwaters Davis-Type GPS drifter data collected during the Nearshore Study.

Drifter Serial Number	Attached Metocean ARGOS ID	Deployment Location	Date/Time In (EDT)	Date/Time Out (EDT)	Elapsed Time (hrs)	Comments
06	9812	-	06/10/93 0920	06/10/93 1435	5.00	Bad GPS fixes.
07	9813	-	06/10/93 1230	06/11/93 1118	22.75	
	9813	7	06/11/93 1155	06/13/93 1034	46.50	GPS failure near C. Hat.
	9813	7	06/14/93 1402	06/14/93 1632	2.50	Not transmitting.
08	9812	8	06/11/93 1204	06/13/93 1505	51.00	
	9812	8	06/14/93 1415	06/14/93 1655	2.50	Beached.
	9812	7	06/15/93 1345	06/17/93 1017	44.50	
	9812	7	09/14/93 1427	09/16/93 1117	44.75	
	9812	7	09/16/93 1257	09/20/93 1154	94.75	
	9812	9	09/20/93 1600	09/21/93 1340	21.50	
09	9818	9	06/11/93 1225	06/13/93 1500	50.75	
	9818	9	06/14/93 1432	06/14/93 1707	2.25	Recovered near surf zone.
	9818	8	06/15/93 1358	06/17/93 1032	44.50	
	9813	8	09/14/93 1525	09/14/93 1730	2.00	VHF range problem.
	9813	8	09/16/93 1317	09/16/93 1525	1.75	VHF range problem.
	9813	10	09/17/93 1111	09/20/93 1320	74.00	
	9813	10	09/20/93 1606	09/21/93 1415	22.00	
11	9815	10	06/14/93 1448	06/15/93 0935	18.75	Beached.
	9815	9	06/15/93 1412	06/17/93 1120	45.25	
	9815	9	09/14/93 1602	09/16/93 1045	42.50	
	9815	9	09/16/93 1328	09/17/93 2200	32.50	Beached with 12(13).
12(13)	9818	10	09/16/93 1344	09/17/93 2200	32.25	Beached with 11.

Figure 4.3-3 Photograph showing a Brightwaters drifter (in the foreground) and a Technocean drifter (in the background).

Figure 4.3-4 Beached Technocean Davis-type ARGOS drifter.

Table 4.3-3 Summary of Technocean Davis-Type ARGOS drifter data collected during the Nearshore Study.

Drifter ID	Deploy. Loc	Date/Time Out (ZDT)	Date/Time In (ZDT)	Comments
9814	11	09/20/93 1611	----------	No recovery attempted.
14701	9 12 10	06/11/93 1232 06/14/93 1502 09/16/93 1344	06/13/93 1355 06/17/93 1334 ----------	No recovery attempted (in GS on 09/21/93).
14702	13 8	06/14/93 1515 09/20/93 1551	06/17/93 1327 09/22/93 2100	Beached.
14703	14	06/10/93 1256	----------	No recovery attempted (in GS on 06/18/93).
14704	10	06/15/93 1420	06/17/93 1200	

GS = Gulf Stream

and therefore tended to trail the Brightwaters Drifters during periods of higher winds and seas.

4.4 Current Meter Data

The instrument performance and data return for the three different types of current meters used in this program are presented in this section. The results are also broken down by mooring type (surface or subsurface) and are summarized in Table 4.4-1. The overall useful current meter data return for instrumented levels was 87.1% (756,223 of 868,703 possible hourly records) for the entire program. The data return for all 'recovered' instruments was 91.3%. A total of 304 instrument deployments were made on 23 moorings at 51 levels. The 87.1% data return includes the influence of the loss of thirteen of sixteen lost instruments, seven during the last three months of the study (See Table 4.4-2). Three of the lost instruments were backups and so are not counted in the instrument level data return percentage. Eight instruments were lost from six different moorings (three from surface moorings and five from subsurface moorings) at the B3 site and four were lost from three different moorings (two from surface moorings and two from a subsurface mooring) at the C3 site. These two sites accounted for 75% of all instrument losses. None of the lost instruments have been recovered. The causes of these loses are discussed in Section 5.2. The data return was also affected by four instrument floodings, a number of other instrument malfunctions, and two mooring flotation failures which caused the loss of 'useful' data from parts of four current meter records (See Figure 4.4-1).

Specifically excluded from all data return calculations are those locations/levels which were purposely not instrumented during parts of the two year field program. For example, the lower current meter level on the C1 surface mooring (an S4) was not instrumented during the last six months (August 1993 through February 1994) in order to provide a spare current meter for rotation into the surface moorings. In addition, the C3 surface mooring (with an S4 at 5 meters depth) was not deployed during the last six months of the program in order to provide a surface mooring for the B3 site. Finally, the A5 subsurface mooring (with six current meter levels) was recovered early and not deployed for the last three months (November 1993 through February 1994) in anticipation of unfavorable weather conditions for a February 1994 recovery. This mooring was located under the Gulf Stream in the extreme NE corner of the study area on the 3000m isobath.

4.4.1 Aanderaa RCM-5/8s and RCM-8s

As noted in Table 4.4-1 the overall useful data return for the Aanderaa current meters was 93.9%. Five of these instruments were deployed at the 1900m and 2900m levels on the 2000m and 3000m Gulf Stream moorings. Aanderaa software communication problems (data downloading) were responsible for a small amount of data loss following the initial recovery of the instruments. This problem was detected but not understood during the initial downloading process at sea. Each time the Data Storage Unit (DSU) was downloaded, the file size stored on disk was a different length. Subsequently, three or four copies of each file were made before the DSUs were erased in preparation for the next deployment. Later, it was discovered that extra carriage returns were present in the tabular data. This required extensive post cruise editing in order to restore the data to its proper format. Some data could not be recovered, but because of the day/date time stamps in the data and the fact that each file downloading was intermittently scrambled and then not scrambled at different points in the record, fairly complete records were reassembled. A change to a

Table 4.4-1 Data return summary for current meter type and location during the NC Field Program.

Instrument Type (No. of Instrument Deployments)	Locations (No. of Levels)	Percent Data Return for Inst. Levels	Comments
Aanderaa RCM 5/8 and RCM 8 (18)*	A4(1),A5(2),B4(1), C4(1)	93.9% 93.9%***	No instruments lost or flooded. Battery and downloading problems accounted for lost data.
General Oceanics Mk1 and Mk2 (60)*	A4(4),A5(4),B4(4), C4(4)	84.1% 85.6%***	One instrument lost. Three instruments flooded, one of them twice (defective pressure sensor installation by manufacturer). Three units had clock battery failures.
General Oceanics Mk2 (124)*	A2(2),A3(2),B2(2), B3(2),C2(2),C3(2), D1(2),D2(2)	93.8% 98.1%***	Seven instruments lost Five were lost on three different subsurface moorings at B3 site.
General Oceanics Mk2 (2)**	B3(1),C3(1)	0.0% NA***	Replacement and backup for InterOcean S4s. One instrument lost as orange attachment ring failed; one instrument lost as standoff disintegrated.
InterOcean S4 (100)**	A1(2),A2(1),A3(1), B1(2),B2(1),B3(1), C1(2),C2(1),C3(1), D1(1),D2(1)	81.5% 88.7%***	Six instruments lost (Four lost during last 3 months of program). One instrument flooded when I/O connector sheared off. Battery ring/power failure problems accounted for most other lost data.
TOTAL: (304)	All Stations (51 Levels)	87.1% 91.3%***	Entire Program.

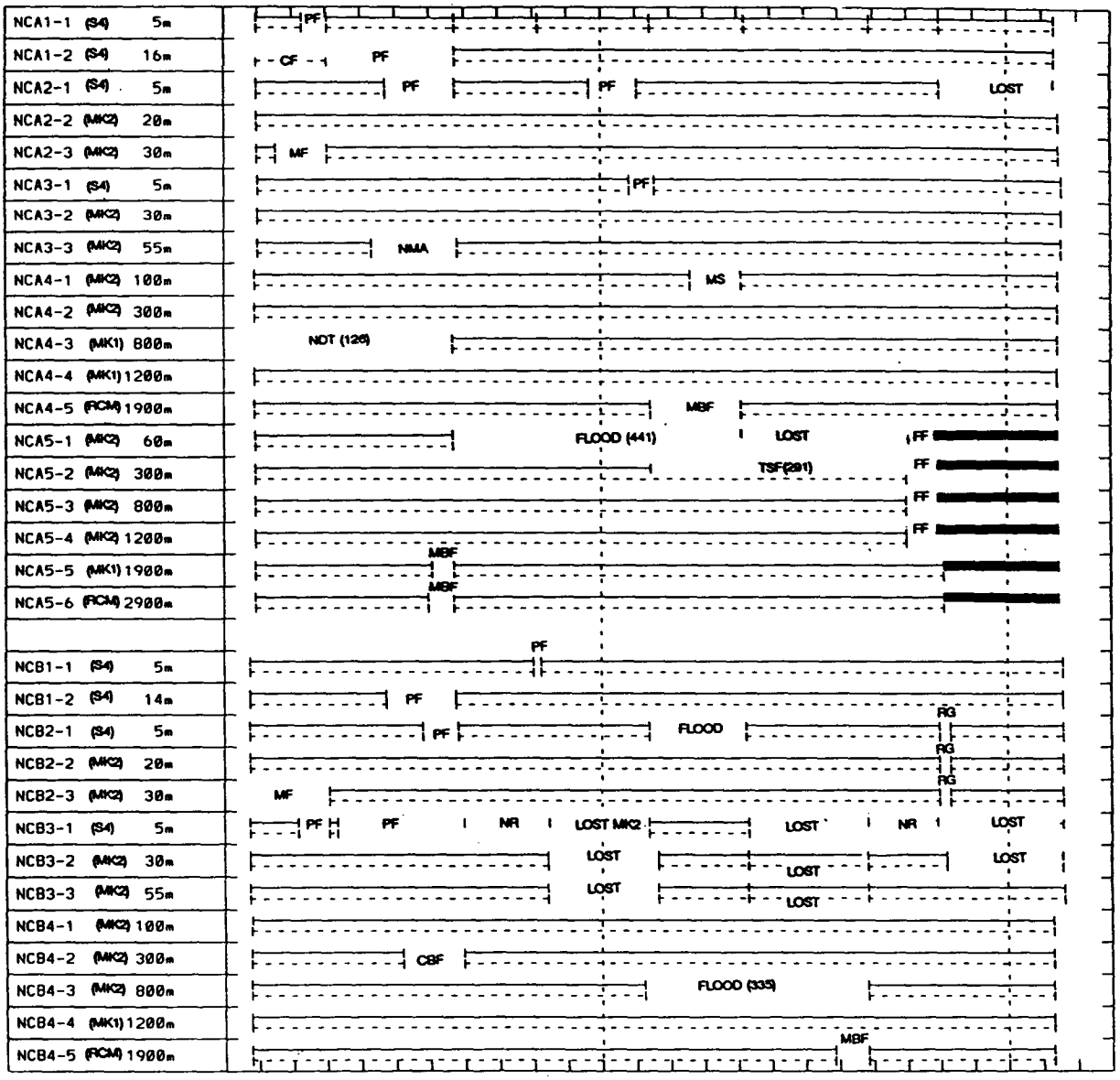
* = On subsurface moorings.
** = On surface moorings.
*** = Recovered instruments only.

Table 4.4-2 Current meter losses by mooring location during the NC Field Program.

Mooring (Depth)	InterOcean S4	General Oceanics Mk2
A2 (5m)	1*	-
A5 (60m)	-	1
B3 (5m)	2**	1
B3 (30m)	-	3**
B3 (55m)	-	2
C2 (5m)	1*	-
C3 (5m)	1	1
C3 (30m)	-	1*
C3 (55m)	-	1*
D1 (5m)	1*	-

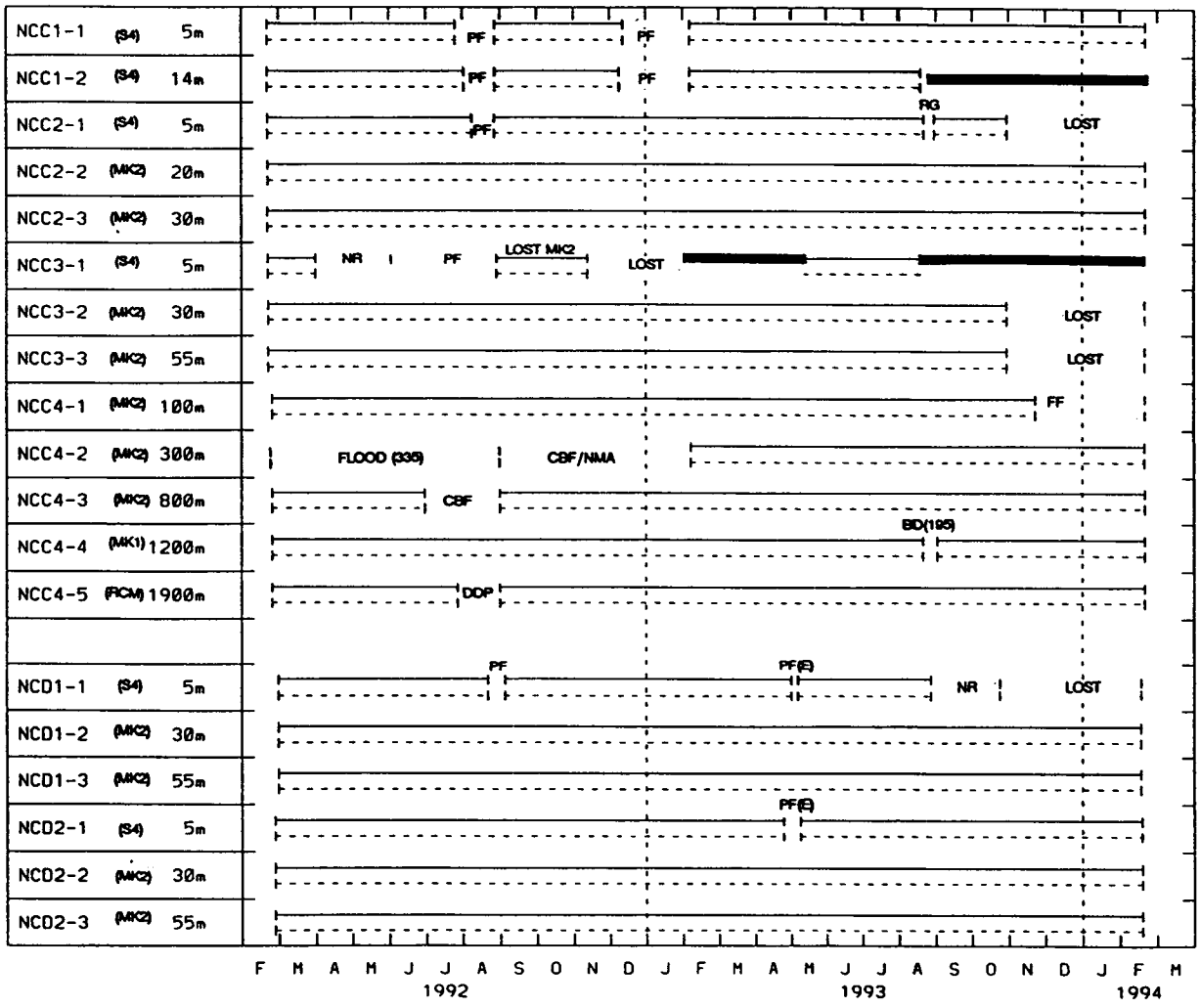
* Lost during last three month deployment period.

** One lost during last three month deployment period.



BD = Bad Data
CBF = Clock Battery Failure
CF = Compass Failure
DDP = Data Downloading Problem
FF = Flotation Failure
FLOOD = Flooded Instrument
LOST = Lost Instrument
MBF = Main Battery Failure
MF = Meter Failure (unknown)
MS = Memory Shortage
NDT = Noisy Data Tape
NMA = No Meter Available
NR = Not Rotated
PF = Power Failure
PF(E) = Power Failure (Eveready)
RG = Rotation Gap
TSF = Tilt Sensor Failure
▬ = Not Deployed

Figure 4.4-1a Time lines of current meter data return for Line A and Line B moorings. Solid lines are currents and dashed lines are temperature.



BD = Bad Data
CBF = Clock Battery Failure
CF = Compass Failure
DDP = Data Downloading Problem
FF = Flotation Failure
FLOOD = Flooded Instrument
LOST = Lost Instrument
MBF = Main Battery Failure
MF = Meter Failure (unknown)
MS = Memory Shortage
NDT = Noisy Data Tape
NMA = No Meter Available
NR = Not Rotated
PF = Power Failure
PF(E) = Power Failure (Eveready)
RG = Rotation Gap
TSF = Tilt Sensor Failure
▬ = Not Deployed

Figure 4.4-1b Time lines of current meter data return for Line C and Line D moorings. Solid lines are currents and dashed lines are temperature.

different computer along with infield confirmation of the proper data format prevented recurrence of the problem.

Some data were also lost due to shorter than expected battery lives. Battery life for the new RCM-8s (serial numbers 10527, 10533 and 10535) was found to average 16 days less than for the RCM-5/8s (serial numbers 7528 and 7582) at the 30 minute setting using the standard Leclanche' carbon/zinc battery (See Table 4.4-3). No data were lost, however, at one hour settings. The RCM-5/8s were originally RCM-5 mechanical reel-to-reel tape units that had been upgraded to DSU units. Apparently the battery drain on the newer RCM-8 units is greater than for the older upgraded instruments.

4.4.2 InterOcean S4s

As noted in Table 4.4-1, the overall useful data return for the S4 current meters was 81.5%. Fourteen of these units were deployed on surface moorings. None were deployed on subsurface moorings. The two major contributors to overall data loss were nearly equally divided between instrument malfunctions and battery related problems (9.5%) and instrument loss and flooding (9.0%). Six instruments were lost and one was flooded. The flooded instrument had a sheared off I/O connector. Instrument loses due to mooring failures are discussed in Section 5.2. Summaries of instrument performances, following each quarterly rotation, are presented in Tables 4.4-4a through 4.4-4h.

All of the instruments were new, shipped directly from the manufacturer in December 1991 or January 1992. As such, each had the most recent upgrades of firmware and hardware that InterOcean was providing. One unit had a bad compass and produced 'bad' current data during its initial deployment. Another unit lost the ability to store data internally nearly halfway through its first deployment. A third unit produced good data for only the first 40% of its second deployment. All other shortened data records (22 in all) were caused by a number of instrument power related issues (power failures). Three of these power failures, however, occurred so close to instrument recovery that they had no significant impact on the data return.

During the initial instrument recoveries (in April-May 1992 and in August-September 1992) thirteen instruments were recovered with two Power Failure flags and subsequently shortened data records. The range in data return was from 0% to 97% on these instruments. Twelve other instruments obtained 100% data return, thereby indicating that the expected battery life was adequate for the deployments. These results were followed by a sequence of modifications and some investigative work by InterOcean, the results of which were significant. Only one of the 31 instruments deployed and recovered during the last three rotations of the field effort got less than 100% data return.

Instrument modifications included replacement of the battery pack rings in all of the instruments and the insertion of a foam pad on the underside of the battery pack ring. The purpose was to reduce up-and-down movement of the battery pack on the two battery posts (thought to be causing the power failures). This was followed with the discovery that all instruments which had experienced power failures had potentially reduced the life of their respective CPU batteries. Indeed, some data were lost as a number of CPU batteries began dying prematurely. The fix was a modification to the instrument's circuitry to prevent the CPU battery from attempting to

Table 4.4-3 Aanderaa DSU Recording Current Meter (RCM) performance review.

SN/Mooring	Instrument Type	Battery Type	Sampling Interval (Minutes)	Days of Data	Battery Voltage Begin/End
7528/B4	RCM 5/8	L	30	160.9 (R)	9.86/7.91
7528/B4	RCM 5/8	L	30	186.8 (R)	----/7.54
7528/B4	RCM 5/8	L	30	173.0 (D)	9.79/2.13
7528/B4	RCM 5/8	L	60	183.0 (R)	9.93/8.39
7582/A4	RCM 5/8	L	30	175.6 (D)	----/5.96
7582/A4	RCM 5/8	L	30	177.5 (R)	----/----
7582/A4	RCM 5/8	U	60	180.0 (R)	----/----
10527/A5	RCM 8	L	30	156.7 (D)	----/----
10527/A5	RCM 8	L	60	255.8 (R)	----/7.90
10527/A5	RCM 8	L	60	183.0 (R)	9.80/8.22
10533/C4	RCM 8	L	30	155.2 (D)	----/6.92
10533/C4	RCM 8	L	60	159.1 (R)	9.89/8.24
10533/C4	RCM 8	U	30	199.8 (R)	----/----
10533/C4	RCM 8	U	30	187.0 (R)	----/----
10535/A5	RCM 8	L	30	161.8 (D)	----/----
10535/A5	RCM 8	L	60	255.8 (R)	----/7.96
10535/A5	RCM 8	L	60	183.0 (R)	9.85/8.26

L = Leclanche´ Battery (carbon/zinc).
U = Ultralife Battery (lithium).
D = Dead at Recovery.
R = Still Running at Recovery.

Table 4.4-4a InterOcean S4 performance review following April-May 1992 recovery.

Instrument SN/Mooring	Deployment Period	Instrument Setting	Two Power Failures	Number of Samples	% Data Return	Voltage Deployment/ Recovery
1744/C1T	02/19/92-05/04/92	A	Y	1936	97	NM
1745/C1B	02/19/92-05/04/92	A	N	1987	100	NM
1746	NOT DEPLOYED	-	-	----	---	--
1747/A1T	02/26/92-04/30/92	A	Y	1364	72	NM
1748/B3T	02/21/92-05/02/92	A	Y	1283	66	NM
1749/C3T	02/20/92-NR	A	-	----	---	--
1750/A3T	02/27/92-05/01/92	A	N	1919	100	NM
1751/B2T	02/21/92-05/02/92	A	Y	1841	95	--
1752/D1T	02/27/92-05/01/92	A	N	1927	100	NM
1753/B1T	02/21/92-05/09/92	A	N	2106	100	NM
1754/A2T	02/27/92-04/30/92	A	N	1900	100	NM
1755/D2T	02/24/92-05/09/92	A	N	2112	100	NM
1756	NOT DEPLOYED	-	-	----	---	--
1757/C2T	02/19/92-05/05/92	A	N	2012	100	NM
1758/A1B	02/26/92-04/30/92	A	Y	1815	0*(96)	NM
1759/B1B	02/21/92-05/09/92	A	N	2106	100	NM

SN = Last four digits of serial number.
T = 5m depth.
B = 14.25m or 16.25m depth.
A = 1 hour cycle interval; 3 minutes on; average count: 360; channels 4, 5, 7 and 8 at average; SRB count: 2; channels at SRB: 7 and 8 (Alkaline battery pack).
N = No.
Y = Yes.
NM = Not measured.
NR = Not rotated during April-May cruise.
* = All curren-ts are bad (compass bad); others parameters ok!

Table 4.4-4b InterOcean S4 performance review following August-September 1992 recovery.

Instrument SN/Mooring	Deployment Period	Instrument Setting	Two Power Failures	Number of Samples	% Data Return	Voltage Deployment/ Recovery
1744/C1T	05/05/92-08/25/92	C	Y	3892	72	NM
1745/C1B	05/05/92-08/25/92	C	Y	4231	79	NM
1746	NOT DEPLOYED	-	-	----	---	--
1747/A1B	05/01/92-08/22/92	C	N	4	0	NM
1748/B3T	05/02/92-08/23/92	C	Y	362	7	NM
1749/C3T	02/20/92-08/26/92	A	Y	1160	25	NM
1750/A3T	05/01/92-08/25/92	C	N	5543	100	NM
1751/B2T	05/02/92-08/23/92	C	Y	3992	74	NM
1752/D1T	05/02/92-09/02/92	C	Y	5315	90	NM
1753/B1T	05/09/92-08/23/92	C	N	5089	100 NE	NM
1754/A1T	05/01/92-08/22/92	C	N	5454	100	NM
1755/D2T	05/09/92-08/31/92	C	N	5478	100	NM
*1756/A2T	04/30/92-08/28/92	C	N	2550	44	NM
1757/C2T	05/05/92-08/26/92	C	Y	4528	85	NM
1758	NOT DEPLOYED	-	-	----	---	--
1759/B1B	05/09/92-08/23/92	C	Y	2102	41	NM

SN = Last four digits of serial number.
T = 5m depth.
B = 14.25m or 16.25m depth.
A = 1 hour cycle interval; 3 minutes on; average count: 360; channels 4, 5, 7 and 8 at average; SRB count: 2; channels at SRB: 7 and 8 (Alkaline battery pack).
C = 30 minute cycle interval; 3 minutes on; average count: 360; channels 4, 5, 7 and 8 at average; SRB count: 2; channels at SRB: 7 and 8 (Alkaline battery pack).
N = No.
Y = Yes.
NE = Noisy end to data in all parameters.
NM = Not measured.
* = Unit unable to store data internally at recovery; 2550 samples recovered by manufacturer.

Table 4.4-4c InterOcean S4 performance review following November 1992 recovery.

Instrument SN/Mooring	Deployment Period	Instrument Setting	Two Power Failures	Number of Samples	% Data Return	Voltage Deployment/ Recovery
1744/C1T	08/26/92-11/08/92	A	N	1776	100	NM/8.64
1745/C2T	08/26/92-11/11/92	A	N	1860	100	NM/8.19
1746/A1B	08/22/92-11/04/92	A	N	1780	100	NM/7.64
1747 (*)	NOT DEPLOYED	-	-	----	---	--/----
1748 (*)	NOT DEPLOYED	-	-	----	---	--/----
1749/C3T	08/28/92-11/11/92	A	N	1821	100	NM/8.06
1750/B2T	08/25/92-11/12/92	A	N	1899	100	NM/6.29
1751/A3T	08/25/92-11/05/92	A	N	1756	100	NM/7.89
1752/D1T	09/03/92-11/07/92	A	N	1569	100	NM/8.37
1753/B1B	08/23/92-11/06/92	C	Y	3561	98	NM/5.80
1754/A2T	08/22/92-11/04/92	A	N	1779	100	--/----
1755/D2T	08/31/92-11/07/92	A	N	1625	100	NM/6.81
1756 (*)	NOT DEPLOYED	-	-	----	---	--/----
1757/C1B	08/26/92-11/08/92	A	N	1779	100	NM/7.69
1758/A1T	08/22/92-11/04/92	A	N	1780	100	NM/8.67
1759/B1T	08/23/92-11/06/92	C	Y	3305	91	NM/4.62

SN = Last four digits of serial number.
T = 5m depth.
B = 14.25m or 16.25m depth.
A = 1 hour cycle interval; 3 minutes on; average count: 360; channels 4, 5, 7 and 8 at average; SRB count: 2; channels at SRB: 7 and 8 (Alkaline battery pack).
C = 30 minute cycle interval; 3 minutes on; average count: 360; channels 4, 5, 7 and 8 at average; SRB count: 2; channels at SRB: 7 and 8 (Alkaline battery pack).
N = No.
Y = Yes.
NM = Not measured.
* = New CPU battery plus circuit protection.

NOTE: All units were deployed with foam insert and replacement battery holder ring.

Table 4.4-4d InterOcean S4 performance review following February 1993 recovery.

Instrument SN/Mooring	Deployment Period	Instrument Setting	Two Power Failures	Number of Samples	% Data Return	Voltage Deployment/ Recovery
1744/C1T	11/08/92-02/04/93	A	Y	1572	74	9.58/8.67
1745/C2T	11/12/92-02/04/93	A	N	2036	100	9.59/8.67
1746/A2T	11/05/92-02/15/93	A	Y	2353	100 (40)	9.56/8.45
1747/A1T(*)	11/04/92-02/11/93	A	Y	2364	99	9.56/8.53
1748/A1B(*)	11/04/92-02/11/93	A	N	2382	100	9.52/8.01
1749/B2T	11/12/92-02/10/93	A	N	2170	100	9.56/8.51
1750 (*)	NOT DEPLOYED	-	-	----	---	----/----
1751/B1T	11/07/92-02/11/93	A	N	2312	100	9.31/8.44
1752/C3T	11/11/92-(LOST)	A	-	----	0***	9.58/----
1753/B1B	11/07/92-02/11/93	A	N	2310	100	9.58/8.53
1754 (*)	NOT DEPLOYED	-	-	----	---	----/----
1755/D1T	11/08/92-NR	A	-	----	---	9.56/----
1756 (*)	NOT DEPLOYED	-	-	----	---	----/----
1757/C1B	11/08/92-02/04/93	A	Y	729	34	9.58/8.89
1758/A3T	11/06/92-02/15/93	A	Y	1945	80**	9.30/3.85
1759/D2T	11/07/92-NR	A	-	----	---	9.59/----

SN = Last four digits of serial number.
T = 5m depth.
B = 14.25m or 16.25m depth.
A = 1 hour cycle interval; 3 minutes on; average count: 360; channels 4, 5, 7 and 8 at average; SRB count: 2; channels at SRB: 7 and 8 (Alkaline battery pack).
N = No.
Y = Yes.
* = New or checked CPU battery plus circuit protection.
(40)= Only 40 percent of the total data collected by the instrument are good.
NR = Not rotated during February cruise.
** = Instrument was found fouled in longline with I/O screw cap missing; external connector pins blackened.
*** = Unit lost with surface buoy when mooring cable parted below current meter; surface buoy was missing in February 1993; instrument loss confirmed 5/10/93.

NOTE: All units were deployed with foam insert and replacement battery holder ring.

Table 4.4-4e InterOcean S4 performance review following May 1993 recovery.

Instrument SN/Mooring	Deployment Period	Instrument Setting	Two Power Failures	Number of Samples	% Data Return	Voltage Deployment/ Recovery
1744/B1B	02/11/93-05/08/93	A	N	2137	100	9.33/7.05 (E)
1745 (*)	NOT DEPLOYED	-	-	----	---	----/----
1746 (*)	NOT DEPLOYED	-	-	----	---	----/----
1747/A2T (*)	02/15/93-05/05/93	A	N	1945	100	9.51/8.65 (D)
1748/A1B (*)	02/11/93-05/06/93	A	N	2013	100	9.51/8.63 (D)
1749/B1T	02/11/93-05/08/93	A	N	2083	100	9.52/8.63 (D)
1750/C2T (*)	02/05/93-05/10/93	A	N	2274	100	9.56/8.66 (D)
1751/B2T	02/11/93-05/07/93	A	-	0000	0**	9.33/8.77 (E)
1753/A1T	02/11/93-05/06/93	A	N	2012	100	9.51/8.62 (D)
1754/C1T (*)	02/05/93-05/10/93	A	N	2269	100	9.52/8.65 (D)
1755/D1T	11/07/92-05/05/93	A	Y	4158	97	9.56/5.23 (E)
1756/B3T (*)	02/10/93-05/09/93	A	N	2163	100	9.52/8.69 (D)
1757/C1B	02/05/93-05/10/93	A	N	2264	100	9.53/8.63 (D)
1758/A3T	02/15/93-05/06/93	A	N	1930	100	9.51/8.60 (D)
1759/D2T	11/07/92-05/07/93	A	Y	4009	92	9.59/4.74 (E)

SN = Last four digits of serial number.
T = 5m depth.
B = 14.25m or 16.25m depth.
A = 1 hour cycle interval; 3 minutes on; average count: 360; channels 4, 5, 7 and 8 at average; SRB count: 2; channels at SRB: 7 and 8 (Alkaline battery pack).
N = No.
Y = Yes.
* = New or checked CPU battery plus circuit protection.
D = Duracell.
E = Eveready.
** = I/O connector sheared off at bulkhead; electronics compartment flooded.

NOTE: All units were deployed with foam insert and replacement battery holder.

Table 4.4-4f InterOcean S4 performance review following August 1993 recovery.

Instrument SN/Mooring	Deployment Period	Instrument Setting	Two Power Failures	Number of Samples	% Data Return	Voltage Deployment/ Recovery
1744/B1B	05/09/93-08/23/93	A	N	2570	100	9.50/8.64 (D)
1745/D1T(*)	05/05/93-08/26/93	A	N	2728	100	9.51/8.64 (D)
1746/C3T(*)	05/11/93-08/22/93	A	N	2493	100	9.51/8.65 (D)
1747/A1B(*)	05/06/93-08/27/93	A	N	2710	100	9.48/8.55 (D)
1748/A3T(*)	05/07/93-08/27/93	A	N	2716	100	9.50/8.64 (D)
1749/B1T	05/09/93-08/23/93	A	N	2570	100	9.49/8.66 (D)
1750/C2T(*)	05/12/93-08/20/93	A	N	2417	100	9.49/8.70 (D)
1751	NOT DEPLOYED	-	-	----	---	----/----
1753/A2T	05/06/93-08/27/93	A	N	2719	100	9.47/8.61 (D)
1754/C1T(*)	05/12/93-08/19/93	A	N	2402	100	9.49/8.70 (D)
1755/A1T	05/06/93-08/27/93	A	N	2713	100	9.50/8.62 (D)
1756/B3T(*)	05/10/93-(LOST)	-	-	----	0***	9.49/---- (D)
1757/C1B	05/12/93-08/19/93	A	N	2356	98**	9.50/8.64 (D)
1758/B2T	05/07/93-08/23/93	A	N	2593	100	9.49/8.64 (D)
1759/D2T	05/07/93-08/26/93	A	N	2657	100	9.49/8.64 (D)

SN = Last four digits of serial number.
T = 5m depth.
B = 14.25m depth.
A = 1 hour cycle interval; 3 minutes on; average count: 360; channels 4, 5, 7 and 8 at average; SRB count: 2; channels at SRB: 7 and 8 (Alkaline battery pack).
N = No.
Y = Yes.
* = New or checked CPU battery plus circuit protection.
NR = Not rotated during August cruise.
D = Duracell.
E = Eveready.
** = CPU/clock battery going bad; unit off by 46 hours at recovery.
***= Unit lost with surface buoy when mooring cable parted below current meter; instrument loss confirmed 8/24/93; buoy had been reported adrift in Gulf Stream on 6/27/93.

NOTE: All units were deployed with foam insert and replacement battery holder ring.

Table 4.4-4g InterOcean S4 performance review following October-November 1993 recovery.

Instrument SN/Mooring	Deployment Period	Instrument Setting	Two Power Failures	Number of Samples	% Data Return	Voltage Deployment/ Recovery
1744/D2T	08/26/93-11/05/93	A	N	1733	100	9.59/8.76 (D)
1745/A1T(*)	08/27/93-10/31/93	A	N	1551	100	9.60/8.75 (D)
1746/B1T(*)	08/23/93-11/08/93	A	N	1851	100	9.58/8.71 (D)
1747/A1B(*)	08/27/93-10/31/93	A	N	1560	100	9.59/8.75 (D)
1748/C2T(*)	08/29/93-10/29/93	A	N	1469	100	9.60/8.81 (D)
1749/B3T	08/24/93-NR	A	-	----	---	9.57/---- (D)
1750/B2T(*)	08/23/93-10/30/93	A	N	1677	100	9.60/8.76 (D)
1751	NOT DEPLOYED	-	-	----	---	----/----
1753/A2T	08/28/93-10/31/93	A	N	1549	100	9.60/8.80 (D)
1754/C1T(*)	08/20/93-10/29/93	A	N	1701	100	9.62/8.80 (D)
1755/A3T	08/27/93-11/04/39	A	N	1653	100	9.59/8.76 (D)
1757 (*)	NOT DEPLOYED	-	-	----	---	----/----
1758/B1B	08/23/93-11/08/93	A	N	1853	100	9.58/8.85 (D)
1759/D1T	08/26/93-NR	A	-	----	---	9.60/---- (D)

SN = Last four digits of serial number.
T = 5m depth.
B = 14.25m depth.
A = 1 hour cycle interval; 3 minutes on; average count: 360; channels 4, 5, 7 and 8 at average; SRB count: 2; channels at SRB: 7 and 8 (Alkaline battery pack).
N = No.
Y = Yes.
* = New or checked CPU battery plus circuit protection.
NR = Not rotated during November cruise.
D = Duracell.
E = Eveready.

NOTE: All units were deployed with foam insert and replacement battery holder ring.

Table 4.4-4h InterOcean S4 performance review following February 1994 final mooring recovery.

Instrument SN/Mooring	Deployment Period	Instrument Setting	Two Power Failures	Number of Samples	% Data Return	Voltage Deployment Recovery
1744/B1B	11/08/93-02/25/94	A	N	2637	100	9.56/8.80 (D)
1745/A1T(*)	10/31/93-02/25/94	A	N	2825	100	9.53/---- (D)
1746/B2T(*)	11/09/93-02-25/94	A	N	2610	100	9.53/8.80 (D)
1747/A2T(*)	10/31/93-(LOST)	A	-	0000	0***	9.55/---- (D)
1748/C1T(*)	10/29/93-02/25/94	A	N	2853	100	9.53/---- (D)
1749/B3T	08/24/93-(LOST)	A	-	0000	0***	9.57/---- (D)
1750/A1B(*)	10/31/93-02/28/94	A	N	2891	100	9.55/8.79 (D)
1751	NOT DEPLOYED	-	-	----	---	----/----
1753/A3T	11/04/93-02/28/94	A	N	2785	100	9.53/8.78 (D)
1754/C2T(*)	10/30/93-(LOST)	A	-	0000	0***	9.54/---- (D)
1755/B1T	11/08/93-02/25/94	A	N	2636	100	9.54/8.80 (D)
1757/D2T(*)	11/04/93-02/28/94	A	N	2784	100	9.53/8.78 (D)
1758	NOT DEPLOYED	-	-	----	---	----/----
1759/D1T	08/26/93-(LOST)	A	-	0000	0***	9.60/---- (D)

SN = Last four digits of serial number.
T = 5m depth.
B = 14.25m depth.
A = 1 hour cycle interval; 3 minutes on; average count: 360; channels 4, 5, 7 and 8 at average; SRB count: 2; channels at SRB: 7 and 8 (Alkaline battery pack).
N = No.
Y = Yes.
* = New or checked CPU battery plus circuit protection.
*** = Unit lost with surface buoy during final mooring recovery cruise in February 1994.
D = Duracell.
E = Eveready.

NOTE: All units were deployed with foam insert and replacement battery holder ring.

provide power to operate the instrument and to collect data when power failures occurred. The CPU batteries were normally expected to be good for at least three years. Another discovery was that Eveready alkaline batteries themselves could cause intermittent power failures. Eveready was in the process of converting from a high mercury content battery to a low or no mercury content battery. Their intermediate battery had the power failure characteristic and was used in some of the early battery packs during the first few deployments. The last three deployments used Duracell batteries only.

One additional problem was identified and resolved. It had to do with wear on the titanium tension rod stopper ring which allowed the instrument to rotate on the tension rod but not move more than a quarter inch or so up and down. This ridge became worn and in some instances had worn to the point that the instrument could slide many inches up the rod and impact the attachment hardware. This caused external damage to the I/O connector and in one instance caused loss of the thermistor shroud. Obviously, this also enhanced the upward and downward momentum of the instrument's internal power pack. The problem was resolved by replacing the worn tension rods and installing nylon washers in the quarter inch space under the stopper ring.

4.4.3 General Oceanics Mk1s and Mk2s

The overall useful data return for the General Oceanics current meters was 88.4%. This is the composite data return from 183 of 186 deployments identified in Table 4.4-1. This percentage includes the influence of seven instruments that were lost and three that were flooded producing no data. Interestingly, this is the only type instrument that produced 100% data return at any of the 51 instrumented levels. Twelve levels instrumented with General Oceanics current meters produced a 100% useful data return for the entire two-year study period.

Three instrument losses were clearly associated with mooring wire failure (1) and premature release activation (2). Four loses are unexplained but are suspected to be due to premature release activation or interference from other offshore interests. One instrument was lost as its orange swivel attachment ring failed and two other standoffs with instruments either disintegrated in high currents (from strumming) or were struck and torn from their moorings by other offshore interests. Six of the ten loses were from four moorings at the B3 site and three were from two moorings at the C3 site (see Table 4.4-2). The three flooded instruments were all equipped with pressure sensors which apparently leaked. Two of the instruments were rebuilt at no charge by the manufacturer. The clock batteries on three of the older cassette drive instruments died during the first year of the deep mooring deployments and two of 22 new RAM cartridge units failed to collect complete data records during their initial three-month deployments. One of these RAM cartridge units also produced questionable directional data (off by about 45°) and an older cassette drive unit had an intermittent sticking problem with its tilt sensor. None of the instruments experienced 'main' battery problems.

4.5 Meteorological and Water Level Data

Time lines of available useful meteorological and water level data are presented in Figure 4.5-1. The Chesapeake Light (CHLV2), Cape Hatteras (93729) and Cape Lookout (CLKN7) meteorological stations produced 100% data

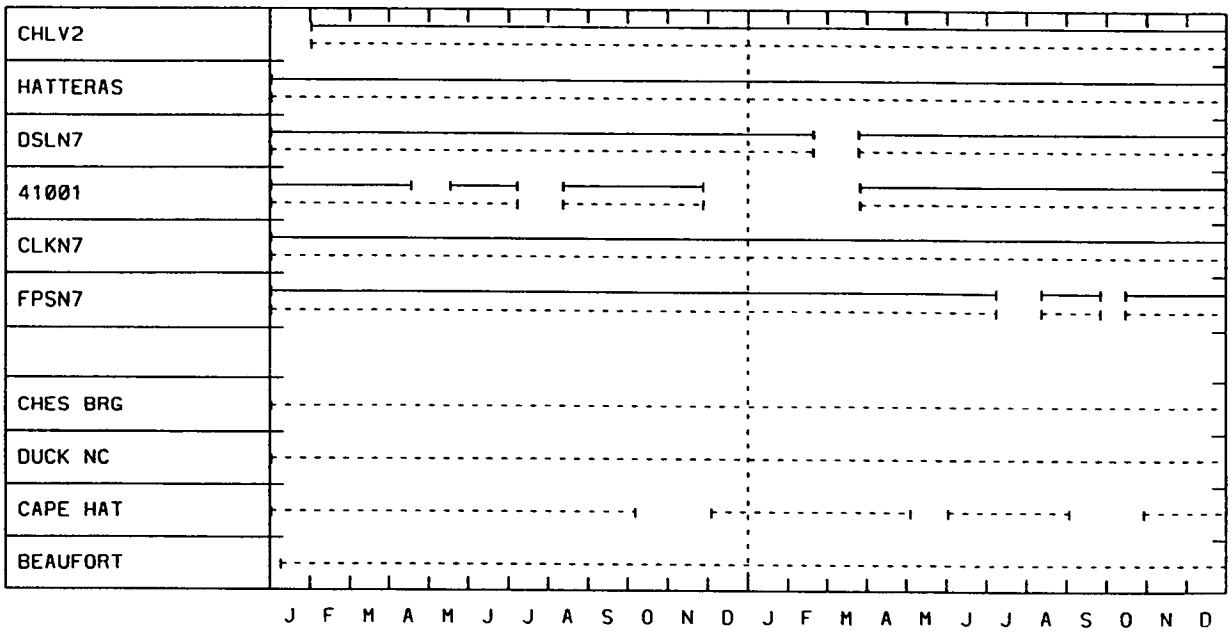


Figure 4.5-1 Time lines of available meteorological and water level data.

return for the study period. The Diamond Shoals station had a 95% data return with a gap in February-March 1993 and the Frying Pan Shoals station had a 92% data return with gaps in July-August and September-October 1993. Offshore Buoy 41001 had a 75% data return with gaps in April-May 1992, July-August 1992 and November 1992-March 1993.

Water level data from three available, useful NOS stations produced 100% data return. These were the Chesapeake Bay Bridge Tunnel (863-8863), Duck, NC (865-1370) and Beaufort, NC (865-6483). A fourth station at Cape Hatteras (865-4400) had a 79% data return with gaps in October-December 1992, May-June 1993 and September-October 1993.

4.6 Satellite Imagery Data

Table 4.6-1 summarizes the Clear Sky AVHRR images received over the course of the two year field program. A total of 976 images were collected during the program, 57.5% of which were obtained in 1993. This year produced more Clear Sky images than 1992 for each respective month except for February and November. Figures 4.6-1 and 4.6-2 present these same data in graphic form.

Table 4.6-1 Inventory of Clear Sky AVHRR Images obtained during the NC Field Program.

YEAR	J	F	M	A	M	J	J	A	S	O	N	D	TOTAL
1992	-	45	29	39	38	36	44	48	35	24	32	14	384
1993	15	27	33	57	78	66	69	56	61	39	28	32	561
1994	31	-	-	-	-	-	-	-	-	-	-	-	31
TOTAL	46	72	62	96	116	102	113	104	96	63	60	46	976

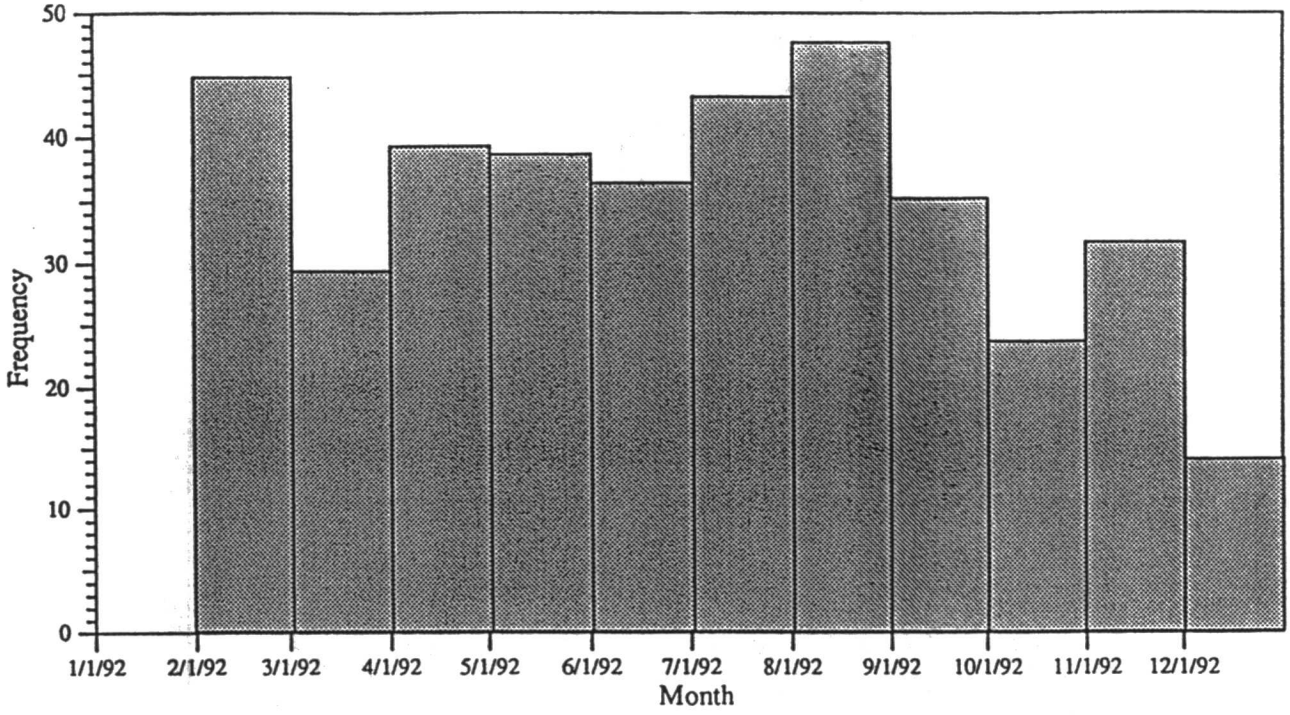


Figure 4.6-1 Distribution of useable satellite images by month for 1992.

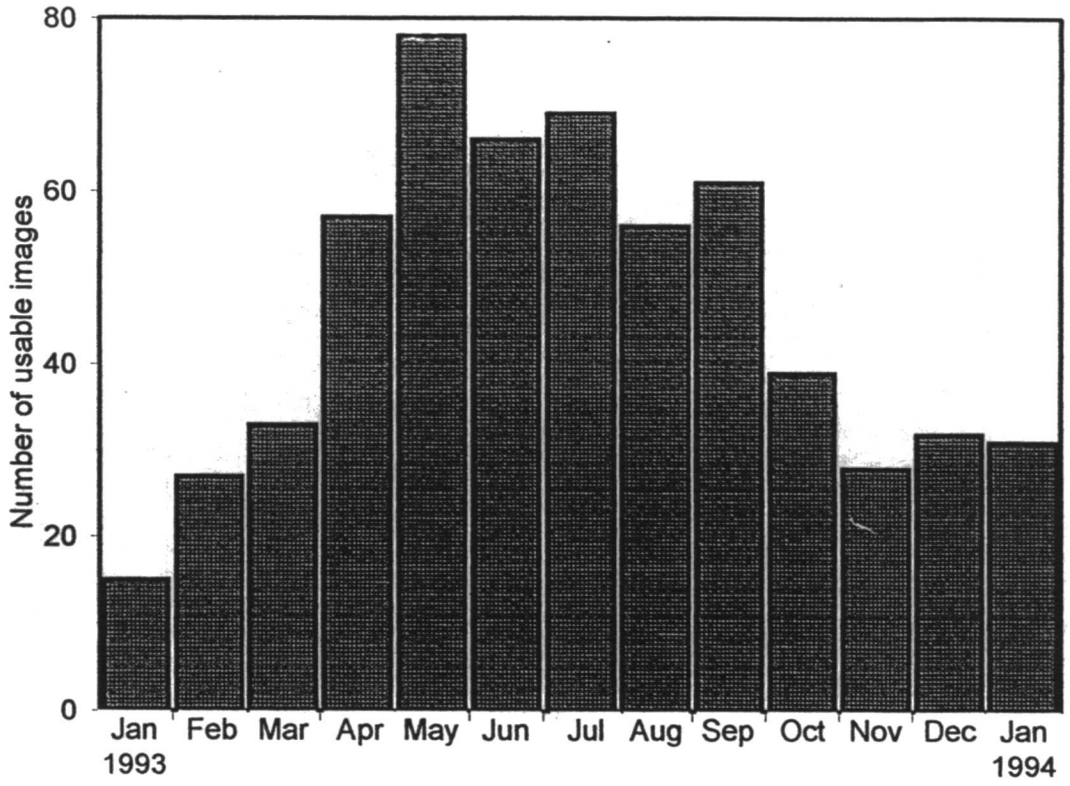


Figure 4.6-2 Distribution of useable satellite images by month for 1993 plus January 1994.

V. MOORING PERFORMANCE AND DAMAGE

5.1 Introduction

This section reviews the technical aspects of the current meter mooring effort with respect to surface and subsurface mooring survivability and surface buoy damage. In addition, since MMS required that the moorings be designed to implement mooring anchor recovery, the results of these efforts are also summarized.

5.2 Mooring Failure and Instrument Loses

5.2.1 Wire Failure

Six mooring wire failures were experienced over the course of the two year field program. Four of these were associated with surface moorings on the shelf and two were at or near the tops of 2000 m and 3000 m Gulf Stream moorings. Four instrument loses (one Mk2 and three S4s) were attributed to these failures. The initial wire failure occurred at the A3 surface mooring site when the wire parted under tension while relocating the mooring anchor during a quarterly servicing. This failure was clearly due to overloading the cable. The second and third failures occurred on surface moorings at the C3 and B3 sites. Both failures appear to be the result of sudden wire overloads. The next failure occurred near the top of the A5 3000 m subsurface Gulf Stream mooring. Crevice corrosion had occurred at a Vel Lock swivel attachment point. Crevice corrosion was also responsible for wire failure at the C2 surface mooring site. Here, over time, a cut or slice in the Nil Spin wire coating had become an active site for corrosion. Finally, wire failure occurred just below the Nicropress termination of the upper float on the C4 2000 m Gulf Stream subsurface mooring. Repeated bending under load just below the termination, and wire corrosion appear to be responsible. These wire failures are summarized in Table 5.2-1. Further discussion of some of these failures is provided below from Paul Higley of Specialty Devices, Inc. He examined samples from four of the failures (C4, C2, A5 and B3).

C4: C4 is 1/4" 3x19 wire with Quiet Cable jacket that had been terminated with an SDI cast-on zinc termination. The failure on this wire occurred at the termination. The wires show two contributing causes of the failure, sharp bending under load at the termination and corrosion of the outer strands of the wire construction. The strands on one side of the wire at the entrance to the termination failed at a slightly different length from the strands on the other side of the wire. Judging by the zinc mold imprint in the wire jacket, the wire was loaded heavily while the wire was bent at the termination. I suspect this occurred during deployment or retrieval as the wire was taut to the winch and the steel float was over the side. Neither cause was solely responsible for the failure. The corrosion was significant on the wire and would have caused a failure regardless of the bending. The fact that the bending can be seen is however reason to address it. The small wire is more subject to both bending stress and corrosion. Some form of limitation to the bend radius in the wire at the termination or procedural change to prevent this kinking would also help. I will look into changing the mold to provide a stress relief at the termination. In defense of the cast on terminations, the zinc probably slowed down the onset of the corrosion significantly and any other termination without the zinc addition may have failed earlier given

Table 5.2-1 Chronological summary of mooring wire failures experienced during the NC Field Program.

Mooring	Wire Size/Type	Date of Failure	Months Deployed	Cause of Failure	Inst. Loses
A3-(Surf)	3/8" Nilspin	08/24/92	5.9	Sudden overload	None
C3-(Surf)	3/8" Nilspin	11/11/92*	8.7	Sudden overload	(1) S4
B3-(Surf)	3/8" Nilspin	06/27/93	16.2	Sudden overload	(1) S4
A5-(Subsurf)	5/16" Quiet	09/29/93	19.1	Crevice Corrosion at fairing attachment	(1) Mk2
C2-(Surf)	3/8" Nilspin	10/29/93*	20.3	Crevice Corrosion at slice in coating	(1) S4
C4-(Subsurf)	1/4" Quiet	11/22/93	21.0	Bending and corrosion at termination	None

* Date last serviced or observed on station.

the same conditions. We should probably not try 1/4" wire for mooring deployments beyond 18 months in deployments that have frequent servicing where we will likely damage the wire jacket. 1/4" wire has been used for deployments for these long periods but the moorings were installed carefully once with care taken not to damage the jacket. Large wire or shorter replacement cycles and some way to prevent the sharp bend at the termination would help.

C2 and A5: C2 is 3/8" Nilspin and A5 is 5/16" Quiet Cable. Both of these wires appear to have failed during high stress loading at places where the wire jacket was pierced and the wire weakened due to corrosion. C2 appears to be a jacket that was cut either during handling or while deployed. The A5 jacket was probably melted through in the process of installing the swivel for the wire fairing. Since it is nearly impossible to prevent some abrasion or cuts in the wire jacket during a long field program with many redeployments, the cure for this type of failure is to replace the wire more often or use larger wire. In both cases I would lean towards more frequent wire replacement rather than larger wire diameter (personal preference).

B3: B3 is 3/8" Nilspin from a Catamaran buoy mooring. This failure is more interesting than the others. In this case the strands of the wire are not significantly corroded as in the other three wires. The jacket is also distorted and appears to have experienced two different forms of damage. One jacket damage area is a nearly uniform wear to the jacket all the way around the wire. I suspect that this occurred during deployments or retrievals as the Catamaran buoy was towed and the wire was wearing on the deck. This did not contribute to the failure but in the future may have lead to a failure due to corrosion.

At the failure point, the jacket is split in three places nearly along the axis of the wire. It appears that these wire splits are the result of an extreme sudden loading on the wire that caused the wires to explode outward as they failed. The ends of the wire strands support this failure as they are sharp angle shear failure consistent with exceeding the breaking strength of the wire. The wire jacket is also distorted along the length of the sample section. This would suggest that one or two of the three bundles failed first and the remaining bundle elongated as it tried to carry the load until it also failed. This loading of one bundle out of the three would cause it to try to be straight and the others to try to move out of the way. This is supported by the different failure point of some of the strands of one bundle versus the failure point of all strands in the other two bundles. To conclude, this failure looks like high sudden shock loading to the wire that exceeded the breaking strength.

5.2.2 Shackle Failure

Shackle failures occurred at the B3 and D1 surface mooring sites sometime after the November 1993 rotation cruise and prior to the February 1994 recovery cruise. Two S4 current meters were lost from these sites. Both moorings had been serviced in August 1993 and observed on station in November 1993, but were not serviced at that time due to weather at the D1 site and weather and strong currents at the B3 site. A 5/8" shackle joining two lengths of 3/4" chain appears to have been responsible for the failure. One severely corroded safety anchor shackle with no nut (but with its cotter pin in place) was recovered. It had been attached to another shackle which was attached to more chain which ran to the surface buoy.

The severe corrosion is suggestive of an electrolysis problem. Efforts to duplicate the problem with spare shackles in the lab have been unsuccessful.

5.2.3 Premature Release Activation

One subsurface mooring at the B3 site was lost with two Mk2 current meters, apparently due to premature release activation. The Benthos acoustic release had been checked and tested on deck prior to deployment. Battery power was checked and more than adequate battery life was available for the deployment. The release was interrogated after deployment and responded without incident. It was also equipped with a rope canister to implement anchor recovery.

The unit did not respond to interrogation or come to the surface during subsequent recovery efforts beginning three months after deployment. However, the anchor was later recovered complete with chain, the release link that went to the release, and all of the rope that had been in the rope canister. The end of the rope, which had been attached to the release, had chafed through. Clearly, this particular release had been activated either by an instrument malfunction or other acoustic activity in the area. Care had been taken, however, to avoid inadvertently activating releases by arranging the release codes throughout the study area in a way to prevent any possibility of activation while at adjacent mooring sites.

5.2.4 Unexplained Disappearances

Unexplained disappearances are attributed to the loss of five other instruments. Four GO Mk2 current meters were lost from two additional subsurface moorings at the B3 and C3 sites. Premature release activation seems the most likely explanation but no anchors were recovered to verify that scenario. However, as for the verified release activation loss, both mooring releases were tested prior to and following deployment and had adequate battery life, but did not respond on interrogation three months after deployment. Grapnel efforts were unsuccessful but did strike 'something' (possibly the anchor) on the bottom where the moorings were expected to be. Finally, the A2 surface mooring disappeared without a trace in spite of an extensive grapnel effort and surface area search. No sign of this mooring was ever detected. One S4 current meter was lost from this site.

5.3 Surface Buoy Damage

Most of the significant buoy damage on the surface moorings was related to damaged or destroyed lights. Four lights were damaged or destroyed early in the field program during can buoy mooring rotations (at the A2, B1 and B2 sites) aboard the R/V CAPE HENLOPEN (See Table 5.3-1). This was primarily due to lights impacting the stern of the vessel during recoveries. This problem was later eliminated with a specially designed lamp protector which was fitted over the lamp before recovery was attempted. Five other buoy lights (at A1, A2 twice, C3 and D1) were found damaged or destroyed over the course of the field effort and the A3 buoy had a large chunk of foam missing from its side and from its radar reflector in November 1993. The light was undamaged.

Table 5.3-1 Chronological summary of surface mooring buoy damage experienced during the NC Field Program.

Mooring	Date Observed	Damage
B2	05/02/92	Can buoy light destroyed during recovery.
A2	08/22/92	Can buoy light lens cracked during deployment.
B1	08/23/92	Can buoy light destroyed during recovery.
C3	08/26/92	Discus buoy light found destroyed.
B1	11/08/92	Can buoy light lens destroyed during recovery.
A2	02/14/93	Can buoy light found damaged.
A1	08/27/93	Can buoy light found destroyed.
A2	08/27/93	Can buoy light found missing.
D1	08/26/93	Discus buoy light found damaged.
A3	11/04/93	Large chunks of foam missing from buoy and radar reflector; light undamaged.

5.4 Shelf Anchor Recoveries

One aspect of mooring design that was required by MMS was a means of recovering the shelf mooring anchors. This was implemented by the use of rope canisters on the eight shelf subsurface moorings. A total of 57 subsurface mooring anchors were recovered and five were lost for a subsurface mooring anchor recovery rate of 91.9%. In turn, sixty-nine surface mooring anchors were recovered and four were lost for a surface mooring anchor recovery rate of 94.5%. Table 5.4-1 summarizes the anchor loses. Eleven of the recovered anchors from the A1(1), A2(3), B1(2), B2(3) and C2(2) sites were found to have been totally buried. In addition, it is suspected that anchor burial contributed to the three anchor losses which occurred at the B1(2) and B2(1) sites. Most anchor burials were observed during the February and May anchor recovery efforts.

Table 5.4-1 Chronological summary of mooring anchor loses during three-month rotations of surface and subsurface shelf moorings during the NC Field Program.

Location (Depth)	Description	Date	Comments
D2(60m)	2-wheel	05/09/92	Rope canister recovery line parted during recovery.
A3(60m)	4-wheel	08/24/92	Mooring cable parted while moving anchor.
B3(60m)	2-wheel	02/06/93	Subsurface mooring missing; anchor may still be present.
B2(35m)	1-wheel	02/10/93	Rope canister recovery line parted during recovery.
D2 (60m)	2-wheel	02/15/93	No rope canister line available to implement recovery.
B1(20m)	2-wheel	05/08/93	1/2" chain parted during recovery.
B1(20m)	2-wheel	02/16/94	Lift cable parted during recovery.
A2 (35m)	2-wheel	02/17/94	Surface mooring missing without a trace.
C3(60m)	2-wheel	02/21/94	Subsurface mooring missing; anchor may still be present.

VI. INSTRUMENT FOULING AND ANIMAL OBSERVATIONS

6.1 Introduction

Fouling of each shelf instrument recovered during the two year field effort was documented. Photographs of most instruments were taken (prior to cleanup) beginning with the second recoveries in August and September 1992. Two types of fouling are reported on: biological and non-biological. Non-biological fouling consisted of longline, mooring fairing, fishing line and rope fouling about the affected instrument. Since no significant fouling was observed on any of the deep moorings (A4, A5, B4 and C4) except for mooring fairing having wrapped around the swivel area of one Mk2 current meter (which also flooded), no discussion is presented for the deep mooring instruments.

6.2 Biological Fouling of Instrumentation

No significant biological fouling other than a thin green film was observed on any of the deep mooring instruments at the A4, A5, B4 and C4 sites. These incidences were restricted to the upper current meter at each site. Varying degrees and types of fouling, however, were observed on the shelf mooring instruments. No antifouling compounds were used. Tables 6.2-1 and 6.2-2 summarize the observed fouling on the S4s and Mk2s, respectively.

A few trends are discernable in the S4 fouling data presented in Table 6.2-1. The heaviest fouling was observed during the November 1992 rotation and the least fouling was observed during the May 1993 rotation. Except for the February 1994 recovery, the instrument on the A3 surface mooring appears to have experienced the least amount of fouling over the study period. Gooseneck barnacles were not observed on instruments on the 20 meter isobath at the A1, B1 and C1 sites. Figure 6.2-1 shows examples of some of the observed fouling on the S4 current meters.

The Mk2 current meters were only deployed in the mid to outer shelf region where water depths were 35 meters and 60 meters depth, respectively. No barnacles were observed on any of the instruments along Line A (the A2 and A3 sites), and none were observed on any of the instruments recovered in February and May 1993. Barnacle deposits were most prolific during the November 1992, August 1993 and November 1993 recoveries. Figure 6.2-2 shows examples of some of the observed fouling on the Mk2 current meters.

6.3 Non-Biological Fouling of Instrumentation

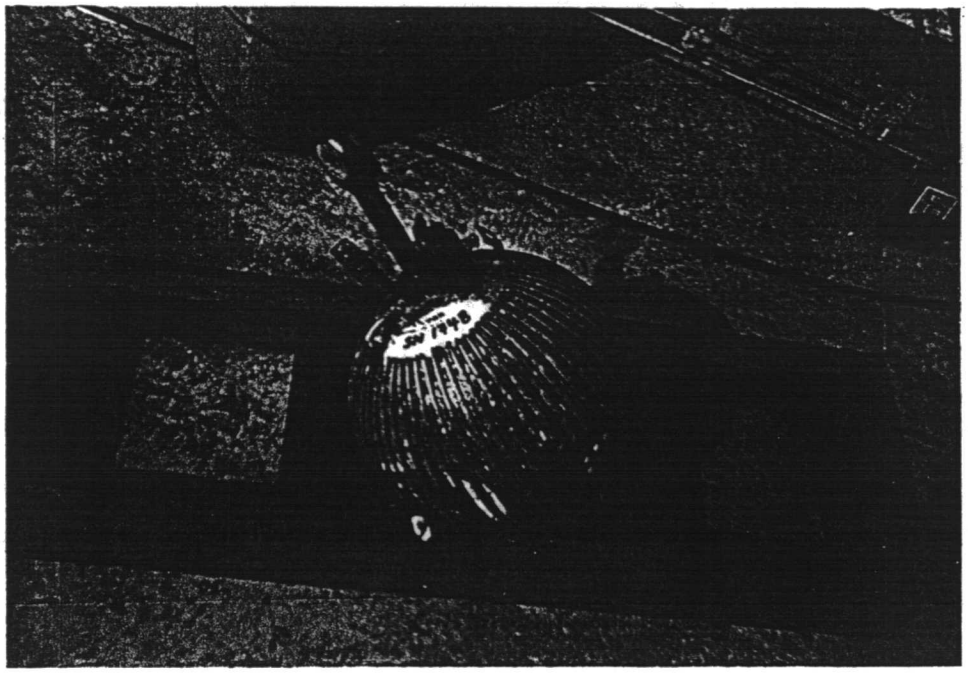
Table 6.3-1 summarizes the eleven incidences of non-biological fouling observed during the field effort. Except for fishing line fouling observed at the C2-surface mooring site (on the 35 meter isobath) in November 1992, all other incidences occurred at moorings along the 60 meter isobath. Longline fouling was found in both February 1993 and February 1994 at the A3 site and in February 1994 at the D2 mooring site. All other foulings but one were likely related to other fishing activities where small lengths of rope or snarls of fishing line were found wrapped about the tension rod of the S4 current meter. These were observed in May, August, September and November 1992 and in August 1993.

Table 6.2-1 Fouling observed during three-month rotations of InterOcean S4 current meters deployed on the North Carolina shelf during the NC Field Program.

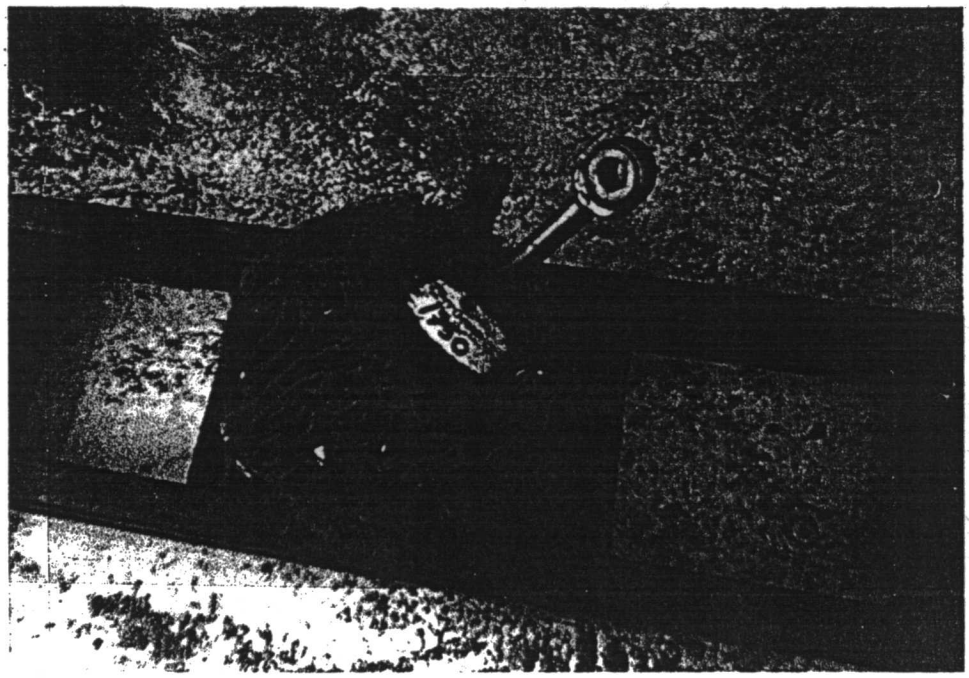
S4 CMs	May '92	Aug '92	Nov '92	Feb '93	May '93	Aug '93	Nov '93	Feb '94
A1 (5m)	-----	thick hairy + small barn.	thick hairy + small barn.	light film	light film	thick hairy	thick hairy	thick hairy
A1 (16m)	-----	thick hairy + small barn.	light hairy + small barn.	light film	light film	thick hairy	mod. hairy + small barn.	light film
A2 (5m)	-----	mod. hairy	thick hairy + gooseneck	light film	light film	light-mod. hairy	light film + gooseneck	-----
A3 (5m)	-----	light film + gooseneck	light film + gooseneck	light film	light film	light film	thick slime	thick hairy + gooseneck
B1 (5m)	-----	-----	thick hairy + mod. dep. small barn.	light film	light film	light-mod. hairy	mod.-thick hairy	thick hairy
B1 (14m)	-----	-----	thick hairy + mod. dep. small barn.	hairy growth	light film	mod. hairy	thick hairy	light film
B2 (5m)	-----	-----	thick hairy + light gooseneck	light film	light film	light-mod. hairy + gooseneck	thick hairy + gooseneck	thick hairy + gooseneck
B3 (5m)	-----	-----	-----	-----	light film	-----	-----	-----
C1 (5m)	-----	-----	mod.-heavy dep. small barn.	hairy growth	heavy slime	thick hairy	thick hairy	thick hairy
C1 (14m)	-----	-----	heavy dep. small barn.	hairy growth	light film	thick hairy	-----	-----
C2 (5m)	gooseneck barn.	light film + gooseneck	mod. hairy + gooseneck	hairy growth	light film	mod. hairy + gooseneck	light film + gooseneck	-----
C3 (5m)	-----	light film + gooseneck	light-mod. hairy + gooseneck	-----	-----	light hairy	-----	-----
D1 (5m)	-----	-----	light hairy	-----	thick hairy	light-mod. hairy growth	-----	-----
D2 (5m)	-----	mod. hairy	mod. hairy + gooseneck	-----	thick hairy	mod. hairy	-----	mod. slime + gooseneck

Table 6.2-2 Fouling observed during three-month rotations of General Oceanics Mk2 current meters deployed on the North Carolina shelf during the NC Field Program.

GO CMs	May '92	Aug '92	Nov '92	Feb '93	May '93	Aug '93	Nov '93	Feb '94
A2 (20m)	-----	light-mod. hairy	light film	light film	light film	light-mod. hairy	mod. hairy	light-mod. hairy
A2 (30m)	-----	thick hairy	light film	light film	light film	light-mod. hairy	thin slime	light film
A3 (30m)	-----	light hairy	thick hairy	mod. hairy	light film	light hairy	light hairy	light hairy
A3 (55m)	-----	-----	light hairy	light film	light film	light hairy	light hairy	light hairy
B2 (20m)	light hairy	light hairy + barn.	mod. hairy + small barn.	mod. hairy + flower	light film	mod. hairy	light-mod. hairy + barn	mod. hairy + heavy dep.
B2 (30m)	light hairy	light hairy	mod. hairy + small barn.	mod. hairy	light film	mod. hairy + small barn.	light-mod. hairy + small barn.	mod. hairy + heavy dep.
B3 (30m)	-----	light hairy	thin film + small barn.	-----	-----	mod.-thick hairy (6 mo.)	light hairy	-----
B3 (55m)	-----	light hairy	thin film + small barn.	-----	-----	mod.-thick hairy (6 mo.) + small barn.	light hairy	light-mod. hairy
C2 (20m)	mod. hairy	mod. hairy	light hairy	light hairy	light film	mod. hairy + small barn.	light-mod. hairy + small barn.	light-mod. hairy
C2 (30m)	mod. hairy	mod. hairy	light-mod. hairy	light hairy	light-mod. hairy	mod. hairy + small barn.	light hairy + small barn.	light-mod. hairy + heavy dep.
C3 (30m)	-----	mod. hairy	light hairy	light film	light-mod. hairy	mod. hairy	mod. hairy	-----
C3 (55m)	-----	mod. barn.	light hairy + small barn.	light hairy	light-mod. hairy	light-hairy + small barn.	light hairy + small barn.	-----
D1 (30m)	-----	mod. hairy	light-mod. hairy	light hairy	mod. hairy	thick hairy	mod.-thick hairy	mod. hairy
D1 (55m)	-----	light hairy	light hairy	light hairy	light film	thick hairy	light hairy	light hairy + small barn.
D2 (30m)	-----	mod. hairy	-----	mod. hairy	light film	mod. hairy	light hairy + small barn.	light hairy
D2 (55m)	-----	mod. hairy	-----	light hairy	light film	light hairy	light hairy + small barn.	light hairy + small barn.

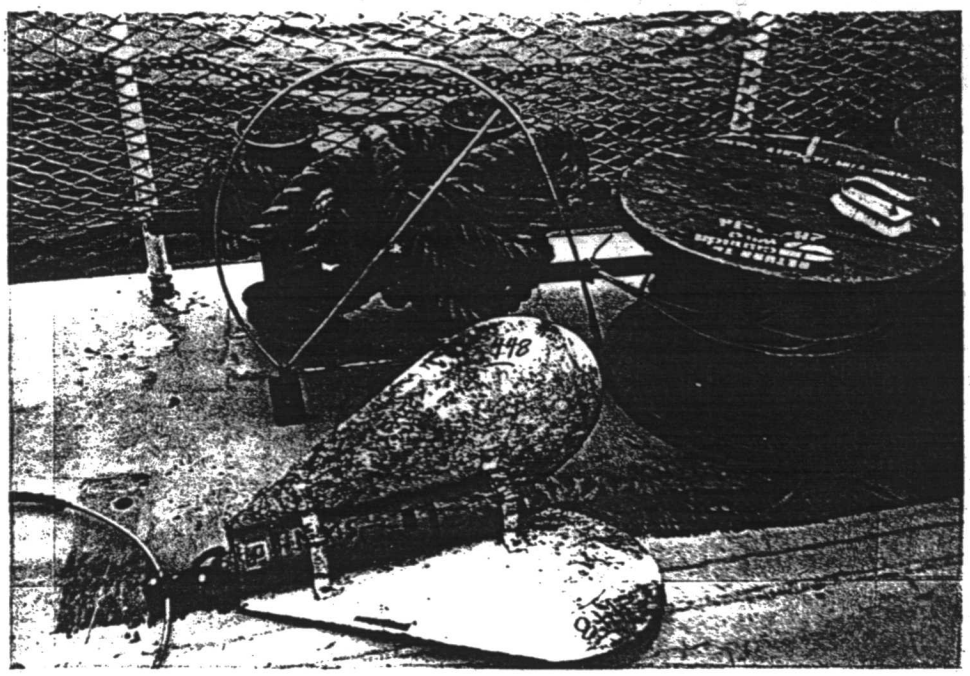


(a)

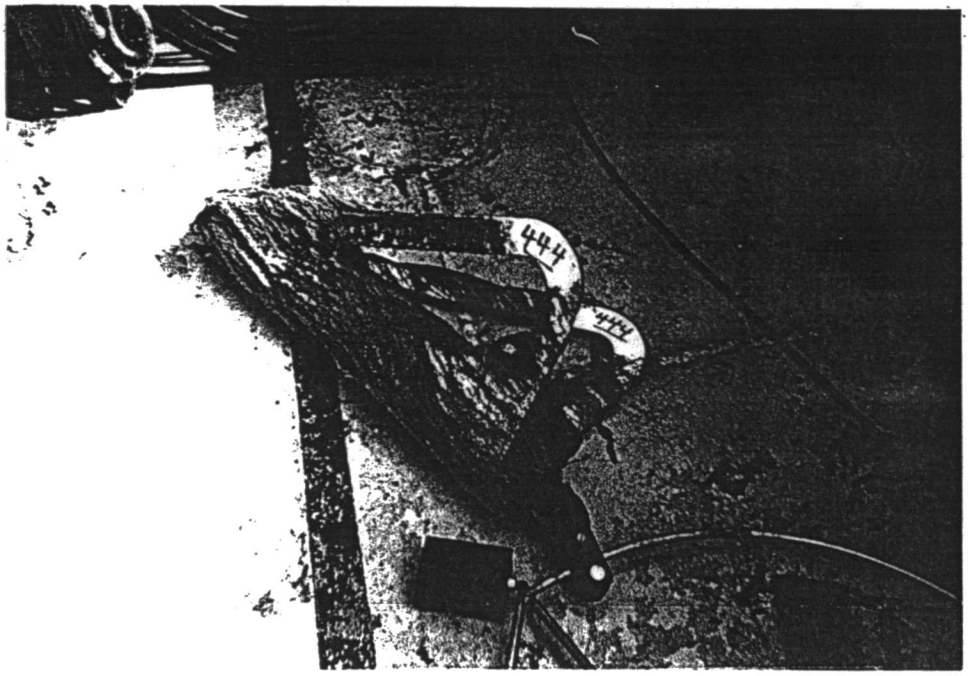


(b)

Figure 6.2-1 Examples of fouling observed on S4 current meters: (a) light film plus gooseneck barnacles; (b) thick hairy growth plus gooseneck barnacles.



(a)



(b)

Figure 6.2-2 Examples of fouling observed on Mk2 current meters: (a) light film; (b) thick hairy growth.

Table 6.3-1 Non-biological fouling observed on shelf mooring instruments during the NC Field Program.

Mooring (Instr. Depth)	Date	Nature of Fouling
A3 (5m)	02/15/93	Longline on S4.
A3 (30m)	02/15/94	Longline on Mk2.
B3 (30m)	05/06/92	Fairing tangled on Mk2.
C2 (5m)	11/11/92	Fishing line on S4.
C3 (5m)	08/26/92	Fairing and fishing line on S4.
C3 (5m)	08/22/93	Fishing line on S4.
D1 (5m)	05/01/92	Rope on S4.
D1 (5m)	09/02/92	Fishing line on S4.
D1 (5m)	11/07/92	Rope on S4.
D2 (5m)	08/26/93	Fishing line on S4.
D2 (60m)	02/16/94	Longline on release and anchor.

6.4 Animal Observations at Mooring Sites

Early on, it became obvious that the mooring anchors had become habitats for a number of types of marine life. Beginning with the February 1993 mooring rotations, site specific observations were recorded for marine life when observed (See Table 6.4-1). Prior to that time, the same types of marine life (particularly octopi and black sea bass) had been observed during each cruise, but no effort had been made to document the locations. Octopi were observed only south of Cape Hatteras at the Line C mooring sites (C1, C2 and C3) and black sea bass, eels and crabs were observed only north of Cape Hatteras at the A3, D1 and D2 sites. Both octopi and black sea bass were observed, however, at the Hatteras Corner (B3) site. Over 80 black sea bass were recovered from the A3 surface mooring anchor in May 1993. The anchor had been deployed for six months.

Other site specific observations included, a shark tooth found embedded in a General Oceanics current meter wing at the B3 site in November 1993, a school of cobia swimming around the A1 surface buoy in August 1993 and a leather back turtle observed at the B3 site in November 1993.

Table 6.4-1 Animal life found in/on anchors during shelf mooring anchor recoveries during the NC Field Program.

Anchor (Depth)	May '92	Aug '92	Nov '92	Feb '93	May '93	Aug '93	Nov '93	Feb '94
A1 (20m)	NR	NR	NR	Sting Ray Eggs	Black Sea Bass	-----	-----	-----
A2 (35m)	NR	NR	NR	-----	Crabs	-----	Crab	-----
A3 (60m)	NR	NR	NR	Black Sea Bass; Crab	Black Sea Bass; Eels	-----	-----	Eels
B1 (20m)	NR	NR	NR	-----	-----	-----	-----	-----
B2 (35m)	NR	NR	NR	-----	-----	-----	-----	-----
B3 (60m)	NR	NR	NR	-----	-----	Black Sea Bass	Octopi	-----
C1 (20m)	NR	NR	NR	-----	-----	Octopi	Octopi	-----
C2 (35m)	NR	NR	NR	Octopi	-----	Octopi	Octopi	Octopi
C3 (60m)	NR	NR	NR	-----	-----	Octopi	Octopi	-----
D1 (60m)	NR	NR	NR	Eel	Black Sea Bass	-----	Crab; Eel	-----
D2 (60m)	NR	NR	NR	-----	-----	-----	----	Eels

NR = Not Recorded.

VII. DATA ARCHIVING

7.1 Introduction

All of the CTD, ARGOS and GPS drifter, and current meter data have been processed and submitted to NODC. The assigned NODC Project Identification Number for all three types of data is 0208. The particulars of each type of data submittal are presented below.

7.2 Data Submitted to NODC

7.2.1 CTD Data

The CTD data were processed and submitted to NODC in format F-022. These submissions occurred in a series of interim and one final submission using the unique NODC project number 0208. The final hydrographic data submission was sent on May 12, 1994. The data are identified by their respective cruise identification numbers which are presented earlier in Table 4.2-1.

7.2.2 Drifter Data

Both ARGOS-tracked and GPS drifter data were processed until they quit transmitting. These data were submitted in a series of submissions, the last of which was May 11, 1994. All of the data, including data from outside the study area, were submitted to NODC in format F-156 using the unique NODC project number 0208. The data are identified by their respective IDs which are presented earlier in Tables 4.3-1, 4.3-2 and 4.3-3.

7.2.3 Current Meter Data

When the processing of each current meter data set was completed at the end of each mooring rotation, an interim submission was made to NODC using Format F-015 and the unique NODC project number 0208. Due to the large number of instruments that were recovered later than the rest of their respective deployments and the data which required special processing, a final submission including data from the entire program and superseding all previous submissions was made on May 11, 1994. Table 7.2-1(a-f) presents a compilation of all of the current meter raw data files (by name) which were submitted.

Table 7.2-1a Compilation of current meter raw data file names.

MOORING	DEPTH (M)	LATITUDE/ LONGITUDE	INSTRUMENT TYPE, RAW DATA FILE NAME AND DEPTH			
			INITIAL DEPLOYMENT (February 1992)	SECOND DEPLOYMENT (April-May 1992)	THIRD DEPLOYMENT (August-September 1992)	FOURTH DEPLOYMENT (November 1992)
A1	22	36°14.7'N 75°42.5'W	IO HA111C.D (5m) IO HA112C.D (16m)	IO HA121C.D (5m) IO HA122C.D (16m)	IO HA131C.D (5m) IO HA132C.D (16m)	IO HA141C.D (5m) IO HA142C.D (16m)
A2	35	36°14.7'N 75°12.4'W 36°14.9'N 75°12.4'W	IO HA211C.D (5m) GO HA212C.D (20m) GO HA213C.D (30m)	IO HA221C.D (5m) GO HA222C.D (20m) GO HA223C.D (30m)	IO HA231C.D (5m) GO HA232C.D (20m) GO HA233C.D (30m)	IO HA241C.D (5m) GO HA242C.D (20m) GO HA243C.D (30m)
A3	60	36°14.6'N 74°54.4'W 36°14.8'N 74°54.5'W 36°14.3'N 74°54.5'W	IO HA311C.D (5m) GO HA312C.D (30m) GO HA313C.D (55m)	IO HA321C.D (5m) NOT ROTATED (30m) NOT ROTATED (55m) GO HA322C.D (30m)	IO HA331C.D (5m) NOT ROTATED (30m) NOT ROTATED (55m) GO HA332C.D (30m) GO HA333C.D (55m)	IO HA341C.D (5m) GO HA342C.D (30m) GO HA343C.D (55m)
A4	2020	36°15.1'N 74°19.6'W	GO HA411C.D (100m) GO HA412C.D (300m) GO HA413C.D (800m) GO HA414C.D (1200m) AA HA415C.D (1900m)	NOT ROTATED (100m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m)	GO HA421C.D (100m) GO HA422C.D (300m) GO HA423C.D (800m) GO HA424C.D (1200m) AA HA425C.D (1900m)	NOT ROTATED (100m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m)
A5	3000	36°18.3'N 73°43.7'W	GO HA511C.D (60m) GO HA512C.D (300m) GO HA513C.D (800m) G0 HA514C.D (1200m) AA HA515C.D (1900m) AA HA516C.D (2900m)	NOT ROTATED (60m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m) NOT ROTATED (2900m)	GO FLOODED (60m) GO HA522C.D (300m) GO HA523C.D (800m) GO HA524C.D (1200m) AA HA525C.D (1900m) AA HA526C.D (2900m)	NOT ROTATED (60m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m) NOT ROTATED (2900m)
B1	21	35°28.9'N 75°21.4'W	IO HB111C.D (5m) IO HB112C.D (14m)	IO HB121C.D (5m) IO HB122C.D (14m)	IO HB131C.D (5m) IO HB132C.D (14m)	IO HB141C.D (5m) IO HB142C.D (14m)
B2	35	35°25.1'N 75°03.4'W 35°25.3'N 75°03.2'W	IO HB211C.D (5m) GO HB212C.D (20m) GO HB213C.D (30m)	IO HB221C.D (5m) GO HB222C.D (20m) GO HB223C.D (30m)	IO HB231C.D (5m) GO HB232C.D (20m) GO HB233C.D (30m)	IO HB241C.D (5m) GO HB242C.D (20m) GO HB243C.D (30m)

Table 7.2-1b Compilations of current meter raw data file names.

MOORING	DEPTH (M)	LATITUDE/ LONGITUDE	INSTRUMENT TYPE, RAW DATA FILE NAME AND DEPTH			
			FIFTH DEPLOYMENT (February 1993)	SIXTH DEPLOYMENT (May 1993)	SEVENTH DEPLOYMENT (August 1993)	EIGHTH DEPLOYMENT (Oct.-Nov. 1993)
A1	22	36°14.7'N 75°42.5'W	IO HA151C.D (5m) IO HA152C.D (16m)	I0 HA161C.D (5m) I0 HA162C.D (14m)	I0 HA171C.D (5m) I0 HA172C.D (14m)	I0 HA181C.D (5m) I0 HA182C.D (14m)
A2	35	36°14.7'N 75°12.4'W	IO HA251C.D (5m)	I0 HA261C.D (5m)	I0 HA271C.D (5m)	I0 *LOST* (5m)
		36°14.9'N 75°12.4'W	GO HA252C.D (20m) GO HA253C.D (30m)	GO HA262C.D (20m) GO HA263C.D (30m)	GO HA272C.D (20m) GO HA273C.D (30m)	GO HA282C.D (20m) GO HA283C.D (30m)
A3	60	36°14.6'N 74°54.4'W	IO HA351C.D (5m)	I0 HA361C.D (5m)	I0 HA371C.D (5m)	I0 HA381C.D (5m)
		36°14.8'N 74°54.5'W			GO HA372C.D (30m) GO HA373C.D (55m)	GO HA382C.D (30m) GO HA383C.D (55m)
		36°14.3'N 74°54.5'W	GO HA352C.D (30m) GO HA353C.D (55m)	GO HA362C.D (30m) GO HA363C.D (55m)		
A4	2020	36°15.1'N 74°19.6'W	NOT ROTATED (100m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m)	GO HA431C.D (100m) GO HA432C.D (300m) GO HA433C.D (800m) GO HA434C.D (1200m) GO H4A35C.D (1900m)	GO HA441C.D (100m) GO HA442C.D (300m) GO HA443C.D (800m) GO HA444C.D (1200m) AA HA445C.D (1900m)	NOT ROTATED (100m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m)
A5	3000	36°18.3'N 73°43.7'W	NOT ROTATED (60m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m) NOT ROTATED (2900m)	GO *LOST* (60m) GO HA532C.D (300m) GO HA533C.D (800m) GO HA534C.D (1200m) AA HA535C.D (1900m) AA HA536C.D (2900m)	NOT ROTATED (60m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m) NOT ROTATED (2900m)	
B1	21	35°28.9'N 75°21.4'W	IO HB151C.D (5m) IO HB152C.D (14m)	I0 HB161C.D (5m) I0 HB162C.D (14m)	I0 HB171C.D (5m) I0 HB172C.D (14m)	I0 HB181C.D (5m) I0 HB182C.D (14m)
B2	35	35°25.1'N 75°03.4'W	IO FLOODED (5m)	I0 HB261C.D (5m)	I0 HB271C.D (5m)	I0 HB281C.D (5m)
		35°25.3'N 75°03.2'W	GO HB252C.D (20m) GO HB253C.D (30m)	GO HB262C.D (20m) GO HB263C.D (30m)	GO HB272C.D (20m) GO HB273C.D (30m)	GO HB282C.D (20m) GO HB283C.D (30m)

Table 7.2-1c Compilation of current meter raw data file names.

MOORING	DEPTH (M)	LATITUDE/ LONGITUDE	INSTRUMENT TYPE, RAW DATA FILE NAME AND DEPTH			
			INITIAL DEPLOYMENT (February 1992)	SECOND DEPLOYMENT (April-May 1992)	THIRD DEPLOYMENT (August-September 1992)	FOURTH DEPLOYMENT (November 1992)
B3	61	35°23.8'N 74°56.5'W	IO HB311C.D (5m)	IO HB321C.D (5m)	GO *LOST* (8m)	NOT ROTATED (8m)
		35°24.0'N 74°56.4'W	GO HB312C.D (30m) GO HB313C.D (55m)	GO HB322C.D (30m) GO HB323C.D (55m)	GO HB332C.D (30m) GO HB333C.D (55m)	GO *LOST* (30m) GO *LOST* (55m)
		35°23.5'N 74°56.8'W				
B4	2000	35°21.6'N 74°43.0'W	GO HB411C.D (100m) GO HB412C.D (300m) GO HB413C.D (800m) GO HB414C.D (1200m) AA HB415C.D (1900m)	NOT ROTATED (100m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m)	GO HB421C.D (100m) GO HB422C.D (300m) GO HB423C.D (800m) GO HB424C.D (1200m) AA HB425C.D (1900m)	NOT ROTATED (100m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m)
C1	20	35°03.8'N 75°54.3'W	IO HC111C.D (5m) IO HC112C.D (14m)	IO HC121C.D (5m) IO HC122C.D (14m)	IO HC131C.D (5m) IO HC132C.D (14m)	IO HC141C.D (5m) IO HC142C.D (14m)
C2	35	34°53.5'N 75°40.8'W	IO HC211C.D (5m)	IO HC221C.D (5m)	IO HC231C.D (5m)	IO HC241C.D (5m)
		34°53.4'N 75°40.5'W	GO HC212C.D (20m) GO HC213C.D (30m)	GO HC222C.D (20m) GO HC223C.D (30m)	GO HC232C.D (20m) GO HC233C.D (30m)	GO HC242C.D (20m) GO HC243C.D (30m)
C3	61	34°47.8'N 75°34.6'W	IO HC311C.D (5m)	NOT ROTATED (5m)	IO HC331C.D (5m) GO *LOST* (9m)	IO *LOST* (5m)
		34°48.0'N 75°34.4'W	GO HC312C.D (30m) GO HC313C.D (55m)	NOT ROTATED (30m) NOT ROTATED (55m)	GO HC332C.D (30m) GO HC333C.D (55m)	GO HC342C.D (30m) GO HC343C.D (55m)
C4	2000	34°41.5'N 75°21.0'W	GO HC411C.D (100m) GO FLOODED (300m) GO HC413C.D (800m) GO HC414C.D (1200m) AA HC415C.D (1900m)	NOT ROTATED (100m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m)	GO HC421C.D (100m) GO HC422C.D (300m) GO HC423C.D (800m) GO HC424C.D (1200m) AA HC425C.D (1900m)	NOT ROTATED (100m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m)

Table 7.2-1d Compilation of current meter raw data files names.

MOORING	DEPTH (M)	LATITUDE/ LONGITUDE	INSTRUMENT TYPE, RAW DATA FILE NAME AND DEPTH			
			FIFTH DEPLOYMENT (February 1993)	SIXTH DEPLOYMENT (May 1993)	SEVENTH DEPLOYMENT (August 1993)	EIGHTH DEPLOYMENT (Oct.-Nov. 1993)
B3	61	35°23.8'N 74°56.5'W	IO HB351C.D (5m)	I0 *LOST* (5m)	I0 *LOST* (5m)	NOT ROTATED (5m)
		35°24.0'N 74°56.4'W		GO *LOST* (30m) GO *LOST* (55m)		
		35°23.5'N 74°56.8'W	GO HB352C.D (30m) GO HB353C.D (55m)	NOT ROTATED (30m) NOT ROTATED (55m)	GO HB372C.D (30m) GO HB373C.D (55m)	GO *LOST* (30m) GO HB383C.D (55m)
B4	2000	35°21.6'N 74°43.0'W	GO HB431C.D (100m) GO HB432C.D (300m) GO FLOODED (800m) GO HB434C.D (1200m) AA HB435C.D (1900m)	NOT ROTATED (100m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m)	G0 HB441C.D (100m) GO HB442C.D (300m) GO HB443C.D (800m) GO HB444C.D (1200m) AA HB445C.D (1900m)	NOT ROTATED (100m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m)
C1	20	35°03.8'N 75°54.3'W	IO HC151C.D (5m) IO HC152C.D (14m)	I0 HC161C.D (5m) I0 HC162C.D (5m)	I0 HC171C.D (5m)	I0 HC181C.D (5m)
C2	35	34°53.5'N 75°40.8'W	IO HC251C.D (5m)	I0 HC261C.D (5m)	I0 HC271C.D (5m)	I0 *LOST* (5m)
		34°53.4'N 75°40.5'W	GO HC252C.D (20m) GO HC253C.D (30m)	GO HC262C.D (20m) GO HC263C.D (30m)	GO HC272C.D (20m) GO HC273C.D (30m)	GO HC282C.D (20m) GO HC283C.D (30m)
C3	61	34°47.8'N 75°34.6'W		I0 HC361C.D (5m)		
		34°48.0'N 75°34.4'W	GO HC352C.D (30m) GO HC353C.D (55m)	GO HC362C.D (30m) GO HC363C.D (55m)	GO HC372C.D (30m) GO HC373C.D (55m)	GO *LOST* (30)m GO *LOST* (55)m
C4	2000	34°41.5'N 75°21.0'W	GO HC431C.D (100m) GO HC432C.D (300m) GO HC433C.D (800m) GO HC434C.D (1200m) AA HC435C.D (1900m)	NOT ROTATED (100m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m)	GO HC441C.D (100m) GO HC442C.D (300m) GO HC443C.D (800m) GO HC444C.D (1200m) AA HC445C.D (1900m)	NOT ROTATED (100m) NOT ROTATED (300m) NOT ROTATED (800m) NOT ROTATED (1200m) NOT ROTATED (1900m)

Table 7.2-1e Compilation of current meter raw data file names.

MOORING	DEPTH (M)	LATITUDE/ LONGITUDE	INSTRUMENT TYPE, RAW DATA FILE NAME AND DEPTH			
			INITIAL DEPLOYMENT (February 1992)	SECOND DEPLOYMENT (April-May 1992)	THIRD DEPLOYMENT (August-September 1992)	FOURTH DEPLOYMENT (November 1992)
D1	61	36°01.6'N 74°57.2'W	IO HD111C.D (5m)	IO HD121C.D (5m)	IO HD131C.D (5m)	IO HD141C.D (5m)
		36°01.5'N 74°57.1'W	GO HD112C.D (30m) GO HD113C.D (55m)	GO HD122C.D (30m) GO HD123C.D (55m)	GO HD132C.D (30m) GO HD133C.D (55m)	GO HD142C.D (30m) GO HD143C.D (55m)
D2	60	35°42.9'N 74°56.0'W	IO HD211C.D (5m)	IO HD221C.D (5m)	IO HD231C.D (5m)	IO HD241C.D (5m)
		35°43.2'N 74°56.0'W	GO HD212C.D (30m) GO HD213C.D (55m)	GO HD222C.D (30m) GO HD223C.D (55m)	GO HD232C.D (30m) GO HD233C.D (55m)	NOT ROTATED (30m) NOT ROTATED (55m)
		35°42.5'N 74°55.8'W				GO HD242C.D (30m) GO HD243C.D (55m)

AA = Aanderaa RCM-5/8 or RCM-8 current meter
GO = General Oceanics Mk1 or Mk2 current meter
IO = InterOcean S4 current meter

Table 7.2-1f Compilation of current meter raw data file names.

MOORING	DEPTH (M)	LATITUDE/ LONGITUDE	INSTRUMENT TYPE, RAW DATA FILE NAME AND DEPTH			
			FIFTH DEPLOYMENT (February 1993)	SIXTH DEPLOYMENT (May 1993)	SEVENTH DEPLOYMENT (August 1993)	EIGHTH DEPLOYMENT (Oct.-Nov. 1993)
D1	61	36°01.6'N 74°57.2'W	NOT ROTATED (5m)	I0 HD161C.D (5m)	I0 *LOST* (5m)	NOT ROTATED (5m)
		36°01.5'N 74°57.1'W	GO HD152C.D (30m) GO HD153C.D (55m)	GO HD162C.D (30m) GO HD163C.D (55m)	G0 HD172C.D (30m) G0 HD173C.D (55m)	GO HD182C.D (30m) GO HD183C.D (55m)
D2	60	35°42.9'N 74°56.0'W	NOT ROTATED (5m)	I0 HD261C.D (5m)	I0 HD271C.D (5m)	I0 HD281C.D (5m)
		35°43.2'N 74°56.0'W	GO HD252C.D (30m) GO HD253C.D (55m)	GO HD262C.D (30m) GO HD263C.D (55m)	GO HD272C.D (30m) GO HD273C.D (55m)	GO HD282C.D (30m) GO HD283C.D (55m)
		35°42.5'N 74°55.8'W				

AA = Aanderaa RCM-5/8 or RCM-8 current meter
GO = General Oceanics Mk1 or Mk2 current meter
IO = InterOcean S4 current meter

The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

The Minerals Management Service Mission

As a bureau of the Department of the Interior, the Minerals Management Service's (MMS) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS), collect revenue from the Federal OCS and onshore Federal and Indian lands, and distribute those revenues.

Moreover, in working to meet its responsibilities, the **Offshore Minerals Management Program** administers the OCS competitive leasing program and oversees the safe and environmentally sound exploration and production of our Nation's offshore natural gas, oil and other mineral resources. The MMS **Minerals Revenue Management** meets its responsibilities by ensuring the efficient, timely and accurate collection and disbursement of revenue from mineral leasing and production due to Indian tribes and allottees, States and the U.S. Treasury.

The MMS strives to fulfill its responsibilities through the general guiding principles of: (1) being responsive to the public's concerns and interests by maintaining a dialogue with all potentially affected parties and (2) carrying out its programs with an emphasis on working to enhance the quality of life for all Americans by lending MMS assistance and expertise to economic development and environmental protection.