

CRUISE REPORT

Cruise Number: KM0313

FOCI Number: 3KM03

Ship: R/V *Kilo Moana*

Area of Operations: Gulf of Alaska

Kodiak, AK – September 13, 2003

Seward, AK (touch and go) – September 19, 2003

Kodiak, AK September 28, 2003

Participating Organizations:

NOAA Pacific Marine Environmental Laboratory

Alaska Fisheries Science Center

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Objectives of Cruise:

FOCI's goal is to understand the effects of abiotic and biotic variability on ecosystems of the North Pacific Ocean and Bering Sea in order to discern the physical and biological processes that determine recruitment variability of commercially valuable finfish and shellfish stocks in Alaskan waters. This cruise is in support of FOCI base, and United States Global Ocean Ecosystems Dynamics (U.S. GLOBEC) program. It was undertaken by FOCI to support research into the physical, chemical, and biological mechanisms acting in the coastal Gulf of Alaska.

The first objective of this cruise was to recover and redeploy 10 moorings along two lines off Alaska's Kenai Peninsula located off Gore Point and Seward, AK. The other objective was to occupy hydrological survey lines in several parts of the region to target specific processes and locations: in Kennedy and Stevenson Entrances to investigate mixing and transport; along the inner portion of the GLOBEC/NEP's Seward Line and FOCI's Gore Point Line to measure the characteristics of the Alaskan Coastal Current; across Amatuli and Stevenson Troughs to assess nutrient transport up troughs; and across the large warm-core eddy that impinged on the continental shelf between Kodiak and Seward during the spring and summer of 2003 to assess its effect on the GOA ecosystem both on and off-shelf.

Our experiment involved deployment of six ARGOS satellite tracked drifters: 4 along the Seward Line and 2 others within the eddy. The latter two replace (augment) data from one of the drifters deployed in May that continues to broadcast from near the center. The data from that drifter helped us to locate the center of the eddy for sampling on this cruise. Six MARMAP Bongo tows with 505mm mesh were taken: 2 to characterize the fall zooplankton on Portlock Bank, 2 more at the edge of the continental shelf nearest the eddy, and 2 more to sample the center of the eddy to ascertain differences between the zooplankton populations inside and at the edge of the eddy. One hundred CTD stations to depths of 5m off the bottom on the CGOA shelf, banks and troughs and to depths of 2000m within the eddy. Water samples were collected and analyzed for nutrient and chlorophyll concentration as well as for salinity calibrations

Summary of Cruise:

R/V *Kilo Moana* departed Kodiak, AK at 13:30 on September 13, 2003 on the high tide. After departing Kodiak, the ship proceeded northward to occupy a transects between Afognak Island and Portlock Bank, part of a box of stations northeast of Kodiak Island, taken to assess mixing processes and transports in the ACC. The next day we proceeded to recover and re-deploy the three moorings on the Gore Point line (at GP32, GP34, and GP36 sites). We then proceeded to occupy the CTD transects across Kennedy and Stevenson Entrances. At the conclusion, of those operations we digressed to the Barren Islands, where we made an unsuccessful small boat operation in an attempt to recover some lost mooring equipment that had washed ashore there.

Forecasts of deteriorating weather conditions prompted us to revise the work plan, and proceed to GB3 to begin mooring and recovery operations with the recovery and re-deployment of the surface mooring there on September 15. That night we occupied CTD transect ATB across Amatuli trough, the site of the next three moorings. We then (September 16) successfully recovered and redeployed those moorings (GB4, GB5, and GB12). The need to re-terminate the CTD and worsening weather conditions precluded the usual post-deployment calibration casts at these sites. We proceeded to the mooring operations at GB2 and GB1. When we deployed the last mooring (at GB1), it became apparent that it was too long; the top 3 m with floats were on the surface. The reason was that the mooring design included an 18.5m length of wire rope that should not be there. A small boat operation was needed to attach a line from the A-frame to the surface floatation to correct the problem. The weather or the evening of September 17 was too rough to launch the small boat, so we patrolled the area during the night, and did it the morning of September 19.

After the successful re-deployment of the last mooring, we sailed to Seward. There, 5 scientists and technicians disembarked via a small boat operation, and two others embarked. We then occupied 8 stations on the inside end of the Seward line from GAK 1-5 (GB3) across the ACC. Next we began CTD operations along the Gore Point line, but after completing 5 casts from GP1-4, operations were halted due to gale conditions and the inability of the ship to hold station any longer. We decided to go to Nuka Bay in Kenai Fjords National Park to wait out the gale.

By noon on September 21 we were back to work. We occupied 2 lines of CTD stations over Portlock Bank and Stevenson trough (STA and STB). Two MARMAP bongo tows using 0.505 mm mesh were taken on the bank crest. Next, we began to occupy stations on a line (ENW1) from the edge of the shelf out over the slope in the direction of the estimated center of a large warm-core eddy that impinged on the shelf during this summer. At that time it was off the continental slope, centered at $\sim 57.5^{\circ}\text{N}$, 147°W . Its diameter was approximately 200km. The location of the eddy was found from two sources: the sea surface altimetry analysis results distributed by Colorado Center for Astrodynamic Research at <http://www-ccar.colorado.edu/~realtime/welcome/>, and from the path of one satellite-tracked drifter we

deployed in May. At the end of 6 stations, we were forced to cease operations in anticipation of the arrival of a severe storm with sustained winds exceeding 50kts with gusts to 65kts.

Approximately 34hrs later we resumed operations. We re-started the transect across the eddy (ENW2) taking CTD casts to the bottom or to 2000m depth in up to 4200 m of water. We sampled zooplankton at four sites along this line using MARMAP bongo tows: one site at the shelf edge, one over the slope, and two near the center of the eddy. There was a dramatic visual difference in the quantity and type of zooplankton found in the center compared to the other sites. We again found a core of slightly warmer, saltier water at ~100m depth in the center of the eddy. We were able to deploy 2 more satellite drifters near the eddy center, to continue and augment the data we have collected from the drifter deployed there in May. After completing the transect across the eddy, we returned to the center of the eddy, and concluded operations by sampling on a line of 6 stations from there to the southwest on a line parallel to the continental slope.

Kilo Moana returned to Kodiak, AK at 14:30, September 28, 2003.

Table 1: Summary of Operations:

Operations	# Events
60cm bongo (60Bon) (0.505mm)	6
Seabird SeaCat CTD (CAT)	6
CTD with bottle samples (CTD)	100
Deployment of satellite buoy (SatBuoy)	6
Bathymetry Data	~2000mi
Multiscan Hydrosweep Bathymetry	2000mi

Table 2: Samples Collected

	Number
SeaBird CTD (CTD casts)	100
SeaBird SeaCat CTD (CAT)	6
Extracted chlorophyll (Chlor)	~200
Stimulated fluorescence collected during CTD casts (Fluor)	all
Photosynthetically Active Radiation (PAR) data during CTD casts	75
Quantitative tow preserved in formalin (QTowF)	6
Water samples for nutrient analyses	~1200

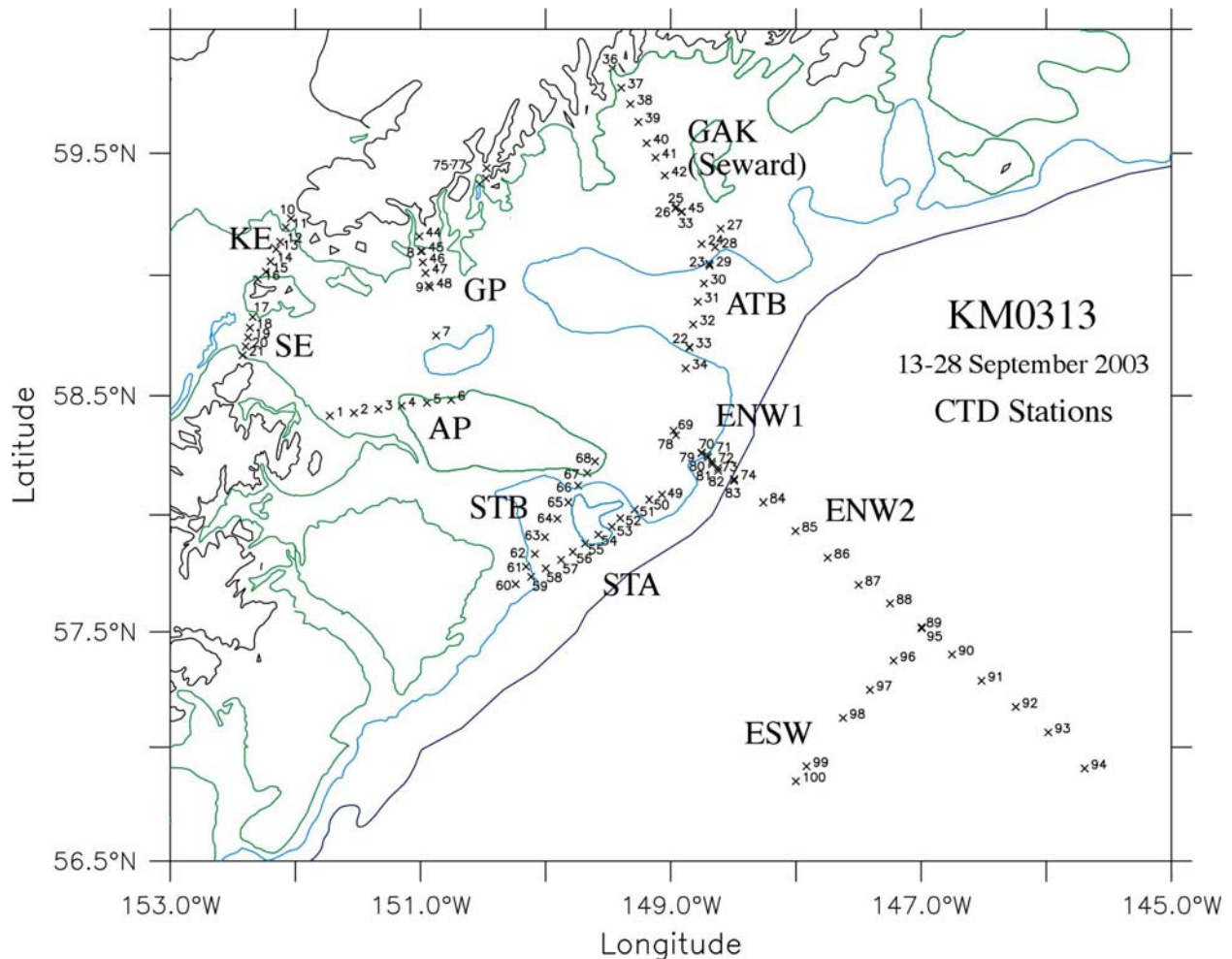


Figure 1. Map of CTD lines and stations for KM0313 for 13-28 September, 2003. Line AP crosses between Afognak I. and Portlock Bank. GP is the Gore Point line. SE and KE cross Stevenson and Kennedy Entrances, respectively. Line STA and STB cross the eastern end of Stevenson Trough.. Line ATB crosses Amatuli Trough Line ENW2 begins on the shelf and crosses the large warm-core eddy, passed its outer edge. Data was taken to a depth of 2000m. Line ESW began back at the observed center of the eddy, and continued to the southwest, parallel to the alignment of the slope. Data was taken to 500 m on this transect. Line ENW1 consisted of the first 6 stations along the ENW line. It was occupied before a major storm, compared to ENW2, which occurred after the storm.

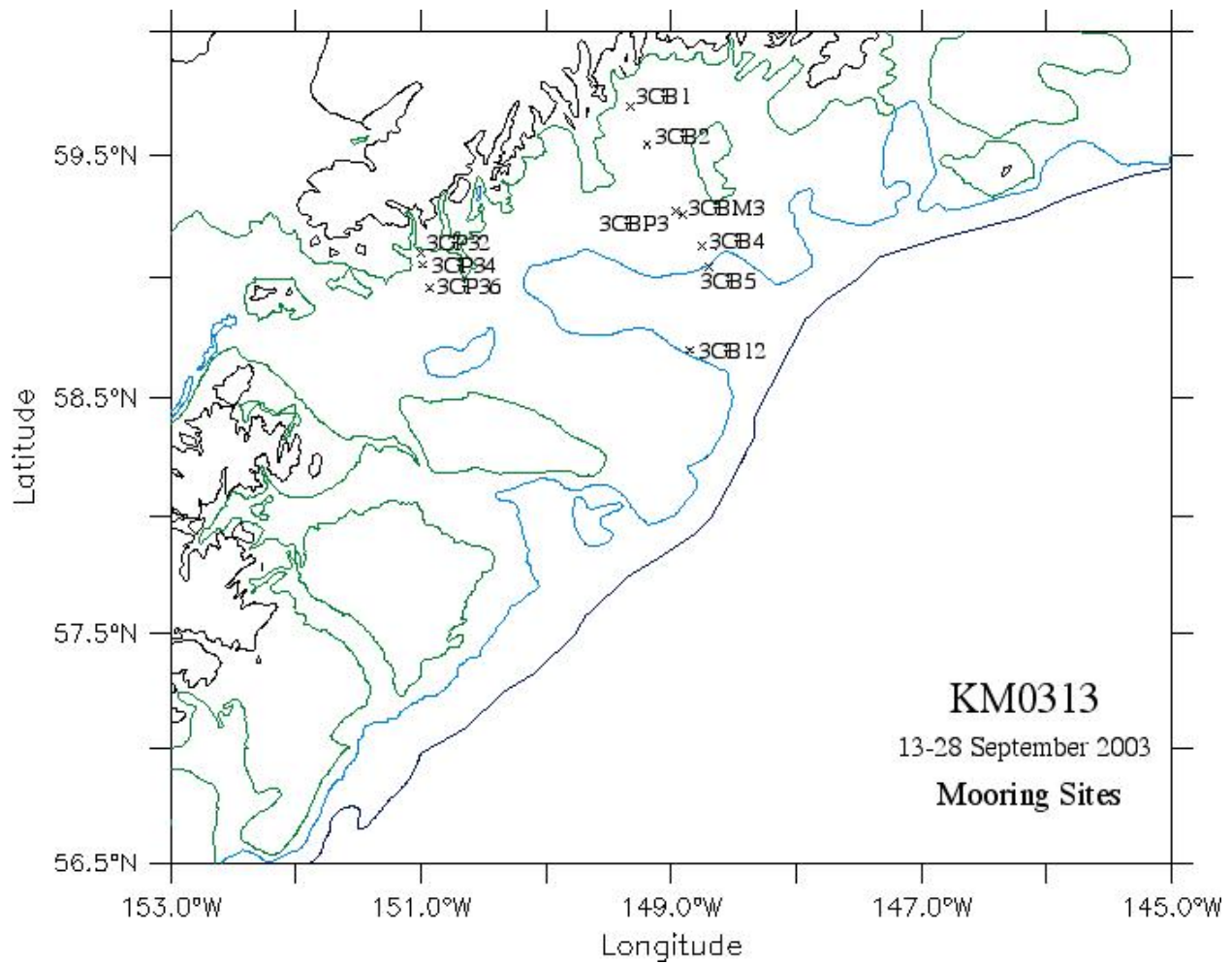


Figure 2. Sites of mooring operations from 14-19 September, 2003 aboard the R/V Kilo Moana

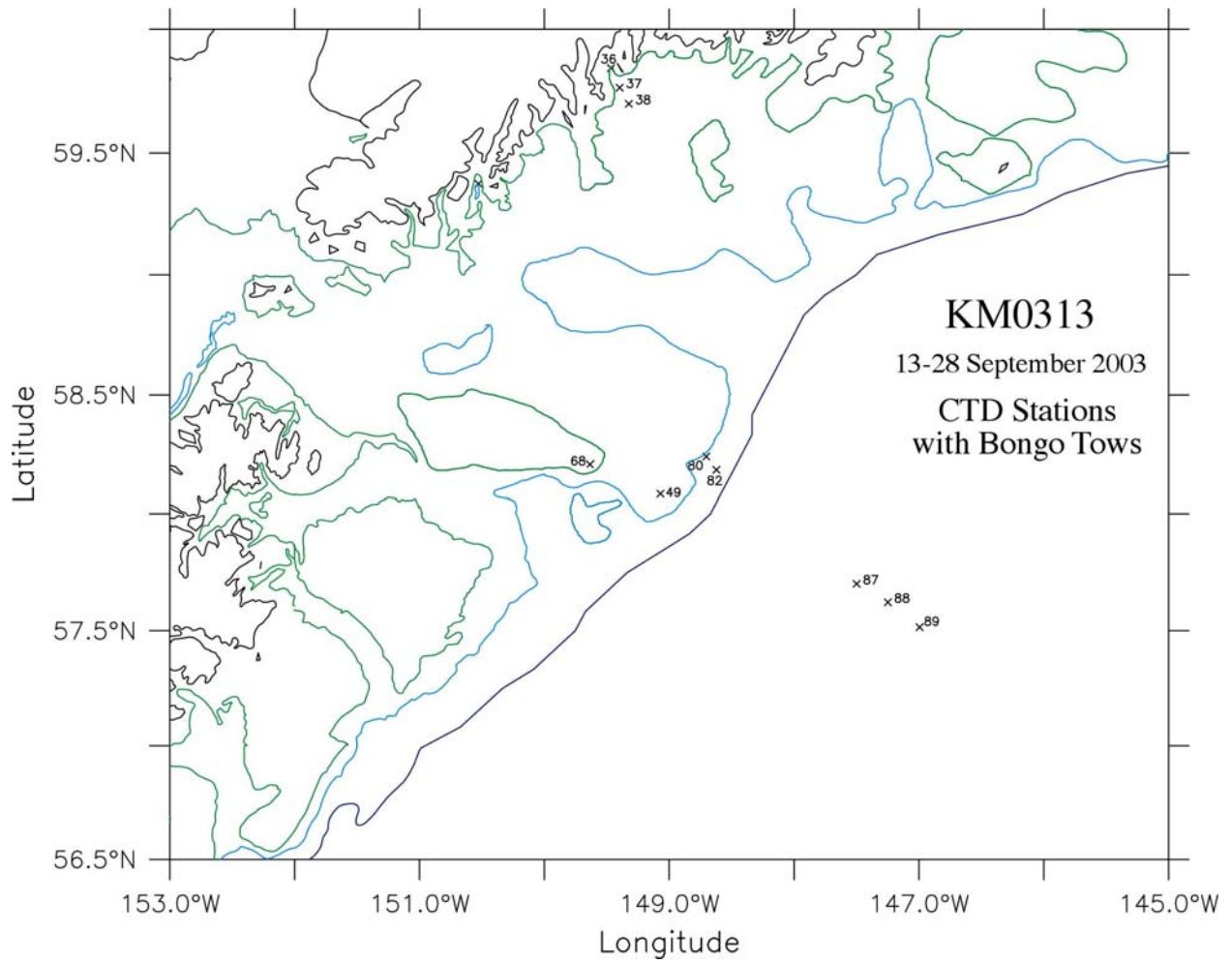


Figure 3. CTD stations with MARMAP bongo tows conducted aboard the R/V Kilo Moana (KM0313) from 13-28 September, 2003.

Table 3.Event log for R/V Kilo Moana cruise KM0313.

date(GMT)	time (GMT)	cast	lat-deg	lat- min	H	lon- deg	lon- min	H	depth	station	Event description
9/13/2003	23:00	n/a	57	43.72	N	152	31.242	W	9	n/a	Depart Kodiak, AK
9/14/2003	4:13	1	58	24.92	N	151	43.480	W	167	ap1	CTD cast
9/14/2003	5:30	2	58	25.65	N	151	31.880	W	165	ap2	CTD cast
9/14/2003	6:44	3	58	26.57	N	151	20.180	W	130	ap3	CTD cast
9/14/2003	7:58	4	58	27.41	N	151	09.030	W	98	ap4	CTD cast
9/14/2003	9:10	5	58	28.21	N	150	56.910	W	73	ap5	CTD cast
9/14/2003	10:21	6	58	28.95	N	150	45.320	W	88	ap6	CTD cast
9/14/2003	12:50	7	58	45.05	N	150	52.510	W	178	gp6	CTD cast
9/14/2003	15:34	8	59	05.97	N	150	59.820	W	163	gp1	CTD cast
9/14/2003	16:22	03gp32a	59	06.20	N	150	59.900	W	165	03gp32a	Release Mooring Mooring
9/14/2003	19:58	03gp32b	59	06.02	N	150	59.380	W	165	03gp32b	deploy
9/14/2003	21:26	9	58	57.50	N	150	56.090	W	146	gp34a	CTD cast
9/14/2003	21:32	03gp34a	58	57.54	N	150	56.250	W	181	03gp34a	Release Mooring
9/15/2003	2:00	03gp36a	58	44.98	N	150	51.800	W	140	03gp36a	Release Mooring
9/15/2003	3:15	03gp36b	58	45.00	N	150	51.996	W	181	03gp36b	Deploy Mooring
9/15/2003	6:06	03gp34b	58	57.78	N	150	55.990	W	140	03gp34b	Deploy Mooring
9/15/2003	10:25	10	59	14.04	N	152	02.120	W	84	ke1	CTD cast
9/15/2003	11:34	11	59	11.84	N	152	04.650	W	95	ke2	CTD cast
9/15/2003	12:44	12	59	08.28	N	152	07.230	W	158	ke3	CTD cast
9/15/2003	13:36	13	59	06.49	N	152	09.210	W	159	ke4	CTD cast
9/15/2003	14:28	14	59	03.43	N	152	11.940	W	134	ke5	CTD cast
9/15/2003	15:14	15	59	00.88	N	152	14.130	W	112	ke6	CTD cast
9/15/2003	16:00	16	58	59.01	N	152	17.970	W	81	ke7	CTD cast
9/15/2003	17:48	17	58	49.67	N	152	20.450	W	121	se1	CTD cast
9/15/2003	18:42	18	58	46.99	N	152	21.800	W	134	se2	CTD cast
9/15/2003	19:27	19	58	44.58	N	152	22.610	W	119	se3	CTD cast
9/15/2003	20:13	20	58	42.30	N	152	23.820	W	151	se4	CTD cast
9/15/2003	21:00	21	58	40.12	N	152	25.320	W	83	se5	CTD cast
9/16/2003	11:00	22	58	42.00	N	148	51.000	W	193	gb12	CTD cast
9/16/2003	13:21	23	59	02.90	N	148	41.550	W	233	gb5	CTD cast
9/16/2003	13:41	Dr#37506	59	02.84	N	148	41.000	W	233	gb5a	Drifter deployment
9/16/2003	14:36	24	59	07.75	N	148	45.230	W	147	gb4a	CTD cast
9/16/2003	14:49	Dr#37488	59	09.79	N	148	44.840	W	147	gb4a	Drifter deployment
9/16/2003	16:08	25	59	16.81	N	148	57.340	W	182	gb3	CTD cast

date(GMT)	time (GMT)	cast	lat-deg	lat- min	H	lon- deg	lon- min	H	depth	station	Event description
9/16/2003	16:22	03gbp3a	59	16.83	N	148	57.260	W	184	03gbp3a	Release Mooring
9/16/2003	19:00	03gbm3a	59	16.44	N	148	56.940	W	186	03gbm3a	Release Mooring
9/17/2003	1:24	03gbm3b	59	17.86	N	148	57.568	W	186	03gbm3b	Deploy Mooring
9/17/2003	3:21	03gbp3b	59	17.02	N	148	57.517	W	184	03gbp3b	Deploy Mooring
9/17/2003	5:08	26	59	16.50	N	148	57.770	W	185	gb3b	CTD cast
9/17/2003	7:06	27	59	11.50	N	148	36.140	W	128	atb0	CTD cast
9/17/2003	8:07	28	59	06.95	N	148	38.730	W	161	atb1	CTD cast
9/17/2003	9:10	29	59	02.40	N	148	41.410	W	197	atb2	CTD cast
9/17/2003	10:14	30	58	57.99	N	148	44.100	W	248	atb3	CTD cast
9/17/2003	11:20	31	58	53.45	N	148	47.020	W	288	atb4	CTD cast
9/17/2003	12:35	32	58	47.83	N	148	49.270	W	251	atb5	CTD cast
9/17/2003	13:53	33	58	42.15	N	148	51.090	W	210	atb6	CTD cast
9/17/2003	15:03	34	58	36.83	N	148	52.910	W	115	atb7	CTD cast
9/17/2003	16:20	03gb12a	58	41.01	N	148	50.876	W	201	03gb12a	Release Mooring
9/17/2003	18:40	03gb12b	58	41.01	N	148	50.876	W	201	03gb12b	Deploy Mooring
9/17/2003	23:53	03gb5a	59	02.50	N	148	42.200	W	194	03gb5a	Release Mooring
9/18/2003	2:12	03gb4a	59	07.75	N	148	45.596	W	146	03gb4a	Release Mooring
9/18/2003	5:02	03gb4b	59	07.67	N	148	45.647	W	146	03gb4b	Deploy Mooring
9/18/2003	6:40	03gb5b	59	02.54	N	148	41.616	W	194	03gb5b	Deploy Mooring
9/18/2003	10:15	35	59	15.67	N	148	54.640	W	166	gb3	CTD cast
9/18/2003	17:12	03gb2a	59	32.02	N	148	10.984	W	212	03gb2a	Release Mooring
9/18/2003	19:32	03gb2b	59	32.02	N	149	10.984	W	212	03gb2b	deploy
9/18/2003	21:18	03gb1a	59	41.61	N	149	19.842	W	228	03gb1a	Release Mooring
9/19/2003	1:09	03gb1b	59	41.69	N	149	19.909	W	228	03gb1b	1st deployment
9/19/2003	4:00	03gb1b	59	41.69	N	149	19.909	W	228	03gb1b	Hove to next to mooring
9/19/2003	16:30	03gb1b	59	41.69	N	149	19.909	W	228	03gb1b	boat attached to retrieve mooring
9/19/2003	18:04	03gb1b	59	41.68	N	149	19.895	W	228	03gb1b	2nd deployment
9/19/2003	20:30	n/a									Arrive Seward; debar Scientific Personnel
9/19/2003	22:45	n/a									Depart Seward; embark Scientific Personnel
9/20/2003	1:02	36	59	50.64	N	149	28.030	W	268	gak1	CTD cast
9/20/2003	2:20	37	59	45.89	N	149	23.790	W	257	gak1i	CTD cast

date(GMT)	time (GMT)	cast	lat-deg	lat- min	H	lon- deg	lon- min	H	depth	station	Event description	
9/20/2003	3:14	38	59	41.97	N	149	19.380	W	222	gb1a	CTD cast	
9/20/2003	4:17	39	59	37.61	N	149	15.540	W	212	gak2i	CTD cast	
9/20/2003	4:36	Dr#37501	59	37.60	N	149	15.500	W	212	gak2i	Drifter deployment	
9/20/2003	5:38	40	59	32.45	N	149	11.580	W	215	gb2a	CTD cast	
9/20/2003	6:59	41	59	28.94	N	149	07.370	W	203	GAK3i	CTD cast	
9/20/2003	8:18	42	59	24.56	N	149	02.850	W	199	gak4	CTD cast	
9/20/2003	9:57	43	59	15.65	N	148	54.870	W	167	gak5	CTD cast	
9/20/2003	10:25	Dr#37498	59	15.65	N	148	54.870	W	268	gak5/ gb3m	Drifter deployment	
9/20/2003	16:04	44	59	09.64	N	151	00.570	W	73	gp0	CTD cast	
9/20/2003	16:52	45	59	05.97	N	150	59.370	W	270	gp1	CTD cast	
9/20/2003	17:35	46	59	03.21	N	150	58.890	W	165	gp1.5	CTD cast	
9/20/2003	18:25	47	59	00.57	N	150	57.630	W	158	gp2	CTD cast	
9/20/2003	19:16	48	58	57.03	N	150	55.510	W	152	gp3	CTD cast	
9/20/2003	20:00	n/a	OPERATIONS SUSPENDED						Suspend operations due to storm. Retreat to Nuka Bay, Kenai Fjords N.P.			
9/21/2003	19:00	n/a							Depart Nuka Bay for operation site			
9/22/2003	4:20	49	58	05.01	N	149	04.220	W	81	sta10	CTD cast	
9/22/2003	5:33	50	58	03.82	N	149	10.350	W	110	sta9	CTD cast	
9/22/2003	6:33	51	58	01.43	N	149	17.330	W	217	sta8	CTD cast	
9/22/2003	7:42	52	57	59.15	N	149	24.250	W	197	sta7	CTD cast	
9/22/2003	8:37	53	57	56.99	N	149	28.270	W	189	sta6	CTD cast	
9/22/2003	9:31	54	57	54.96	N	149	34.720	W	125	sta5	CTD cast	
9/22/2003	10:26	55	57	52.71	N	149	41.110	W	234	sta4	CTD cast	
9/22/2003	11:22	56	57	50.57	N	149	46.970	W	265	sta3a	CTD cast	
9/22/2003	12:25	57	57	48.52	N	149	52.590	W	254	sta3a	CTD cast	
9/22/2003	13:25	58	57	46.33	N	149	59.920	W	178	sta2a	CTD cast	
9/22/2003	14:20	59	57	44.18	N	150	06.980	W	192	sta2	CTD cast	
9/22/2003	15:14	60	57	42.29	N	150	14.390	W	131	sta1	CTD cast	
9/22/2003	16:13	61	57	46.79	N	150	09.420	W	181	stb8	CTD cast	
9/22/2003	17:07	62	57	50.03	N	150	05.140	W	208	stb7	CTD cast	
9/22/2003	18:15	63	57	54.34	N	150	00.300	W	258	stb6	CTD cast	
9/22/2003	19:25	64	57	59.02	N	149	54.370	W	262	stb5	CTD cast	

date(GMT)	time (GMT)	cast	lat-deg	lat- min	H	lon- deg	lon- min	H	depth	station	Event description	
9/22/2003	20:30	65	58	03.17	N	149	49.080	W	243	stb4	CTD cast	
9/22/2003	21:30	66	58	07.29	N	149	44.400	W	218	stb3	CTD cast	
9/22/2003	22:23	67	58	10.47	N	149	40.040	W	105	stb2	CTD cast	
9/22/2003	23:13	68	58	13.44	N	149	36.330	W	69	stb1	CTD cast	
9/23/2003	2:09	69	58	21.18	N	148	58.620	W	123	enw1	CTD cast	
9/23/2003	3:39	70	58	15.64	N	148	45.180	W	157	enw2	CTD cast	
9/23/2003	4:33	71	58	14.47	N	148	42.170	W	390	enw3	CTD cast	
9/23/2003	6:01	72	58	13.34	N	148	40.340	W	504	enw4	CTD cast	
9/23/2003	7:15	73	58	11.81	N	148	37.380	W	720	enw5	CTD cast	
9/23/2003	9:02	74	58	08.94	N	148	29.590	W	1162	enw6	CTD cast	
9/23/2003	9:50	n/a	OPERATIONS SUSPENDED									Suspend operations due to storm. Retreat to Nuka Bay, Kenai Fjords N.P.
9/25/2003	3:24	75	59	26.38	N	150	28.320	W	197	nb1	CTD cast in Nuka Bay	
9/25/2003	4:23	76	59	23.87	N	150	28.640	W	233	nb2	CTD cast in Nuka Bay	
9/25/2003	5:22	77	59	22.47	N	150	31.680	W	244	ng003	CTD cast in Nuka Bay	
9/25/2003	13:00	n/a	OPERATIONS SUSPENDED									Depart Nuka Bay to resume CTD ops
9/25/2003	21:10	n/a	58	20.06	N	148	57.510	W		enw1	Resume operations	
9/25/2003	21:10	78	58	20.06	N	148	57.510	W	126	enw1	CTD cast	
9/25/2003	21:45	79	58	15.49	N	148	45.250	W	166	enw2	CTD cast	
9/25/2003	22:40	80	58	14.91	N	148	42.520	W	351	enw3	CTD cast	
9/26/2003	19:11	Dr#37516	57	37.30	N	146	28.000	W	4843	enw11	Drifter deployment	
9/26/2003	1:00	81	58	12.70	N	148	40.230	W	546	enw4	CTD cast	
9/26/2003	2:30	82	58	11.08	N	148	37.290	W	848	ENW05	CTD cast	
9/26/2003	4:59	83	58	08.51	N	148	29.670	W	1175	ENW06	CTD cast	
9/26/2003	7:00	84	58	03.12	N	148	15.630	W	1351	enw7	CTD cast	
9/26/2003	10:31	85	57	55.88	N	148	00.220	W	2455	enw8	CTD cast	
9/26/2003	13:28	86	57	49.05	N	147	44.780	W	3429	enw9	CTD cast	
9/26/2003	16:08	87	57	42.09	N	147	29.950	W	4922	enw10	CTD cast	
9/26/2003	19:11	88	57	37.34	N	147	14.930	W	4843	enw11	CTD cast	
9/26/2003	22:53	89	57	30.92	N	146	59.660	W	4754	enw12	CTD cast	

date(GMT)	time (GMT)	cast	lat-deg	lat- min	H	lon- deg	lon- min	H	depth	station	Event description
9/27/2003	0:58	Dr#37499	57	25.23	N	146	48.280	W	4300	enw13.5	Drifter deployment
9/27/2003	2:00	90	57	24.14	N	146	45.200	W	4420	enw13	CTD cast
9/27/2003	5:03	91	57	17.32	N	146	31.010	W	4174	enw14	CTD cast
9/27/2003	8:34	92	57	10.52	N	146	14.620	W	3982	enw15	CTD cast
9/27/2003	12:02	93	57	03.88	N	145	58.990	W	4080	enw16	CTD cast
9/27/2003	15:13	94	56	54.42	N	145	41.580	W	3892	enw17	CTD cast
9/27/2003	21:35	95	57	31.20	N	146	59.780	W	4764	enw12	CTD cast
9/27/2003	23:54	96	57	22.54	N	147	13.180	W	4752	esw1	CTD cast
9/28/2003	1:46	97	57	14.94	N	147	24.510	W	4694	esw2	CTD cast
9/28/2003	3:38	98	57	07.64	N	147	37.380	W	4625	esw3	CTD cast
9/28/2003	6:17	99	56	55.01	N	147	54.930	W	4419	esw4	CTD cast
9/28/2003	7:44	100	56	51.07	N	148	00.070	W	4372	esw5	CTD cast
9/28/2003	22:10	n/a	57	43.72	N	152	31.242	W	8	n/a	Arrive Kodiak AK