Hydrographic Sampling of the Chukchi Sea during the R.V. Alpha Helix Cruise, HX194, in September 1996

by:

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Report #: CTD-0A08.DOC

INTRODUCTION

This report describes the CTD sampling during the oceanographic cruise, HX194, of the R.V. Alpha Helix. The work area for this cruise was the Chukchi Sea north of the Bering Strait. This cruise was an international collaborative effort between Japanese, Russian, and U.S. scientists. The ship time was funded in part by the National Science Foundation (OPP-9630774 to Christensen) and in part by the Japan Marine Science and Technology Center (JAMSTEC). This report was prepared via support from NSF (OPP-9630774 and OPP-9905947).

METHODS & RESULTS

The R.V. Alpha Helix left Dutch Harbor Alaska on 28 August 1996 and returned to Seward Alaska on 6 October 1996. The work area was the U.S. and international portions of the Chukchi Sea north of the Bering Strait. The ship began scientific operations in the Bering Strait on the evening of 31 August. Having completed the major goals of the cruise, we left the Bering Strait heading south on 27 September.

The scientific party was:

Dr. John Christensen	Chief Scientist	Bigelow Laboratory	USA
Mr. Andrew Gilbert	Scientist	Bigelow Laboratory	USA
Ms. Alice Murphy [(a)]	Scientist	Oregon State Univ.	USA

Dr. Pavel Tichchenko [b]	Scientist	Pacific Oceanological Institute	Russia
Mr. Nicolay Pivovarov [b]	Scientist	Pacific Oceanological Institute	Russia
Mr. David Allen [c]	Scientist	University of Alaska	USA
Dr. Koji Shimada	Scientist	JAMSTEC	Japan
Mr. Kiyoshi Hatakeyama	Scientist	JAMSTEC	Japan
Mr. Noboru Koyama	Scientist	JAMSTEC	Japan
Mr. Tatsuro Hara	Scientist	JAMSTEC	Japan
Mr. Masayuki Fujisaki	Scientist	JAMSTEC	Japan
Mr. Steven Hartz		University of Alaska	USA
Ms. Christine Cooper-Sheehan		University of Alaska	USA

Collaborators included Dr. P.A. Wheeler (Oregon State University, a above), Dr. Igor Semiletov (Pacific Oceanological Institute, b above), and Dr. T. Weingartner (University of Alaska, c above) who recovered current meter moorings during the cruise. Also, Dr. K. Faulkner (Oregon State University) received water samples.

Over the 4 week period, the hydrographic and water chemistry portions of the work were accomplished by 204 CTD casts from the seasurface to the seafloor. Locations and sampling times for the CTD casts are listed in TABLE 1 and the locations are depicted in Figs. 1-3. Using the R.V. Alpha Helix's Seabird CTD with Rosette system, continuous profiles were made on the downcast with data was averaged over 1 m intervals and Niskin bottles were tripped on the upcast. This system continuously measures conductivity, temperature, pressure, light transmission, in situ fluorescence, and oxygen. Most CTD casts were taken within major transects (Fig.1). Line B extended across the U.S. portion of the Bering Strait and was occupied twice, at the beginning and at the end of the cruise (Fig. 2). Line C was the north-south line located just 5 nm east of the Russian/U.S. border. Stations extended from the Bering Strait in the south to the ice edge in the north. The lower section north of the Bering Strait was occupied at the beginning of the cruise and at the end. Line F followed the ice edge eastward from the border line toward the Hannah Shoal. Several transect lines were made crossing Barrow Canyon and crossing the shelf break on the east and west of the Canyon's mouth (Fig. 3). Three current meter moorings were recovered and three were deployed (Figs. 2,3, Table 2).

The CTD data was converted from the format used by the Institute for Marine Studies, University of Alaska Fairbanks, to standard Seabird format (Seasoft CTD Data Acquisition software version 4.224). The programs used for this conversion are available from the chief scientist. Salinities assessed by the CTD, with shipboard correction factors, were 0.007 psu high from 5 bottle samples collected from greater than 100 m from different times during the cruise. The salinity of these bottle samples were determined on an AutoSal salinometer after the cruise using IAPSO standard seawater as reference. CTD results were corrected for this error. Data from several stations showed significant differences between the first and second sets of temperature and conductivity sensors. Ultimately, sensor set 2 were deemed most appropriate on CTD casts 11, 116, and 122-126. Details of the comparisons and corrections are available from the Chief Scientist.

The table, CTD-FULL.CSV, lists all the downcast data in comma separated value format. The first ten lines of the file are the header, giving the data name and units. The presented data are: CTD cast number (column 1), the sensor set number (column 2), water depth (column 3), pressure (column 4), temperature (column 5), potential temperature (column 6), conductivity (column 7), salinity (column 8), sigma-t (column 9), sigma-theta (column 10), fluorescence (column 11), transmissometer output (column 12), oxygen probe O_2 concentrations (column 13), geopotential anomaly (column 14), dynamic height (column 15), specific volume anomaly (column 16), and bouyancy (Brunt Vaisala frequency, column 17). The fluorescence and transmissometry output were uncorrected voltage outputs, and the oxygen concentrations have not been compared with titrated samples. There are 17134 rows of data in the table, CTD-FULL.CSV.

TABLE 1. Sampling times and locations of all CTD/rosette casts made during the cruise, HX194, on the R/V Alpha Helix. Each CTD was given a chronological cast number. CTDs were generally located along transect lines. For station types listed as 0, only automated data (temperature, salinity, depth, etc.) were measured. More complete biological and chemical sampling occurred at stations of type 2. Latitude and Longitude is given in decimal degrees (DECDEG). This Table is available in the comma separated value file, X194CTD2.CSV.

FILE: X194CTD2.CSV
DATE: 15OC96
BY: JPC&AG
OF ROWS: 204
OF COLS: 14
NOTE 1: CRUISE HX194 CTD STATION LISTING
NOTE 2:

CAST #	LINE #	STATION NAME	STATION TYPE	DATE GMT	TIME GMT	LATITUDE NORTH	LONGITUDE WEST
-	-	-	0/2	MN/DAY/YR	H:M:S	DECDEG	DECDEG
1	B1	L1-1	2	09/01/96	5:42:11	65.6862	-168.1742
2	B1	L1-2	0	09/01/96	6:28:05	65.6968	-168.3185
3	B1	L1-2	2	09/01/96	6:59:31	65.6980	-168.3180
4	B1	L1-3	2	09/01/96	7:54:38	65.7133	-168.4677
5	B1	L1-4	2	09/01/96	8:53:04	65.7282	-168.6150
6	B1	L1-5	2	09/01/96	9:59:43	65.7383	-168.7477
7	B1	L1-6	2	09/01/96	10:53:45	65.7583	-168.8690
8	C1	L2-1	2	09/01/96	17:54:25	66.0017	-168.8605
9	C1	L2-2	0	09/01/96	19:55:26	66.3343	-168.8698
10	C1	L2-3	2	09/01/96	21:58:05	66.6682	-168.8652
11	C1	L2-4	0	09/02/96	0:00:06	67.0010	-168.8642
12	C1	L2-5	0	09/02/96	2:11:06	67.3352	-168.8647
13	C1	L2-6	2	09/02/96	4:18:04	67.6673	-168.8640
14	C1	L2-7	0	09/02/96	6:42:22	68.0007	-168.8643
15	C1	L2-8	2	09/02/96	8:54:40	68.3343	-168.8665
16	C1	L2-9	0	09/02/96	11:03:25	68.6675	-168.8662
17	C1	L2-10	2	09/02/96	13:14:18	69.0007	-168.8650
18	MOORB	1-95	0	09/03/96	21:53:35	71.0512	-159.5230
19	MOORJ	1QO	0	09/04/96	8:03:03	71.0562	-159.5237
20	N	L17-1	0	09/04/96	20:17:45	71.5002	-153.4995
21	N	L17-1	2	09/04/96	20:35:14	71.4998	-153.5003
22	N	L17-2	2	09/04/96	21:50:27	71.5833	-153.4190
23	N	L17-3	0	09/04/96	22:55:17	71.6675	-153.3348
24	N	L17-4	2	09/05/96	0:01:22	71.7508	-153.2507
25	N	L17-5	2	09/05/96	1:46:44	71.8742	-153.1258
26	N	L17-5	2	09/05/96	3:23:05	71.8745	-153.1220
27	MOORC	B-W96	0	09/05/96	4:48:05	71.7953	-153.2053
28	CORE A		0	09/06/96	1:06:14	71.9802	-156.6777
29	L1	L15-1	2	09/06/96	3:59:37	72.0013	-156.0002

30	L1	L15-2	0	09/06/96	5:03:59	72.0338	-155.8338

TABLE 1 continued.

31	L1	L15-3	0	09/06/96	6:18:51	72.0678	-155.6660
32	L1	L15-4	2	09/06/96	7:18:40	72.1012	-155.4995
33	L1	L15-5	0	09/06/96	8:27:34	72.1343	-155.3338
34	M	L15-6	2	09/06/96	9:25:46	72.1677	-155.1663
35	M	L16-8	0	09/06/96	11:19:54	72.0833	-155.0833
36	M	L16-7	0	09/06/96	12:33:36	72.0007	-154.9995
37	M	L16-6	0	09/06/96	13:41:55	71.9172	-154.9150
38	M	L16-5	0	09/06/96	14:51:40	71.8347	-154.8367
39	M	L16-4	0	09/06/96	15:51:00	71.7520	-154.7445
40	M	L16-3	0	09/06/96	16:40:15	71.6677	-154.6648
41	M	L16-2	0	09/06/96	17:25:14	71.5853	-154.5782
42	M	L16-1	2	09/06/96	18:11:52	71.5017	-154.4985
43	L1	L14-2	2	09/06/96	20:16:53	71.4172	-155.4147
44	L1	L14-3	0	09/06/96	21:01:59	71.5005	-155.5007
45	L1	L14-4	0	09/06/96	21:45:03	71.5840	-155.5808
46	L1	L14-5	2	09/06/96	22:37:14	71.6540	-155.6508
47	L1	L14-6	0	09/07/96	0:03:11	71.7505	-155.7513
48	L1	L14-7	0	09/07/96	0:52:36	71.8337	-155.8350
49	L1	L14-8	0	09/07/96	1:39:48	71.9165	-155.9175
50	MOORJW1-96		0	09/07/96	3:35:13	71.7623	-155.2242
51	K1	L12-2	0	09/07/96	11:00:17	71.3343	-156.8297
52	K1	L12-3	2	09/07/96	11:56:00	71.4165	-156.9183
53	K1	L12-4	0	09/07/96	13:12:57	71.4998	-157.0033
54	D	L3-9	0	09/10/96	8:12:38	67.9990	-165.9993
55	D	L3-8	0	09/10/96	9:24:12	67.9987	-166.3310
56	D	L3-7	0	09/10/96	10:31:52	67.9992	-166.6658
57	D	L3-6	0	09/10/96	11:45:08	67.9990	-166.9997
58	D	L3-5	2	09/10/96	12:55:28	67.9985	-167.3333
59	D	L3-4	0	09/10/96	14:26:00	67.9975	-167.6718
60	D	L3-3	0	09/10/96	15:58:19	67.9977	-168.0017
61	D	L3-2	0	09/10/96	17:06:15	67.9978	-168.3322
62	D	L3-1	2	09/10/96	18:13:35	67.9965	-168.6667
63	CORE B		0	09/10/96	20:05:19	67.9085	-168.9477
64	MOORCBJ-96		0	09/12/96	4:47:10	71.0900	-159.4180
65	I	L8-3	0	09/12/96	6:54:06	70.9160	-159.4212
66	I	L8-4	0	09/12/96	8:07:05	70.9995	-159.5030
67	I	L8-5	2	09/12/96	9:16:46	71.0825	-159.5878
68	I	L8-6	0	09/12/96	10:44:24	71.1668	-159.6695
69	I	L8-7	0	09/12/96	11:56:05	71.2495	-159.7537
70	I	L8-8	0	09/12/96	13:13:04	71.3333	-159.8360
71	I	L8-9	0	09/12/96	15:09:25	71.5002	-160.0013
72	I	L8-10	0	09/12/96	16:41:02	71.6652	-160.1752
73	I	L8-11	0	09/12/96	18:09:26	71.8325	-160.3363
74	I	L8-12	0	09/12/96	19:29:34	71.9995	-160.5030
75	I	L8-13	0	09/12/96	21:01:01	72.1675	-160.6642

76	I	L8-14	0	09/12/96	22:32:16	72.3340	-160.8333
77	I	L8-15	0	09/12/96	23:55:09	72.4997	-160.9997
78	I	L8-15	2	09/13/96	0:16:41	72.5003	-161.0020
79	I	L8-16	0	09/13/96	2:07:25	72.6668	-161.1688
80	I	L8-17	0	09/13/96	3:42:18	72.8335	-161.3402

TABLE 1 continued.

81	CORE C		0	09/13/96	5:08:56	72.8258	-161.3172
82	L2	L18-1	0	09/14/96	1:06:07	71.4172	-155.4165
83	L2	L18-2	0	09/14/96	1:36:44	71.4607	-155.4583
84	L2	L18-3	0	09/14/96	1:58:54	71.5000	-155.5032
85	L2	L18-4	0	09/14/96	2:23:07	71.5422	-155.5445
86	L2	L18-5	0	09/14/96	2:52:30	71.5825	-155.5858
87	L2	L18-6	0	09/14/96	3:34:17	71.6252	-155.6278
88	L2	L18-7	0	09/14/96	4:17:09	71.6542	-155.6523
89	L2	L18-8	0	09/14/96	5:11:54	71.7078	-155.7115
90	L2	L18-9	0	09/14/96	5:50:54	71.7495	-155.7548
91	L2	L18-10	0	09/14/96	6:25:47	71.7913	-155.7957
92	L2	L18-11	0	09/14/96	6:58:39	71.8337	-155.8358
93	L2	L18-12	0	09/14/96	7:46:10	71.9175	-155.9208
94	L2	L19-1	0	09/14/96	8:37:46	72.0002	-156.0018
95	L2	L19-2	0	09/14/96	9:17:54	72.0335	-155.9177
96	L2	L19-3	0	09/14/96	9:52:00	72.0670	-155.8343
97	L2	L19-4	0	09/14/96	10:32:37	72.1003	-155.7530
98	L2	L19-5	0	09/14/96	11:13:54	72.1338	-155.6710
99	L2	L19-6	2	09/14/96	12:41:03	72.1993	-155.5087
100	L2	L19-5A	0	09/14/96	13:45:24	72.1662	-155.5880
101	L2	L19-3	0	09/14/96	14:52:06	72.0670	-155.8353
102	K2	L13-3	0	09/14/96	18:30:45	71.9173	-157.2512
103	K2	L13-2	0	09/14/96	19:14:57	71.8325	-157.2530
104	K2	L13-1	0	09/14/96	19:56:07	71.7488	-157.2507
105	K2	L12-6	0	09/14/96	20:48:12	71.6667	-157.1630
106	K2	L12-5	0	09/14/96	21:37:55	71.5830	-157.0827
107	K2	L12-4	0	09/14/96	22:30:56	71.4998	-156.9967
108	K2	L12-3	0	09/14/96	23:29:21	71.4168	-156.9157
109	K2	L12-2	0	09/15/96	0:26:40	71.3330	-156.8323
110	J	L10-1	0	09/15/96	4:00:52	70.9170	-157.9197
111	J	L10-2	0	09/15/96	4:43:01	71.0005	-158.0013
112	J	L10-3	0	09/15/96	5:26:09	71.0837	-158.0838
113	J	L10-4	0	09/15/96	6:11:01	71.1672	-158.1687
114	J	L10-5	2	09/15/96	6:58:33	71.2508	-158.2535
115	J	L10-5	2	09/15/96	7:07:00	71.2522	-158.2582
116	J	L10-6	0	09/15/96	8:21:08	71.3335	-158.3330
117	J	L10-7	0	09/15/96	9:14:22	71.4165	-158.4180
118	J	L10-8	0	09/15/96	10:04:30	71.4998	-158.4998
119	J	L10-9	0	09/15/96	11:25:28	71.6663	-158.6677
120	J	L10-10	0	09/15/96	12:45:54	71.8332	-158.8367
121	J	L10-11	0	09/15/96	14:08:17	71.9993	-159.0020
122	J	L10-12	0	09/15/96	16:53:06	72.1663	-159.2193
123	J	L10-13	0	09/15/96	18:23:57	72.3320	-159.3452
124	J	L10-14	0	09/15/96	19:42:49	72.5008	-159.5070
125	J	L10-14	0	09/15/96	19:47:03	72.5007	-159.5088

126	J	L10-14	2	09/15/96	20:39:45	72.4988	-159.5002
127	CORE	D	0	09/16/96	15:20:28	72.0003	-168.8377
128	C1	L2-19	2	09/16/96	19:03:41	71.9995	-168.8700
129	C1	L2-18	0	09/16/96	21:16:29	71.6650	-168.8708
130	C1	L2-17	2	09/16/96	23:28:30	71.3318	-168.8678

TABLE 1 continued.

131	C1	L2-16	0	09/17/96	1:39:30	70.9993	-168.8670
132	C1	L2-15	2	09/17/96	3:51:43	70.6650	-168.8700
133	C1	L2-14	0	09/17/96	6:02:51	70.3328	-168.8692
134	C1	L2-13	2	09/17/96	8:14:41	69.9993	-168.8673
135	E	L4-9	0	09/17/96	9:33:19	69.8327	-168.6670
136	E	L4-8	0	09/17/96	11:01:39	69.6662	-168.3330
137	E	L4-7	0	09/17/96	12:29:03	69.5002	-168.0013
138	E	L4-6	0	09/17/96	13:58:21	69.3335	-167.6662
139	E	L4-5	0	09/17/96	15:31:31	69.1668	-167.3342
140	E	L4-4	0	09/17/96	17:05:15	69.0003	-167.0003
141	E	L4-3	2	09/17/96	18:00:30	68.9167	-166.8325
142	E	L4-2	0	09/17/96	19:18:01	68.8308	-166.6663
143	E	L4-1	0	09/17/96	20:13:38	68.7498	-166.4985
144	CORE E		0	09/20/96	15:13:32	70.0012	-167.6603
145	C1	L2-20	2	09/21/96	7:11:59	72.1685	-168.8612
146	C1	L20-1	2	09/21/96	20:47:57	72.8853	-168.6660
147	F	L20-2	0	09/21/96	22:03:39	72.8475	-168.3378
148	F	L20-3	2	09/21/96	23:49:08	72.7472	-168.0030
149	F	L20-4	0	09/22/96	1:01:33	72.6767	-167.6673
150	F	L20-5	0	09/22/96	2:41:58	72.6957	-167.3353
151	F	L20-6	2	09/22/96	3:43:32	72.7052	-166.9973
152	F	L20-7	0	09/22/96	4:48:58	72.6918	-166.6688
153	F	L20-8	2	09/22/96	5:52:47	72.7157	-166.3292
154	F	L20-9	0	09/22/96	7:08:54	72.6208	-166.0005
155	F	L20-10	0	09/22/96	17:28:47	72.5852	-165.6723
156	F	L20-11	2	09/22/96	18:35:37	72.5992	-165.3355
157	F	L20-12	0	09/22/96	19:54:38	72.6818	-165.0032
158	F	L20-13	0	09/22/96	21:01:50	72.6762	-164.6687
159	F	L20-14	2	09/22/96	22:05:57	72.6433	-164.3417
160	F	L20-14	2	09/22/96	22:13:21	72.6418	-164.3447
161	F	L20-15	0	09/22/96	23:17:35	72.6067	-164.0053
162	F	L20-16	0	09/23/96	0:26:06	72.6267	-163.6737
163	F	L20-17	0	09/23/96	1:31:59	72.6413	-163.3370
164	F	L20-18	2	09/23/96	2:35:59	72.6153	-162.9978
165	F	L20-19	0	09/23/96	4:55:04	72.5612	-162.5008
166	F	L20-20	0	09/23/96	6:20:02	72.6468	-162.0007
167	F	L20-20	0	09/23/96	7:44:42	72.6335	-161.9512
168	CORE F		0	09/24/96	0:16:20	72.5918	-165.0933
169	H	L7-5	0	09/24/96	17:55:19	71.0005	-161.0050
170	H	L7-4	0	09/24/96	18:59:44	70.9175	-160.8380
171	H	L7-3	0	09/24/96	19:52:01	70.8332	-160.6730
172	H	L7-2	0	09/24/96	21:01:16	70.7465	-160.5232
173	H	L7-1	2	09/24/96	22:00:59	70.6648	-160.3397
174	G	L6-7	2	09/25/96	4:01:12	70.7503	-163.5050
175	G	L6-6	0	09/25/96	4:55:29	70.6677	-163.3350
176	G	L6-5	0	09/25/96	5:48:09	70.5837	-163.1698

177	G	L6-4	0	09/25/96	6:38:46	70.5013	-163.0040
178	G	L6-3	2	09/25/96	7:30:17	70.4178	-162.8358
179	-	L5-7	0	09/25/96	12:36:47	69.8317	-164.6718
180	C2	L2-8	2	09/27/96	0:01:06	68.3313	-168.8713

TABLE 1 continued.

181	C2	L2-7	0	09/27/96	2:19:56	67.9988	-168.8658
182	C2	L2-6	2	09/27/96	4:31:24	67.6663	-168.8685
183	C2	L2-5	2	09/27/96	6:51:29	67.3332	-168.8670
184	C2	L2-4	0	09/27/96	9:11:56	67.0000	-168.8670
185	C2	L2-3	2	09/27/96	11:30:49	66.6668	-168.8662
186	C2	L2-2	0	09/27/96	13:57:32	66.3332	-168.8688
187	C2	L2-1	2	09/27/96	16:14:33	66.0012	-168.8673
188	B2	L1-6	2	09/27/96	17:56:19	65.7580	-168.8692
189	B2	L1-5	0	09/27/96	18:30:57	65.7370	-168.7512
190	B2	L1-4	0	09/27/96	19:04:24	65.7272	-168.6155
191	B2	L1-3	0	09/27/96	19:39:16	65.7118	-168.4682
192	B2	L1-2	0	09/27/96	20:15:39	65.6952	-168.3208
193	B2	L1-1	2	09/27/96	20:55:40	65.6833	-168.1657
194	-	L21-1	0	09/28/96	0:30:19	65.3330	-169.0003
195	-	L21-2	0	09/28/96	3:46:53	64.9995	-169.7675
196	A	L22-1	0	09/28/96	6:58:46	64.6658	-170.4983
197	A	L22-2	2	09/28/96	8:24:34	64.6675	-169.9972
198	A	L22-3	0	09/28/96	9:47:29	64.6675	-169.4975
199	A	L22-4	0	09/28/96	11:12:50	64.6672	-168.9983
200	A	L22-5	2	09/28/96	12:41:55	64.6677	-168.4985
201	A	L22-6	0	09/28/96	14:07:32	64.6680	-167.9987
202	A	L22-7	0	09/28/96	15:33:18	64.6673	-167.4992
203	A	L22-8	2	09/28/96	16:58:29	64.6673	-167.0005
204	A	L22-9	0	09/28/96	18:08:44	64.6673	-166.5820

TABLE 2. Current meter mooring sites where instruments were either recovered or deployed. This Table is also available in the comma separated value file, X194MOR2.CSV.

FILE: X194MOR2.CSV
DATE: 2OC96
BY: JPC
NOTE 1: MOORING LOCATIONS DURING HX194

MOORING NAME	JOB	LOCALE	DATE -- M/D/Y	TIME LOCAL HR:MIN
A2-95	RECOVER	BERING STRAIT	9/01/96	8:28
B1-95	RECOVER	BARROW CANYON	9/03/96	13:23
J-1-95	RECOVER	BARROW CANYON	9/03/96	23:05
JE-1-96	DEPLOY	EAST OF BARROW	9/04/96	21:59
JW-1-96	DEPLOY	BARROW C. MOUTH	9/06/96	22:10
J-1-96	DEPLOY	BARROW C. HEAD	9/11/96	21:29

MOORING NAME	|------- LATIUDE -------|			|----- LONGITUDE ----- |		DEPTH	CTD
	DEG	MIN	DECDEG	DEG	MIN	DECDEG	M	#
A2-95	65	46.60	65.7766	168	35.40	168.5900	52	-
B1-95	71	3.00	71.0500	159	31.60	159.5266	78	18
J-1-95	71	3.39	71.0565	159	31.82	159.5303	155	19
JE-1-96	71	47.59	71.7931	153	12.48	153.2080	249	27
JW-1-96	71	45.74	71.7623	155	13.57	155.2261	248	50
J-1-96	71	5.38	71.0896	159	24.88	159.4146	80	64

Figure 1. CTD transect lines and station locations and numbers on R.V. Alpha Helix cruise, HX194. Small circles are stations with only downcast CTD data. Large circles represent stations with chemical and biological measurements from Niskin bottles.

Figure 2. CTD sampling sites and current meter moorings in the Bering Strait region during the R.V. Alpha Helix cruise, HX194. Small and large circles represent CTD and CTD/Niskin bottle stations, respectively. Open triangles are mooring sites.

Figure 3. CTD sampling sites and current meter moorings in the Point Barrow region during the R.V. Alpha Helix cruise, HX194. Small and large circles represent CTD and CTD/Niskin bottle stations, respectively. Open triangles are mooring sites.