ALPHA HELIX CRUISE HX235
Friday 25th August 2000 - Thursday 7th September 2000
BERING STRAIT CRUISE REPORT

FUNDING SOURCE: NSF-OPP-9815707 (Kelly Falkner, OSU)

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SCIENTIFIC PURPOSE:

This cruise has two scientific goals.

The first (and foremost) is the recovery and redeployment of two moorings (A2 and A3) in the Bering Strait. These moorings are part of a multi-year time-series (currently over 10 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 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.

The moorings carry conventional instrumentation - current meters (RCM), temperature and salinity sensors (SBE16) and Upward-Looking-Sonars (ULS) - and new prototype instruments - either a water sampler (MITESS) or a nutrient sampler. The current meters and ULSs allow the quantification of the movement of ice and water through the strait. The prototype water sampler (OSU), designed to take *in situ* water samples throughout the year-long deployment, is to be recovered. The prototype nutrient sampler (UAF), designed to take *in situ* nutrients measurements, is to be deployed on the new northern mooring. These prototype instruments are valuable new technology which should greatly enhance our ability to make year-long *in situ* measurements and significantly advance our understanding of the system in the strait.

The second aim of the cruise is to conduct a CTD, chemistry 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. The hydrographic casts (CTD and chemistry) will be used to calibrate the moored instruments and to give a framework for the analysis of the data. Where possible, the hydrographic lines will be repeats of sections from previous years, thus allowing an interannual comparison.

CRUISE SUMMARY:

Despite high winds and rough conditions for most of the 13-day cruise, a mild weather window in the Bering Strait and Chukchi region allowed us to complete the main cruise objectives (the mooring recoveries and deployments) and to sample and extend almost all of the proposed CTD lines. Since forecast bad weather made it imprudent to up to the most northerly CTD line, we instead extended the CTD line in the northern Bering Strait and ran additional stations in the Bering Strait section and both on route to and on return from the working area. In addition, we took CTD casts for primary productivity at both mooring sites and were able to sample in a coccolithophorid bloom, which we encountered on the transits to and from the work area.

CRUISE SCHEDULE:

25th August	Sail from Seward 9.20am CTD casts at Res2.5 and Gak1
26th August	Transit to Bering Strait
27th August	Transit to Bering Strait
28th August	Transit to Bering Strait
29th August	Transit to Bering Strait
30th August	Transit to Bering Strait
31st August	Starting at first light, recover A2-99, CTD, deploy A2-00 Steam to A3, recover A3-99, CTD, deploy A3-99 Run first 7 stations of A3L CTD line Run ADCP line back down to A3 & to the start of the CHUK line
1st September	Run CHUK line (10 CTD stations) & EEXT (3 CTD casts) ADCP back to the east end of the A3L line Complete the A3L line, with a repeat of station 7
2nd September	Complete ADCP of A3L line, and half of CHUK line Turn S before end of CHUK line to be at A3 for c.9am ship time Primary Productivity station (A3L-A) at A3 Run NBS line (14 CTD casts, extended to east) ADCP back along NBS line
3rd September	ADCP along BSL line west to east Run BSL line (6 CTD casts, plus 3 extra stations) back to west Primary Productivity station (A2P) at A2 at c.9am ship time ADCP back to east end of BSL line Steam for Dutch Harbor
4th September	Transit to Dutch Harbor
5th September	Transit to Dutch Harbor CTD cast in coccolithophorid bloom at mooring site M4
6th September	Transit to Dutch Harbor (due to arrive 6th/7th September)

MOORING WORK:

Given the fair weather window in Bering Strait, the mooring operations were performed without a hitch on 31st August. Both recoveries were on the stated positions. A2 appeared on the single-beam echo sounder. A3 did not. We did not however search for it after the initial pass. The omnidirectional echosounder failed to find A2. In this shallow water (55m), the bottom echos drown out any signal. Releases functioned well. Both moorings were in good condition with moderate fouling, acorn barnacles and hydriods. Current meters and Seacats functioned well. Of the ULSs, only one would communicate

on the ship and neither would download. Of the twelve separate units in the water sampler, only five of the units would communicate. Of these, three samples had tight lids, although two of these samples contained bubbles. Both the ULSs and the water sampler will be further investigated after the cruise.

The deployments went smoothly. For future deployments, note that the nutrient analyzer has extra chemical bags taped to the outside of the instrument and would be better deployed without the mooring being towed to the mooring site. For the second deployment, the automatic release hook on the deep trawl wire only released on the second attempt.

Table 1 gives details of the moorings. Preliminary time series are included in an appendix.

HYDROGRAPHIC WORK:

In total, 53 hydrographic casts were taken (Table 2, Figure 1). The first 2 stations (Res2.5 and Gak1) are part of a multiyear time series which is always sampled on leaving Seward. Calibration CTD casts (A2-99 and A3-99) were run at both mooring sites between recovery and deployment. The A3L line was run immediately subsequent to the deployment at A3. Bad weather prevented the completion of the line in one run. The second section sampled was the CHUK line, followed by the EEXT line, and the remainder of the A3L line (with a 1 station overlap for comparison). ADCP lines were run either directly before or directly after the CTD sections, generally at 7 knots. A primary production cast (A3L-A) was performed at A3 at c.9 am ship time, just before local noon. The NBS line was run that afternoon, and was extended further towards the coast. The BSL was run the next morning, with a higher station spacing at the western end of the line than the original plan. A final primary productivity cast (A2P) was taken at A2, again at c.9am ship time. (Note lines have been renamed from the original cruise plan, to avoid confusion with pre-existing sections.). On route to Dutch Harbor, a final opportunistic cast was made at the site of a mooring M4 near the Pribilof Islands, within a coccolithophorid bloom which was also observed on transit north to the Bering Strait.

At each cast (except the primary productivity stations), up to 9 bottles were fired at approximate depths of surface, 5m, 10m, and then at 10m intervals, bottom –2m and bottom. On only one occasion did a bottle fail to close. Duplicate salinity samples were taken in an homogeneous layer at c. every other cast for later CTD calibration. After the A3L line, new caps were used on each salinity sample and upcasts were routinely stored, although the CTD was heaved at 60m/min, so the resolution may be poor. O18 samples and Barium samples (including some doubles) were taken at all hydrocasts, except for Res2.5, Gak1, A2-99, station 8 on A3L, the NBS section, the extra stations added to the BSL, the primary productivity stations and the coccolithophorid station. A salinity sample was taken from all bottles sampled for O18 and Barium to ensure the bottle closed correctly and did not leak. In total, 200 O18 and 200 Barium samples were taken. Nutrient samples were taken from all bottles except the NBS line, and on the BSL line where only 3 depths were sampled. Chlorophyll samples were taken at the surface on the A3L and CHUK lines and at all depths at the two primary productivity stations. Nutrients were run on board. O18 and Barium samples will be shipped back to OSU for analysis.

Preliminary CTD sections are included in an appendix.

TABLE 1: MOORING POSITIONS AND INSTRUMENTATION

ID	LATITUDE (N)	LONGITUDE (W)	WATER DEPTH / m	METER or SAMPLER	INST. DEPTH /m	SAMPLE INTERVAL
Recovered						
A2-99	65˚ 46.713'	168˚ 34.751'	55 (corr.)	ULS	42	5min
				RCM7	46	1 hour
				SBE16	47	1hour
A3-99	66˚ 19.71'	168˚ 58.10'	58 (corr.)	ULS	46	5min
				RCM7	49	1hour
				SBE16	50	1hour
				Water sampler	52	1 month
Deployed						
A2-00	65˚ 46.729'	168˚ 34.766'	55 (corr.)	ULS	42	5min
				RCM7	46	1hour
				SBE16	47	30min
A3-00	66˚ 19.66'	168˚ 58.00'	58 (corr.)	ULS	48	5min
				RCM7	51	1hour
				SBE16	52	30min
				Nutrient sampler	54	6hours

TABLE 2: CTD casts:

Station Number	Station name	Date	Time (GMT)	Latitude (N)	Longitude (-ve = W)	Bottom depth / m	Max pressure /dbar
1	RES2.5	2000-08-25	18:03	60.0245	-149.359	295	295
2	GAK1	2000-08-25	19:22	59.8440	-149.467	270	266
3	A2-99	2000-08-31	16:13	65.7805	-168.576	52	53
4	A3-99	2000-08-31	20:48	66.3306	-168.970	54	54
5	A3L-2	2000-09-01	01:12	66.3583	-168.814	53	53
6	A3L-3	2000-09-01	02:21	66.3832	-168.669	55	56
7	A3L-4	2000-09-01	03:17	66.4079	-168.505	51	54
8	A3L-5	2000-09-01	04:18	66.4357	-168.313	45	48
9	A3L-6	2000-09-01	05:18	66.4711	-168.107	25	28
10	A3L-7	2000-09-01	06:02	66.4968	-167.948	21	26
11	CHUK1	2000-09-01	14:53	66.8162	-168.967	44	43
12	CHUK2	2000-09-01	15:40	66.8000	-168.764	39	42
13	CHUK3	2000-09-01	16:27	66.7831	-168.564	30	31
14	CHUK4	2000-09-01	17:11	66.7664	-168.364	30	32
15	CHUK5	2000-09-01	17:59	66.7493	-168.130	29	30
16	CHUK6	2000-09-01	18:40	66.7329	-167.946	27	28
17	CHUK7	2000-09-01	19:21	66.7173	-167.762	27	29
18	CHUK8	2000-09-01	20:20	66.6927	-167.463	29	31
19	CHUK9	2000-09-01	21:17	66.6676	-167.173	33	34
20	CHUK10	2000-09-01	21:59	66.6510	-166.996	31	31
21	EEXT-1	2000-09-01	22:53	66.6261	-166.730	29	30
22	EEXT-2	2000-09-01	23:33	66.6111	-166.563	23	24
23	EEXT-3	2000-09-02	00:39	66.5840	-166.198	15	17
24	A3L-10	2000-09-02	04:06	66.6226	-167.155	31	31
25	A3L-9	2000-09-02	05:04	66.5777	-167.422	27	30
26	A3L-8	2000-09-02	06:09	66.5292	-167.713	23	25
27	A3L-7	2000-09-02	07:01	66.4947	-167.948	22	23
28	A3L-A	2000-09-02	17:38	66.3352	-168.964	54	54

29	NBS-1	2000-09-02	20:23	66.0011	-168.964	51	51
30	NBS-2	2000-09-02	20:51	66.0015	-168.828	51	52
31	NBS-3	2000-09-02	21:17	66.0010	-168.689	52	52
32	NBS-4	2000-09-02	21:43	66.0013	-168.552	53	53
33	NBS-5	2000-09-02	22:11	66.0016	-168.414	55	55
34	NBS-6	2000-09-02	22:39	66.0021	-168.275	51	52
35	NBS-7	2000-09-02	23:07	66.0019	-168.138	45	46
36	NBS-8	2000-09-02	23:35	66.0021	-167.998	32	32
37	NBS-9	2000-09-02	23:53	66.0007	-167.917	20	20
38	NBS-10	2000-09-03	00:11	66.0009	-167.852	9	10
39	NBS-11	2000-09-03	01:00	65.9998	-167.666	15	16
40	NBS-12	2000-09-03	01:32	65.9999	-167.483	17	18
41	NBS-13	2000-09-03	02:06	66.0008	-167.299	14	15
42	NBS-14	2000-09-03	02:32	66.0004	-167.164	10	13
43	BSL-6	2000-09-03	12:24	65.6849	-168.180	26	27
44	BSL-5	2000-09-03	12:56	65.6979	-168.323	51	51
45	BSL-4	2000-09-03	13:34	65.7139	-168.466	51	52
46	BSL3B	2000-09-03	14:00	65.7190	-168.539	54	56
47	BSL3	2000-09-03	14:21	65.7264	-168.614	49	50
48	BSL2.5	2000-09-03	14:44	65.7315	-168.681	49	50
49	BSL2	2000-09-03	15:05	65.7366	-168.748	50	51
50	BSL1.5	2000-09-03	15:27	65.7480	-168.810	49	51
51	BSL1	2000-09-03	15:45	65.7571	-168.868	41	42
52	A2P	2000-09-03	17:16	65.7831	-168.580	52	52
53	M4	2000-09-05	21:32	57.8548	-168.865	70	70