

CRUISE REPORT

Cruise Number: MF06-05

Vessel: NOAA Ship Miller Freeman

Area of Operations: Shelikof Strait, Bering Sea

Itinerary:

Depart Kodiak, Alaska:	12 April 2006
Touch-and-go Dutch Harbor, Alaska:	18 April 2006
Touch-and-go Dutch Harbor, Alaska:	3 May 2006
Arrive Dutch Harbor, Alaska:	6 May 2006

Participating Organizations: NOAA/PMEL/FOCI

Chief Scientist: Carol DeWitt
NOAA/PMEL/OERD2/FOCI
206-526-6808
Carol.DeWitt@noaa.gov

Other Participating Scientists:

Alex DeRobertis	M	USA	NOAA/AFSC
William Floering	M	USA	NOAA/PMEL
David Hyrenbach	M	Spain	UW/Duke
Antonio Jenkins	M	USA	NOAA/PMEL
Peter Proctor	M	USA	NOAA/PMEL
Dylan Righi	M	USA	NOAA/PMEL
Steve Smith	M	USA	NOAA/PMEL
Sarah Thornton	F	Canada	UA/Fairbanks
Chris Wilson	M	USA	NOAA/AFSC

Cruise Objectives: The dual objectives of the cruise were the recovery and deployment of moorings in the Bering Sea and the observation and sampling at and near the eastern Bering Sea ice edge.

Summary of Operations and Samples Collected:

CTD Casts	40
20/60 cm Bongo Tow	1
Moorings Recovered	10
Moorings Deployed	12
Salinity Samples	38
Chlorophyll Samples	207
Nutrient Samples, PMEL	211
Nutrient Samples, UAF	197
Methot Tows	6
Hydroacoustic lines, km	~1000
Diving operations	2
Towed vehicle deployments	3
Bird observations, track-lines, km	453

Cruise Summary:

On April 12th the NOAA Ship MILLER FREEMAN – with scientific personnel DeWitt, Floering Proctor, and Smith - departed Kodiak, Alaska for the line 8 mooring sites in Shelikof Strait. Adverse weather caused a 54 hour delay in operations. On April 15th, mooring operations resumed with the successful recovery of two moorings. Each recovery was preceded by a calibration CTD cast. Dragging operations at 05SSP-1A were not successful.

Due to the loss of time due to weather and to permit some flexibility in the joint operations schedule with the THOMPSON, the FREEMAN proceeded directly to Dutch Harbor – instead of to Amukta Pass as originally planned. Due to weight and space limitations, the Amukta Pass ADCPs/syntactic floats were off-loaded, allowing additional oceanographic gear to be loaded. Scientific personnel – DeRobertis, Jenkins, Righi, Thornton, and Wilson – embarked the FREEMAN.

We then proceeded to the

Kodiak crab moorings. At each of two sites, mooring operations consisted of recovering one subsurface mooring and deploying one subsurface mooring. A calibration CTD was completed prior to each mooring recovery.

We then proceeded to Bering Sea site 2. Prior to mooring operations, a calibration CTD with nutrient and chlorophyll samples was completed. Mooring operations consisted of recovering two subsurface moorings and deploying one surface and three subsurface moorings. One of the subsurface moorings, 06BSP-2B, was a short-term test mooring of an Aanderaa RDCP that was recovered later in the cruise. After the completion of all mooring operations, a calibration CTD with nutrient and chlorophyll samples was completed.

We then proceed to Bering Sea site 4 to rendezvous with the THOMPSON to conduct joint operations until April 27th. On April 22nd scientists from the THOMPSON transferred to the FREEMAN for a planning meeting and equipment and personnel transfer (Hyrenbach transferred to the FREEMAN for the duration of the joint operations). During the joint operations, we conducted approximately 1000 nautical miles of hydroacoustic surveying with six confirmation Methot tows. Preliminary results provided by Dr. Alex DeRobertis are:

“1) In general, very little echosign attributable to fish was found in the area. Insufficient fish echosign was observed to merit confirmation trawls with the Poly Nor'eastern trawl.

2) An extensive and persistent layer of backscatter was observed at 120 and 200 kHz. This layer performed vertical migrations: it was distributed primarily within ~30 m of bottom during daylight hours, and migrated into the upper 20 m after dark. Confirmation trawls with a Methot trawl indicated that this layer was dominated by backscatter from adult euphausiid crustaceans as well as adult jellyfish (*Chrysaora melanaster*).

3) A multifrequency approach was developed to isolate backscatter from euphausiids from jellyfish and other scatterers. Preliminary findings indicate that this approach will allow estimation of euphausiid biomass from these data.”

Additional work accomplished during the joint operations were marine mammal watches, 453 km track-lines of bird watching, 2 tows of the underwater towed vehicle, and two dive operations were completed. On April 24th the FREEMAN heeded storm warnings and departed the ice edge work area to seek shelter in the Pribilof Islands. While at the Pribilofs, the underwater towed vehicle – which, after the first deployment, had been modified to minimize rolling - was tested – with the result that the roll was greatly reduced. By April 26th the FREEMAN headed back towards the ice edge- resuming the hydroacoustic survey. On April 27th DeRobertis, Hyrenbach and Wilson transferred from the FREEMAN to the THOMPSON.

We then proceeded to Bering Sea site 5. The ice thwarted our efforts and after hours of making no significant northward progress, we abandoned our efforts and proceeded to Bering Sea site 4. Ice delayed our progress, but we were eventually able to reach site 4. Prior to mooring operations, a calibration CTD with nutrient and chlorophyll samples was completed. Two subsurface moorings were recovered. Due to the ice extent, the surface mooring originally scheduled to be deployed was replaced by a subsurface mooring. The original ADCP mooring was deployed as designed. The mooring deployment sites were approximately 5.6 nautical miles from the original site – again due to the ice coverage. After the completion of all mooring operations, a calibration CTD with nutrient and chlorophyll samples was completed.

One CTD with nutrients and chlorophyll samples was completed north of site 4 along the 70 meter isobath before the ice forced us southward. The CTDs/nutrients/chlorophylls along – or near - the 70 meter isobath were completed as the ice coverage allowed. Approximately half way between Bering Sea sites 2 and 4, the FREEMAN left the ice edge behind. At Bering Sea site 2, we completed the “box” around the site. The test mooring – 06BSP-2B – was recovered.

We then proceeded to Scripps mooring site 05MM-4A and recovered a mooring. On the way to Dutch Harbor the underwater towed vehicle was tested.

We had a touch-and-go in Dutch Harbor where we off-loaded equipment and disembarked all scientific personnel except Floering and Smith. After the touch-and-go in Dutch Harbor the FREEMAN proceeded to Amukta Pass where four moorings were deployed and five CTDs were completed. The ship then returned to Dutch Harbor.

Summary of Cruise:

Days lost to weather – 4 days

Days lost to equipment failure – 0 days

Acknowledgments:

It was a pleasure working with Captain Mike Gallagher and his crew.

There were some problems with the SCS system and sensors during the cruise – including the event logger, Thermosalinograph, POS/MV, and barometer. The gyro sync failed periodically and according to a report provided by CST Phil White “All true wind speed and direction data should be considered suspect.” These problems – although not insignificant – did not affect the success of the major cruise objectives. CST White’s diligence in tracking and troubleshooting these problems is commendable.

The autosal – which was report out of service in February – was still out of service during this cruise.

The original cruise plan was altered radically due to days lost to weather and due to the ice extent which prohibited us from getting to mooring sites 5 and 8. It is worth mentioning that had the original cruise plan been executed, there would have been a minimum of 48 hours of lost production. This would have been due to the ship only having three deck hands qualified for CTD winch operations, fishing operations, and deck work during mooring operations. Bosun Kris Mackie and his deck force were commendable for putting in long days in arduous conditions. The NOAA corps officers were notable for pitching in to assist the deck crew.

Thanks to the officers and bridge watch for their navigational efforts along the ice edge. Special thanks to the NOAA divers – XO LCDR Mark Boland, FOO Lt Sean Cimilluca, and Bosun Kris Mackie – for successful dive operations in an extreme environment.

Also special thanks to Steve Bus for fabricating two parts for the towed vehicle.

May 10, 2006

This was the first FREEMAN cruise with 24 hr internet access. It proved to be a valuable tool throughout the cruise. Although there were glitches in the system, the access to the ice desk and weather reports enhanced our cruise planning ability. Internet communications with the THOMPSON during our joint operations significantly enhanced coordination efforts between the two ships.

Attachments:

Date (GMT)	Time (GMT)	Button	Notes	Latitude (N)			Longitude (W)			Depth (m)
4/12/2006		Departed Kodiak								
4/16/2006	2:06	Mooring Recovered	06SSP-3A	57	29.010	N	154	48.450	W	192
4/16/2006	4:12	Mooring Recovered	06SSP-1A	57	40.805	N	155	12.239	W	287
4/18/2006		Touch-and-go Dutch Harbor								
4/19/2006	23:16	CTD at Depth	CTD 001	56	29.919	N	161	0.636	W	67
4/19/2006	23:51	Mooring Recovered	05KC-2A	56	29.819	N	160	59.814	W	66
4/20/2006	0:40	Mooring Deployed	06KC-2A	56	29.940	N	161	0.001	W	66
4/20/2006	3:10	CTD at Depth	CTD 002	56	25.700	N	160	13.770	W	26
4/20/2006	3:25	Mooring Recovered	05KC-1A	56	25.271	N	160	13.690	W	25
4/20/2006	3:57	Mooring Deployed	06KC-1A	56	25.599	N	160	13.111	W	25
4/20/2006	14:58	CTD at Depth	CTD 003	56	51.081	N	164	2.929	W	73
4/20/2006	15:42	Mooring Recovered	05BSP-2B	56	51.750	N	164	3.796	W	73
4/20/2006	16:15	Mooring Recovered	05BS-2C	56	51.748	N	164	3.280	W	72
4/20/2006	23:25	Mooring Deployed	06BSM-2A	56	51.790	N	164	2.832	W	73
4/21/2006	0:20	Mooring Deployed	06BST-2A	56	51.819	N	164	2.751	W	72
4/21/2006	1:51	Mooring Deployed	06BSP-2A	56	51.719	N	164	2.357	W	73
4/21/2006	2:45	Mooring Deployed	06BSP-2B	56	51.987	N	164	2.558	W	73
4/21/2006	3:07	CTD at Depth	CTD 004	56	52.055	N	164	2.529	W	72
4/21/2006	3:51	CTD at Depth	CTD 005	56	52.165	N	164	2.607	W	72
4/21/2006		Beginning of joint operations with the THOMPSON (including hydroacoustic transects)								
4/21/2006	19:42	CTD at Depth	CTD 006	57	53.260	N	168	50.807	W	72
4/22/2006	4:05	Methot at Depth	Methot 001	58	11.901	N	168	56.702	W	69
4/22/2006	23:21	Methot at Depth	Methot 002	58	30.209	N	169	59.552	W	71
4/23/2006	0:19	Methot at Depth	Methot 003	58	29.402	N	169	59.952	W	71
4/23/2006	1:19	U-Tow IN	U-tow 1	58	28.548	N	170	0.804	W	72
4/23/2006	2:02	U-Tow OUT	U-tow 1	58	27.433	N	169	52.804	W	70
4/23/2006	22:04	Divers IN		58	26.566	N	171	4.203	W	86
4/23/2006	22:18	Divers OUT		58	26.554	N	171	4.280	W	86
4/23/2006	22:35	Divers IN		58	26.273	N	171	3.492	W	85
4/23/2006	22:46	Divers OUT		58	26.248	N	171	3.562	W	85
4/24/2006	4:34	Methot at Depth	Methot 004	58	29.950	N	171	23.720	W	98
4/24/2006	20:57	Methot at Depth	Methot 005	58	45.582	N	172	8.991	W	98
4/25/2006	17:29	U-Tow IN	U-tow 2	57	4.446	N	170	7.150	W	53
4/25/2006	18:24	U-Tow OUT	U-tow 2	57	2.568	N	169	55.475	W	64
4/25/2006	19:09	Bongo at Depth	BON 001	57	2.419	N	169	57.758	W	64
4/25/2006	20:11	Methot at Depth	Methot 006	57	2.538	N	169	57.593	W	64
4/28/2006		End of joint operations with the THOMPSON								
4/29/2006	16:44	CTD at Depth	CTD 007	57	51.683	N	168	53.709	W	72
4/29/2006	17:11	Mooring Recovered	05BSP-4B	57	51.487	N	168	52.409	W	72
4/29/2006	17:38	Mooring Recovered	05BS-4B	57	51.316	N	168	52.111	W	72
4/29/2006	22:59	Mooring Deployed	06BS-4A	57	45.566	N	168	51.999	W	70
4/29/2006	23:34	Mooring Deployed	06BSP-4A	57	45.572	N	168	52.452	W	69
4/30/2006	0:15	CTD at Depth	CTD 008	57	45.745	N	168	53.480	W	69
4/30/2006	1:01	CTD at Depth	CTD 009	57	46.519	N	168	54.408	W	69

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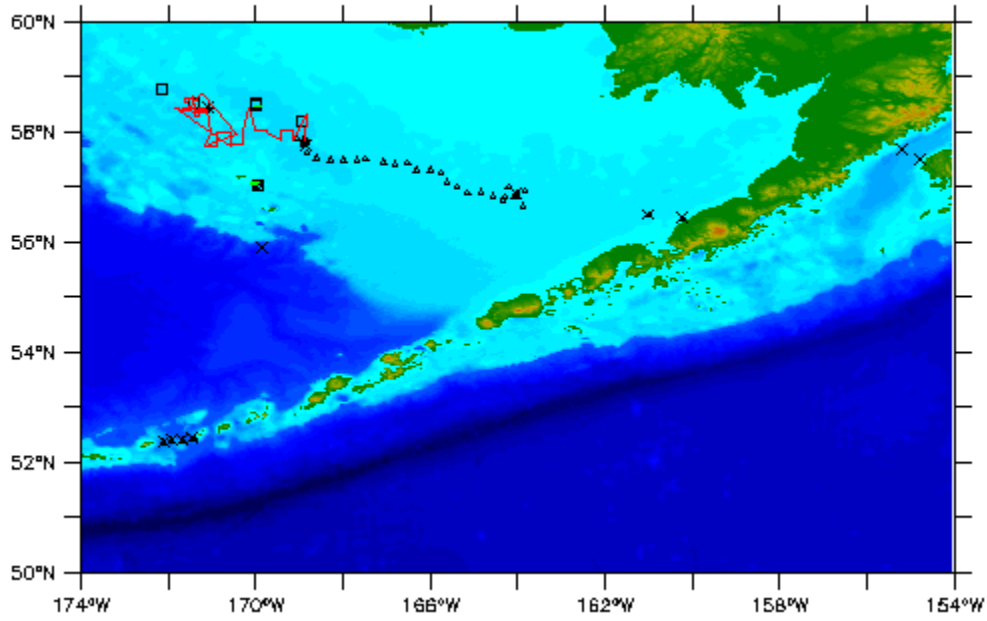
Date (GMT)	Time (GMT)	Button	Notes		Latitude (N)		Longitude (W)		Depth (m)
4/30/2006	4:37	CTD at Depth	CTD 010	57	54.407	N	169	4.232	W 69
4/30/2006	6:48	CTD at Depth	CTD 011	57	48.260	N	168	51.080	W 72
4/30/2006	14:39	CTD at Depth	CTD 012	57	37.585	N	168	49.517	W 70
4/30/2006	16:06	CTD at Depth	CTD 013	57	31.576	N	168	36.303	W 72
4/30/2006	17:45	CTD at Depth	CTD 014	57	30.025	N	168	17.707	W 72
4/30/2006	19:02	CTD at Depth	CTD 015	57	29.968	N	167	58.904	W 72
4/30/2006	20:24	CTD at Depth	CTD 016	57	30.023	N	167	40.076	W 72
4/30/2006	22:36	CTD at Depth	CTD 017	57	31.140	N	167	28.413	W 71
5/1/2006	3:17	CTD at Depth	CTD 018	57	28.016	N	167	3.618	W 70
5/1/2006	4:34	CTD at Depth	CTD 019	57	25.797	N	166	48.027	W 70
5/1/2006	5:46	CTD at Depth	CTD 020	57	26.607	N	166	30.988	W 69
5/1/2006	6:57	CTD at Depth	CTD 021	57	19.239	N	166	19.218	W 70
5/1/2006	8:09	CTD at Depth	CTD 022	57	19.170	N	166	0.110	W 69
5/1/2006	9:14	CTD at Depth	CTD 023	57	15.746	N	165	44.656	W 70
5/1/2006	10:28	CTD at Depth	CTD 024	57	6.426	N	165	36.621	W 71
5/1/2006	11:46	CTD at Depth	CTD 025A	57	0.345	N	165	23.512	W 72
5/1/2006	12:05	CTD at Depth	CTD 025	56	59.972	N	165	23.446	W 72
5/1/2006	13:29	CTD at Depth	CTD 026	56	53.610	N	165	8.572	W 74
5/1/2006	14:53	CTD at Depth	CTD 027	56	54.532	N	164	50.140	W 72
5/1/2006	16:10	CTD at Depth	CTD 028	56	50.908	N	164	34.535	W 73
5/1/2006	17:21	CTD at Depth	CTD 029	56	49.933	N	164	18.562	W 74
5/1/2006	18:38	CTD at Depth	CTD 030	56	54.047	N	164	1.697	W 72
5/1/2006	19:51	CTD at Depth	CTD 031	57	0.935	N	164	12.646	W 70
5/1/2006	21:29	CTD at Depth	CTD 032	56	56.398	N	163	49.925	W 70
5/1/2006	22:34	CTD at Depth	CTD 033	56	52.078	N	164	2.182	W 72
5/1/2006	23:07	Mooring Recovered	06BSP-2B	56	51.817	N	164	2.763	W 72
5/2/2006	1:03	CTD at Depth	CTD 034	56	39.904	N	163	52.188	W 76
5/2/2006	2:55	CTD at Depth	CTD 035	56	45.983	N	164	20.400	W 74
5/2/2006	21:00	Mooring Recovered	05MM4A	55	54.213	N	169	51.932	W 100
5/3/2006		Touch-and-go Dutch Harbor							
5/4/2006	18:07	Mooring Deployed	06AMP-1A	52	25.993	N	171	27.001	W 412
5/4/2006	19:16	Mooring Deployed	06AMP-2A	52	24.987	N	171	40.029	W 455
5/4/2006	20:39	Mooring Deployed	06AMP-3A	52	23.995	N	171	54.998	W 308
5/4/2006	21:42	Mooring Deployed	06AMP-4A	52	22.993	N	172	7.002	W 359
5/4/2006	22:13	CTD at Depth	CTD 036	52	22.734	N	172	7.146	W 368
5/4/2006	23:28	CTD at Depth	CTD 037	52	24.275	N	171	55.295	W 306
5/5/2006	0:51	CTD at Depth	CTD 038	52	24.388	N	171	40.551	W 415
5/5/2006	2:12	CTD at Depth	CTD 039	52	25.558	N	171	26.301	W 383
5/5/2006	2:55	CTD at Depth	CTD 040	52	26.120	N	171	23.309	W 159
5/5/2006		Arrived Dutch Harbor							

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May 10, 2006

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Figure 1: Station Map



Appendix 1: Seabird and Cetacean Observations

**Seabird and Cetacean Observations During the *Sea Ice 2006* Cruise,
onboard the NOAA RV Miller Freeman
(22 – 27 April, 2006)**

George L. Hunt, Jr. & K. David Hyrenbach

geohunt2@u.washington.edu khyrenba@u.washington.edu
School of Aquatic and Fishery Sciences,
University of Washington, Box 355020,
Seattle, WA 98195, U.S.A.

As part of coordinated FOCI - RACE sea-ice operations, we censused marine bird and cetacean distributions in conjunction with acoustic surveys of the marginal ice zone. One of us (KDH) surveyed marine birds and cetaceans from the bridge of the RV Miller Freeman, eye height of 10 m above the sea surface, during daylight hours while the vessel was underway. The observer scanned the water ahead of the ship using hand-held 8X binoculars, and recorded all birds sighted within a 300-m arc, extending from the bow to the beam (90 degrees) on the side of the track with better visibility (e.g., lower glare). We assigned each bird a behavioral code (flying with a specific direction, sitting on the water, feeding, following the ship, sitting on ice), and only recorded ship-following individuals when first encountered. We also noted the number, behavior, and radial distance to any cetacean we encountered, as well as the weather conditions (Beaufort Sea State, visibility, swell height) at hourly intervals. We recorded these observations continuously into a field computer with a temporal resolution of 0.1 minutes.

We surveyed a total of 453 km of track-line during four survey days (April 22, 23, 24, 27). We recorded a total of 2,277 seabirds, and identified 2,093 (91.9 %) belonging to 13 different species (Table 1). Six “common” species together accounted for over 98 % of all the identified birds: the Black-legged Kittiwake (33.2 %), the Thick-billed Murre (20.6 %), the Glaucous-winged Gull (19.3 %), the Northern Fulmar (17.3 %), the Glaucous Gull (5.6 %), and the Common Murre (2.1 %). These locally-breeding species largely forage on fish, even though they also consume euphausiids and medusae. Zooplankton-feeding seabirds were largely absent; with very low numbers of Parakeet Auklets (0.4 %), a generalist feeder known to consume euphausiids and larval fish. We also encountered several rare species during our survey. Most notably, we documented the occurrence of a Siberian (Vega Gull) and an Arctic (Ivory Gull) species in the Bering Sea marginal ice zone. The remaining 184 (8.1 %) birds, including two pairs of closely-related species which are difficult to identify at-sea, were identified to genus. Unidentified murre (Common or Thick-billed) and unidentified gulls (Glaucous or Glaucous-winged) accounted for 42.4 % and 57.6 % of these sightings, respectively.

We also recorded 10 cetaceans during this cruise, and identified 6 (60 %) to species level (Table 2). We documented three baleen (Humpback Whale, Minke Whale, Grey Whale) and one toothed (Killer Whale) cetacean species in the marginal ice zone. In spite of their widespread occurrence in the Bering Sea in spring / summer, we did not encounter any Dall’s Porpoise during this survey.

Table 1. Seabird observations during acoustic surveys along the marginal sea ice zone by the RV Miller Freeman (April 22 - 27, 2006).

Species	Total Count (n)	Proportion of Total (%)	Overall Abundance (# / 100 km)
Black-legged Kittiwake	695	30.52	153.49
Thick-billed Murre	431	18.93	95.19
Glaucous-winged Gull	405	17.79	89.44
Northern Fulmar	362	15.90	79.95
Glaucous Gull	118	5.18	26.06
Unidentified Gull	106	4.66	23.41
Unidentified Murre	78	3.43	17.23
Common Murre	43	1.89	9.50
Ivory Gull	12	0.53	2.65
Parakeet Auklet	9	0.40	1.99
Red-faced Cormorant	9	0.40	1.99
Vega Gull	5	0.22	1.10
Arctic Tern	2	0.09	0.44
Herring Gull	1	0.04	0.22
Pigeon Guillemot	1	0.04	0.22
Total Birds	2277	100	502.87

Table 2. Cetacean observations during acoustic surveys along the marginal sea ice zone by the RV Miller Freeman (April 22 - 27, 2006).

Species	Total Count (n)	Proportion of Total (%)	Overall Abundance (# / 100 km)
Killer Whale	4	40.00	0.88
Unidentified Whale	4	40.00	0.88
Humpback Whale	1	10.00	0.22
Minke Whale	1	10.00	0.22
Total Cetaceans	10	100	2.21