ALPHA HELIX CRUISE HX274
(0900) Monday 30th June 2003 – (0900) Tuesday 8th July 2003
Teller - Nome
BERING STRAIT CRUISE REPORT

FUNDING SOURCE: NSF-OPP-0125082 (Grebmeier, U of TN)
ONR: N00014-99-1-0345 (Aagaard & Woodgate, UW)

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SCIENTIFIC PERSONNEL:

Rebecca Woodgate	APL, Moorings, Chief Scientist	(F)
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Terry Whitledge	UAF, Nutrients & Sampler	(M)
Sarah Thornton	UAF, Nutrients & Sampler	(F)
Sang Heon Lee	UAF, Nutrients & Sampler	(M)
Clara Deal	UAF, DMS sampling	(F)
Justin Denton	SUNY/UAF, DMS sampling	(M)
Anne Hess	MATE intern	(F)

SCIENTIFIC PURPOSE:

This cruise had two scientific goals.

The first (and foremost) was the recovery and redeployment of moorings in the Bering Strait. These moorings are part of a multi-year time-series (currently over 12 years long) of measurements of the flow through the Bering Strait. The properties of this flow not only influence the Chukchi and Beaufort seas, but can also be traced across the Arctic Ocean to the Fram Strait and beyond. The long-term monitoring of the inflow into the Arctic Ocean via the Bering Strait is important for understanding climatic change both locally and in the Arctic.

Three moorings (A2 and A4, in the eastern channel of Bering Strait, and A3, ca. 35nm north of Bering Strait), which were deployed from the Alpha Helix last year, were to be recovered and redeployed.

All the moorings carry conventional instrumentation - current meters (RCM or ADCP), temperature and salinity sensors (SBE16). In addition, moorings A2 and A3 carry Upward-Looking-Sonars (ULS). The mooring A4 carries an upward looking ADCP (instead of the RCM) to study the coastal jet. Mooring A3 also supports a nutrient sampler, and a transmissometer and a fluorometer (the latter two connected to the SBE16). These instruments are from UAF and the replacement mooring also carries these sensors. The current meters and ULSs allow the quantification of the movement of ice and water through the strait. The nutrient sampler, the transmissometer and fluorometer yield the first biophysical time series measurements in the region, greatly advancing our understanding of the biological system in the Bering Strait and Chukchi Sea.

The second aim of the cruise was to conduct a hydrographic and ADCP survey of the Bering Strait and the southern part of the Chukchi Sea, concentrating on sections in the vicinity of the moorings and the region north of the mooring sites. These CTD and nutrient measurements will be used to calibrate the moored instruments and to give a framework for the analysis of the data. The hydrographic lines repeated and extended the sections from previous years, thus allowing an interannual comparison. (This year, no EEZ application was made to work in Russian waters, and all work took place in the US EEZ.) Post cruise data analysis will also draw on SeaWifs images kindly collected for us by Mike Schmidt, NASA.

In addition to maintaining the time series measurements in Bering Strait, this work also provides key boundary conditions for the Chukchi Shelf/Beaufort Sea region, the main work area of the NSF/ONR SBI (Shelf Basin Interaction) program, which is now in the second of its three field years. It also complements other NSF grants. Specifically the hydrography and O-18 sampling supports not only our analysis but also the sections taken by the Little Diomede Observatory (Cooper *et al*) and also student education by participation in this cruise of Justin Denton, (a chemistry student from SUNY, College of Environmental Science and Forestry, Chemistry Department, Syracuse, New York), and Anne Hess, (a trainee Marine Science Technician from the MATE Center, Monterey Peninsula College, California).

Pre-cruise, an invitation to take part in the cruise was extended to Sergey Pisarev (Shirshov Institute of Oceanology). However, due to visa issues, Sergey was unable to participate in the cruise.

CRUISE OBJECTIVES:

1. To recover moorings A2-02, A3-02 and A4-02 (see Table 1).
2. To deploy moorings A2-03, A3-03, and A4-03.
3. To run hydrographic casts (CTD and nutrients) and ADCP sections in the vicinity of the moorings and in the southern region of the Chukchi Sea (see Table 2 and Figure 1).

All the cruise objectives were successfully accomplished. The moorings were recovered and redeployed, and a total of 123 CTD stations, and corresponding ADCP lines were run. Sampling details are provided below.

CRUISE SCHEDULE:

Times are in AKDS (Alaskan Daylight) time, i.e. GMT-8hrs. The map in Figure 1 gives the location of the CTD and ADCP lines.

29th June 2003 Science party arrives in Nome. Weather too bad for Helix to come into port. Embarkation port changed to Teller (ca.3 hrs drive north of Nome).

30th June 2003 Transfer of Science Party to Teller to meet the ship at 5am on request of outgoing science party.

0530-0830 Small boat transfer of people and gear
Due to bad weather, set-up of equipment while at anchor
2200 Sail for Bering Strait

1st July 2003	0320-0710 ADCP section along BSL1 (from E to W) 0710-1300 CTD section along BSL1 (from W to E) Visit A-4 and A-2, but too foggy for mooring recovery 1430-1515 Productivity station at A2 Visit A-3, but too foggy for mooring recovery 1840-0150 CTD section along A3L (northeastwards to Chuk10)
2nd July 2003	0150-0930 ADCP section along A3L (southwestwards) 0930 1100 Recovery of A3-02 1100-1230 Productivity station at A3 1300-1330 Deployment of A3-03 1730-1800 Recovery of A2-03 1845-1905 Recovery of A4-02 2000-2030 Deployment of A4-03 2130-2200 Deployment of A2-02 2315-0220 CTD section along MBS (from W to E)
3rd July 2003	0220-0600 ADCP section along MBS (from E to W) 0630-1300 ADCP section along NBS line (from W to E) 1300-2100 CTD section along NBS line (from E to W) (incl 1430 Productivity station at NBS12)
4th July 2003	0145-1000 CTD section along Chuk & EEXT lines (from W to E) 1000-2015 ADCP section along Chuk & EEXT lines (from E to W) 2300-1100 CTD and ADCP section along PHL (from S to N) Many grey whales sighted on this line
5th July 2003	1100-1515 Transit to Cape Lisburne 1515-2330 CTD and ADCP section along CPL (from E to W) Wind increasing and final station aborted to turn S onto CCL line
6th July 2003	0045-1220 CTD section along CCL southwards. Progress slowed due to weather 1220 Productivity station at CCL-15 1300-1130 continue CTD section along CCL southwards Progress slowed and CCL7 omitted due to bad weather
7th July 2003	1200-1600 CTD section along BSL2 (from W to E) 1600-1820 ADCP section along BSL2 (from E to W) Turn for Nome
8th July 2003	Arrive Nome 0700, tie up for transfer of science party ashore 0800

SCIENCE PROGRAMS:

Although fog delayed mooring recoveries, prompt completion of the mooring work and subsequently reasonable weather allowed us to extend our CTD and ADCP sampling as far north as Cape Lisburne.

Mooring work:
All three moorings (see Table 1) were successfully and smoothly recovered and redeployed. Releases functioned well. All instrumentation was recovered in good condition. Fouling was moderate, with a strong predominance of barnacles, especially on the upper instruments. Unlike in previous years, A3-02 was the least fouled and A4 was the most fouled. Rotors were still turning and salinity cells were clear.

All current meters (RCM7, RCM11 and the ADCP) and seacats yielded complete year long records (see the appendices). Of the optics sensors on the A3 seacat, the fluorometer yielded a full year of data, whilst fouling of the lenses degraded the PAR and transmissometer data after 3 months. The ULSs were still working on recovery and yielded good data throughout the year. The NAS nitrate sensor contained almost 1500 data points which represents 150 days of data. The nitrate data was very clean for the first two months but an increased scatter appears in the latter half of the record. The summer drawdown and fall enrichment of nitrate was clearly observed in the record.

CTD and ADCP work:
A total of 123 CTD casts were taken along 8 different sections (see map, Figure 1, and sections in the appendices). The Bering Strait line (BSL) was CTDed twice, once at the start (BSL1) and once at the end (BSL2) of the cruise. At each major section (BSL, MBS, NBS, A3L, CHUK and EEXT) the CTD line was either preceded or followed immediately by an ADCP line run at 7 knots. The longer sections (PHL, CPL and CCL) could not be traversed twice and thus transit between CTD sections was undertaken at a compromise speed of ca. 8 knots, to acquire reasonable ADCP data whilst still maintaining quasi-synopticity of the line. In the shallow, changeable shelf system, the latter is important, as witnessed by the differences between BSL1 and BSL2 taken 6 days apart. Note also for example, section CCL took almost 36 hours to run, in part due to stormy weather conditions. During this storm, the mixed layer depth presumably deepened throughout the Chukchi Sea. However, since CCL was run from north to south the deeper mixed layer depths are only evident later in the section, (i.e. at the southern end).

The CTD package carried sensors for temperature, conductivity, fluorescence, PAR and the comparatively new ISUS nitrate sensor. Sections for these parameters are shown in the appendices. As a trial set-up, the ISUS nitrate sensor was mounted in place of one of the bottles, with its sensors pointing up. For a more permanent installation, the instrument should be mounted either below the bottles of the rosette or with its head down. The instrument was found to require an eight minute warming up period before deployment. Without this, spurious signals are evident in the upper part of the cast (see e.g. BSL1).

The sections show, for example, the warm fresh coastal current on the US coast. The strength of this current is seen qualitatively also by increased ship drift during CTD casts in this area. The deviations of the nutrient-rich western waters into the eastern side of the Chukchi Sea are also evident. The high bottom maximum in nitrate on the PHL was associated with a concentration of grey whale sightings. The changes in the BSL section over just a few days indicates the fast response to wind forcing.

Nutrient Analysis work (Whitledge, Thornton, Lee):

A total of 485 nutrient samples were taken and analyzed on board for silicate, phosphate, nitrate, nitrite and ammonia by Whitledge, Thornton and Lee. Preliminary section plots are included in the appendices. In addition, at many stations samples were taken at surface, mid water column and bottom for chlorophyll, and at some stations samples were taken for size-fractionated chlorophyll, fractionated on 20um, 5um and GF/F filters. At the four sites A2, A3, NBS12 and CCL15, primary productivity stations (stable isotope nutrient enrichment primary productivity experiments with 15N-labeled nitrate and ammonia and 13C-labeled carbon) were also run.

Chromophoric Dissolved Organic Matter (CDOM) and DOC Analysis work and sampling (Deal, Denton):

A total of 233 CDOM samples and 176 DOC samples were taken at the 34 sites listed below. Some measurements of CDOM absorption spectra were made on board, while most of the measurements were made in the laboratory at the University of Alaska Fairbanks. The DOC samples will be analyzed post cruise by Celine Guegen, IARC/Frontier.

CDOM and DOC seawater profiles were taken at 34 sites, namely
July 1: BSL-1,2,3,4,5 and 6,A2P
July 2: A3,A2,A4
July 3: NBS-12,9,6 and 3
July 4: CHUK-1,4 and 8
July 5: PHL1,3,6,9 and 11, CPL2 and 6
July 6: CPL8,CCL20,15 and 10
July 7: CCL6,8 and 4, BSL1,3 and 5

Oxygen isotope sampling (Woodgate for Cooper, Tennessee):

A total of 346 water samples were taken for O18 sampling. Samples were taken at bottom, 5m and (where appropriate) midwater column at all stations except some of the productivity stations (see bottle list in the appendices). These samples were sealed with parafilm and shipped to Lee Cooper at the University of Tennessee for later analysis. To ensure the integrity of the bottle samples, when possible salinity samples (ca. 200) were taken from the bottles used for O18 samples.

Underway sampling:

Seachest data and standard underway meteorological sampling was conducted for the duration of the cruise. These data will be combined with the CTD and ADCP data to elucidate spatial structures.

SEAWIFs imagery:

Mike Schmidt, NASA, kindly supplied to the cruise any Seawifs images collected during the science mission. Although extreme cloud cover prevented collection of a clear image of the entire work area, useful part-area images were collected. These 2-

dimensional images (see the appendices will aid analysis of the highly spatially variable water mass structures in the region.

Educational Outreach:

Two students took part in the cruise.

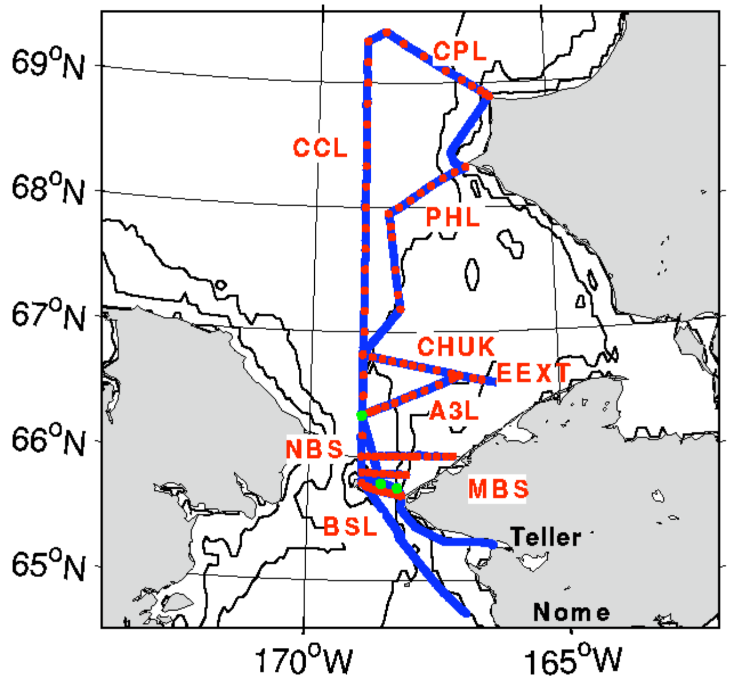
Justin Denton, (a chemistry student from SUNY, College of Environmental Science and Forestry, Chemistry Department, Syracuse, New York), assisted with the CDOM and DOC sampling (Deal, see above).

Anne Hess, (a trainee Marine Science Technician from the MATE Center, Monterey Peninsula College, California) gained experience of CTD and mooring work during the cruise, including running a CTD watch, O18 and salinity sampling and CTD operations.

FIGURE 1: Cruise Map

HX274
Alpha Helix
July 2003

= mooring
= CTD
= track



extract of
cruise track
near Bering
Strait

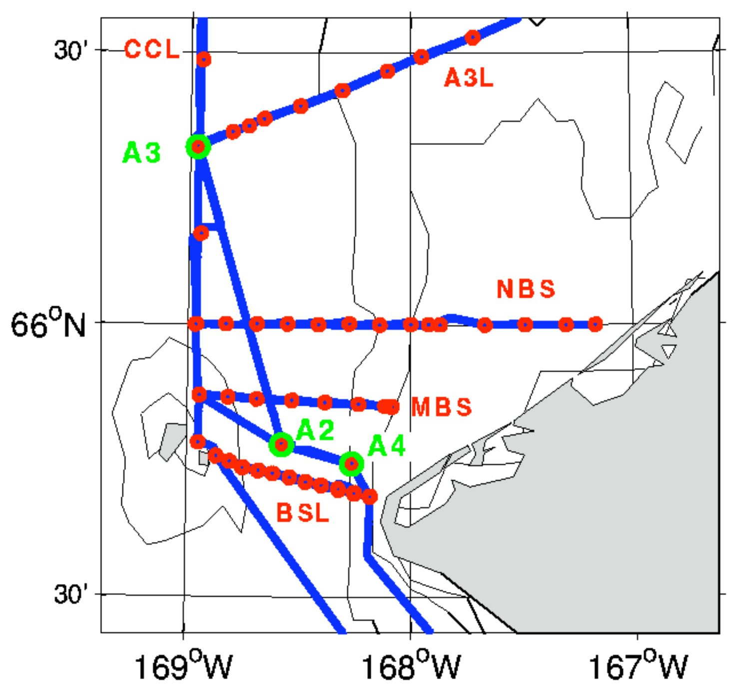


TABLE 1: Mooring positions and instrumentation

ID	LATITUDE (N)	LONGITUDE (W)	WATER DEPTH /m	INST.
Recover				
A2-02	65° 46.77'	168° 34.53'	56	ULS RCM7 SBE16
A3-02	66° 19.56'	168° 58.03'	57	ULS RCM11 SBE+TF NAS-2E
A4-02	65° 44.70'	168° 15.78'	49	ADCP SBE16
Deploy				
A2-03	65° 46.76'	168° 34.51'	55	ULS RCM7 SBE16
A3-03	66° 19.57'	168° 58.03'	57	ULS RCM9 SBE+TF NAS-2E
A4-03	65° 44.70'	168° 15.78'	48	ADCP SBE16

ULS = APL Upward Looking Sonar
RCM7 = Aanderaa Mechanical Recording Current Meter
RCM9 = Aanderaa Acoustic Recording Current Meter
SBE16 = Seabird CTD recorder
SBE+TF = Seabird CTD recorder including transmissometer and fluorometer
NAS-2 = Nutrient Analyzer
Microcat = Seabird CTD recorder
ADCP = RDI Acoustic Doppler Current Profiler

TABLE 2: CTD Positions

Name	Date	GMT	Latitude	Longitude	Cast	Name	D
hx274001	Jul 1 2003	15:18	65 45.56 N	168 52.04 W	001	bsl1	40
hx274002	Jul 1 2003	15:51	65 44.95 N	168 48.57 W	002	bsl1.5	50
hx274003	Jul 1 2003	16:31	65 44.26 N	168 45.05 W	003	bsl2	51
hx274004	Jul 1 2003	17:08	65 43.93 N	168 40.81 W	004	bsl2.5	50
hx274005	Jul 1 2003	17:39	65 43.63 N	168 36.89 W	005	bsl3	50
hx274006	Jul 1 2003	18:10	65 43.20 N	168 32.39 W	006	bsl3.5	53
hx274007	Jul 1 2003	18:39	65 42.69 N	168 28.11 W	006	bsl4	51
hx274008	Jul 1 2003	19:11	65 42.36 N	168 23.90 W	008	bsl4.5	51
hx274009	Jul 1 2003	19:47	65 41.83 N	168 19.27 W	009	bsl5	52
hx274010	Jul 1 2003	20:19	65 41.40 N	168 15.06 W	010	bsl5.5	43
hx274011	Jul 1 2003	20:47	65 41.06 N	168 10.86 W	011	bsl6	27
hx274012	Jul 1 2003	22:27	65 47.00 N	168 34.56 W	012	a2p	53
hx274013	Jul 1 2003	23:05	65 46.87 N	168 34.50 W	013	a2p	53
hx274014	Jul 2 2003	02:41	66 19.70 N	168 58.23 W	014	a3	54
hx274015	Jul 2 2003	03:18	66 21.26 N	168 48.52 W	015	a3l2	54
hx274016	Jul 2 2003	03:42	66 21.93 N	168 44.08 W	016	a3l2.5	49
hx274017	Jul 2 2003	04:05	66 22.74 N	168 39.94 W	017	a3l3	55
hx274018	Jul 2 2003	04:42	66 24.15 N	168 30.08 W	018	a3l4	52
hx274019	Jul 2 2003	05:21	66 25.89 N	168 18.65 W	019	a3l5	46
hx274020	Jul 2 2003	06:01	66 28.04 N	168 06.33 W	020	a3l6	26
hx274021	Jul 2 2003	06:33	66 29.63 N	167 56.93 W	021	a3l7	22
hx274022	Jul 2 2003	07:17	66 31.74 N	167 42.82 W	022	a3l8	23
hx274023	Jul 2 2003	08:08	66 34.64 N	167 25.46 W	023	a3l9	28
hx274024	Jul 2 2003	08:59	66 37.35 N	167 09.29 W	024	a3l10	31
hx274025	Jul 2 2003	09:33	66 38.97 N	167 00.80 W	025	chuk10	31
hx274026	Jul 2 2003	19:14	66 19.60 N	168 58.09 W	026	a3	54
hx274027	Jul 2 2003	19:59	66 19.58 N	168 58.05 W	027	a3	54
hx274028	Jul 2 2003	20:09	66 19.66 N	168 58.07 W	028	a3	54
hx274029	Jul 3 2003	03:31	65 44.82 N	168 15.69 W	029	a2	45
hx274030	Jul 3 2003	05:16	65 46.86 N	168 34.54 W	030	a4	52
hx274031	Jul 3 2003	07:13	65 52.26 N	168 56.73 W	031	mbs1	43
hx274032	Jul 3 2003	07:39	65 52.01 N	168 49.06 W	032	mbs2	50
hx274033	Jul 3 2003	08:06	65 51.82 N	168 41.29 W	033	mbs3	51
hx274034	Jul 3 2003	08:39	65 51.68 N	168 31.89 W	034	mbs4	52
hx274035	Jul 3 2003	09:09	65 51.48 N	168 22.98 W	035	mbs5	50
hx274036	Jul 3 2003	09:40	65 51.29 N	168 13.93 W	036	mbs6	45
hx274037	Jul 3 2003	10:07	65 51.07 N	168 06.83 W	037	mbs7	38
hx274038	Jul 3 2003	10:21	65 51.01 N	168 04.98 W	038	mbs8	29
hx274039	Jul 3 2003	21:06	66 00.01 N	167 10.02 W	039	nbs14	11
hx274040	Jul 3 2003	21:35	66 00.01 N	167 17.97 W	040	nbs13	13
hx274041	Jul 3 2003	22:12	66 00.04 N	167 28.97 W	041	nbs12	17
hx274042	Jul 3 2003	22:39	66 00.05 N	167 28.96 W	042	nbs12	17
hx274043	Jul 3 2003	23:24	66 00.03 N	167 39.88 W	043	nbs11	15
hx274044	Jul 4 2003	00:08	66 00.06 N	167 51.97 W	044	nbs10	10
hx274045	Jul 4 2003	00:27	66 00.09 N	167 55.09 W	045	nbs9	19
hx274046	Jul 4 2003	00:53	66 00.11 N	167 59.89 W	046	nbs8	31
hx274047	Jul 4 2003	01:29	66 00.05 N	168 08.27 W	047	nbs7	45
hx274048	Jul 4 2003	02:05	66 00.15 N	168 16.50 W	048	nbs6	51

hx274049	Jul 4 2003	02:39	66 00.05 N	168 24.82 W	049	nbs5	54
hx274050	Jul 4 2003	03:14	66 00.11 N	168 33.14 W	050	nbs4	53
hx274051	Jul 4 2003	03:47	66 00.08 N	168 41.44 W	051	nbs3	52
hx274052	Jul 4 2003	04:18	66 00.08 N	168 49.76 W	052	nbs2	51
hx274053	Jul 4 2003	04:49	65 60.00 N	168 58.05 W	053	nbs1	51
hx274054	Jul 4 2003	09:43	66 48.88 N	168 58.15 W	054	chuk1	51
hx274055	Jul 4 2003	10:24	66 47.85 N	168 46.08 W	055	chuk2	39
hx274056	Jul 4 2003	11:04	66 46.99 N	168 34.01 W	056	chuk3	30
hx274057	Jul 4 2003	11:42	66 45.84 N	168 22.08 W	057	chuk4	30
hx274058	Jul 4 2003	12:24	66 44.83 N	168 08.10 W	058	chuk5	28
hx274059	Jul 4 2003	12:57	66 43.83 N	167 57.04 W	059	chuk6	27
hx274060	Jul 4 2003	13:31	66 42.93 N	167 45.99 W	060	chuk7	27
hx274061	Jul 4 2003	14:20	66 41.49 N	167 27.89 W	061	chuk8	30
hx274062	Jul 4 2003	15:10	66 40.01 N	167 10.39 W	062	chuk9	32
hx274063	Jul 4 2003	15:44	66 38.98 N	167 00.93 W	063	chuk10	31
hx274064	Jul 4 2003	16:34	66 37.57 N	166 43.66 W	064	eext1	30
hx274065	Jul 4 2003	17:06	66 36.67 N	166 33.70 W	065	eext2	22
hx274066	Jul 4 2003	18:06	66 35.01 N	166 11.85 W	066	eext3	15
hx274067	Jul 5 2003	07:05	67 11.02 N	168 12.16 W	067	phl1	38
hx274068	Jul 5 2003	08:09	67 18.00 N	168 15.08 W	068	phl2	46
hx274069	Jul 5 2003	09:36	67 29.99 N	168 19.09 W	069	phl3	45
hx274070	Jul 5 2003	11:23	67 45.61 N	168 23.61 W	070	phl4	47
hx274071	Jul 5 2003	12:06	67 50.97 N	168 25.11 W	071	phl5	50
hx274072	Jul 5 2003	12:54	67 57.04 N	168 28.01 W	072	phl6	57
hx274073	Jul 5 2003	13:40	67 59.97 N	168 13.95 W	073	phl7	57
hx274074	Jul 5 2003	14:29	68 03.54 N	167 59.96 W	074	phl8	54
hx274075	Jul 5 2003	15:16	68 07.04 N	167 46.90 W	075	phl9	51
hx274076	Jul 5 2003	16:02	68 10.49 N	167 33.45 W	076	phl10	47
hx274077	Jul 5 2003	17:04	68 13.99 N	167 17.91 W	077	phl11	44
hx274078	Jul 5 2003	18:03	68 17.01 N	167 02.90 W	078	phl12	37
hx274079	Jul 5 2003	18:59	68 19.37 N	166 48.41 W	079	phl13	22
hx274080	Jul 5 2003	23:16	68 53.26 N	166 15.41 W	080	cpl0	16
hx274081	Jul 5 2003	23:40	68 54.39 N	166 19.82 W	081	cpl1	26
hx274082	Jul 6 2003	00:10	68 55.99 N	166 26.29 W	082	cpl2	32
hx274083	Jul 6 2003	00:58	68 58.58 N	166 37.90 W	083	cpl3	38
hx274084	Jul 6 2003	01:51	69 01.46 N	166 50.86 W	084	cpl4	43
hx274085	Jul 6 2003	03:07	69 05.92 N	167 11.85 W	085	cpl5	46
hx274086	Jul 6 2003	04:37	69 12.93 N	167 41.92 W	086	cpl6	49
hx274087	Jul 6 2003	05:59	69 18.93 N	168 08.81 W	087	cpl7	49
hx274088	Jul 6 2003	07:14	69 24.39 N	168 32.07 W	088	cpl8	50
hx274089	Jul 6 2003	08:43	69 20.00 N	168 56.75 W	089	ccl24	50
hx274090	Jul 6 2003	09:59	69 10.00 N	168 56.88 W	090	ccl23	50
hx274091	Jul 6 2003	11:18	69 00.00 N	168 56.87 W	091	ccl22	51
hx274092	Jul 6 2003	12:40	68 50.04 N	168 56.85 W	092	ccl21	51
hx274093	Jul 6 2003	13:56	68 40.00 N	168 56.89 W	093	ccl20	51
hx274094	Jul 6 2003	15:16	68 29.97 N	168 56.93 W	094	ccl19	57
hx274095	Jul 6 2003	16:30	68 19.96 N	168 56.91 W	095	ccl18	54
hx274096	Jul 6 2003	17:45	68 09.97 N	168 56.93 W	096	ccl17	55
hx274097	Jul 6 2003	19:01	67 59.98 N	168 57.13 W	097	ccl16	55
hx274098	Jul 6 2003	20:22	67 49.81 N	168 56.92 W	098	ccl15	53
hx274099	Jul 6 2003	20:55	67 49.97 N	168 57.03 W	099	ccl15	53

hx274100	Jul 6 2003	22:17	67 40.00 N	168 56.91 W	100	ccl14	49
hx274101	Jul 6 2003	23:34	67 30.01 N	168 56.86 W	101	ccl13	49
hx274102	Jul 7 2003	00:53	67 19.92 N	168 56.82 W	102	ccl12	48
hx274103	Jul 7 2003	02:11	67 10.08 N	168 56.84 W	103	ccl11	47
hx274104	Jul 7 2003	03:38	67 00.06 N	168 56.81 W	104	ccl10	46
hx274105	Jul 7 2003	05:16	66 49.00 N	168 57.94 W	105	ccl9	43
hx274106	Jul 7 2003	07:01	66 39.18 N	168 56.89 W	106	ccl8	41
hx274107	Jul 7 2003	09:18	66 29.18 N	168 56.91 W	107	ccl6	55
hx274108	Jul 7 2003	12:15	66 19.73 N	168 57.99 W	108	ccl5	53
hx274109	Jul 7 2003	15:19	66 10.02 N	168 56.85 W	109	ccl4	53
hx274110	Jul 7 2003	17:24	66 00.05 N	168 57.81 W	110	ccl3	50
hx274111	Jul 7 2003	18:40	65 52.20 N	168 56.75 W	111	ccl2	42
hx274112	Jul 7 2003	19:24	65 47.00 N	168 56.93 W	112	ld1	31
hx274113	Jul 7 2003	19:58	65 45.49 N	168 52.13 W	112	ccl1	39
hx274114	Jul 7 2003	20:36	65 44.90 N	168 48.38 W	114	bsl1.5	49
hx274115	Jul 7 2003	20:57	65 44.25 N	168 44.79 W	115	bsl2	50
hx274116	Jul 7 2003	21:16	65 43.91 N	168 40.69 W	116	bsl2.5	49
hx274117	Jul 7 2003	21:35	65 43.62 N	168 36.83 W	117	bsl3	49
hx274118	Jul 7 2003	21:56	65 43.17 N	168 32.35 W	118	bsl3.5	54
hx274119	Jul 7 2003	22:16	65 42.75 N	168 28.04 W	119	bsl4	50
hx274120	Jul 7 2003	22:37	65 42.31 N	168 23.79 W	120	bsl4.5	49
hx274121	Jul 7 2003	23:04	65 41.96 N	168 19.40 W	121	bsl5	50
hx274122	Jul 7 2003	23:33	65 41.56 N	168 15.04 W	122	bsl5.5	43
hx274123	Jul 7 2003	23:54	65 41.14 N	168 10.78 W	123	bsl6	25

D=approximate water depth in m

APPENDICES:

A) CTD sections for BSL1
BSL2
MBS
NBS
A3L
CHUK + EEXT
PHL
CPL
CCL

Each page shows temperature, salinity, sigma-theta, Fluorescence, PAR and ISUS nitrate. Vertical axis is pressure in dbar. This data is preliminary, post-cruise, without significant quality control. In the biological parameters, these results should be taken only qualitatively. The ISUS readings, especially, require significant work at the early sections, e.g. BSL1.

B) Nutrient sections for BSL1
BSL2
MBS
NBS
A3L
CHUK + EEXT
PHL
CPL
CCL

Each page shows phosphate, silicate, total nitrogen, nitrate and ammonia. Vertical axis is pressure in dbar. All other units are micromolar (uM). This data is preliminary, post-cruise, without significant quality control.

C) Preliminary Current Meter and SBE Results
Results using rough calibrations only. All current directions are magnetic, i.e. not corrected for local declination.

D) SeaWifs images

E) O18 bottle logs (paper copy only)

F) Cruise photos (including instrument fouling)