COMIDA CAB Phase 1 FINAL Cruise Report, 23 September 2009
Jackie Grebmeier, Chief Scientist, MV Alpha Helix

RV ALPHA HELIX COMIDA FINAL CRUISE REPORT

COMIDA PHASE 1: 21 JULY-12 AUGUST 2009 AND PHASE 2: 12-17 AUGUST 2009

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**NOTE: *****Brenda Holladay (Shell) only rides ship Dutch Harbor to Nome, off in Nome; Dr. Brenda Konar (COMIDA) comes on in Nome, bkonar@ims.uaf.edu, F

ALPHA HELIX COMPONENT

1. John Seville, Captain
2. Lance Wiskowski, Chief Mate
3. Rich Soderblom, 2nd Mate
4. Dave Bean, Chief Eng
5. Matt Caddock, Asst Eng
6. Jamie Boston, AB
7. Jason Giery, AB
8. Pete Shannon, Cook
9. India Grammatica, OS

A. CORE PROJECT SUMMARY

A team of scientists from the University of Texas at Austin (Marine Science Institute and main campus: PIS Ken Dunton and David Maidment), Florida Institute of Technology (FIT; PI: John Trefry), the Chesapeake Biological Laboratory (CBL) University of Maryland Center for Environment Science (UMCES) (PIs: Lee Cooper, Jackie Grebmeier and Rodger Harvey), and the University of Alaska Fairbanks (PI: Brenda Konar) conducted work through support by the Minerals Management Service (MMS) as part of the project entitled "Chukchi Sea Offshore Monitoring in Drilling Area (COMIDA): Chemical and Benthos (CAB)". An additional fisheries study component undertook mid-water trawls (Dr. Brenda Norcross, University of Alaska Fairbanks), and collaborated with Dr. Brenda Konar's epibenthic trawling events. The MMS sampling plan is designed as a robust, comprehensive effort to characterize the lease area (#193) biota and chemistry in the Chukchi Sea in the context of the Chukchi Sea ecosystem and will generate data that is comparable for both contemporary and retrospective evaluation of the region. Additionally, oil companies that leased blocks in the Chukchi Sea Lease Sale 193 (Shell and Conoco-Phillips) area are developing monitoring programs to qualify for Federal permits for exploration. For instance, both Shell Oil and Conoco-Phillips began conducting pre-drilling baseline benthic environmental studies in summer 2008. These private data collections will serve as a significant complement to the datasets collected under this MMS project.

Objectives

- To establish baseline data set for benthic infauna and epifauna, organic carbon and sediment grain size, radioisotopes for down core dating, as well as measure trace metals in sediments, biota and suspended particles of the COMIDA study area.
- To determine the sources, cycles and fate of selected trace metals and the role of trace metals (along with Rodger's biomarkers and Lee's/Ken's isotopes, etc.) on organic carbon dynamics in the coastal Chukchi Sea.

Our goals for stations during the cruise were:

- Shared water column hydrography from <=50 locations and sediment cores (25 stations)
- Water samples for TSS (total suspended solid), POC (particulare organic carbon), nutrients, selected trace metals, etc. at up to 50 stations/cruise
- Benthic infaunal samples at 50 stations/cruise (20 for Dunton/Schonberg, 30 for Grebmeier, of which 10 are overlap stations with Dunton/Schonberg for QA/QC checks)
- Epibenthic trawls at 25 stations/yr
- Biota as available for chemical analysis (organic contaminants and metals)
- Fish samples for population studies (Shell component)

B. CRUISE MAP, STATION LOCATIONS, AND MOORING SITES

1. The combined COMIDA/Shell cruise schedule:

June 29-30	COMIDA PIs-mobilize in Seattle, WA
July 14	**Depart Seattle**-Alpha Helix departs am
July 21	**Arrive Dutch Harbor,** AK 0800: Shell fisheries component mobilize 0830 at the North Pacific Fuel Dock, depart soon afterwards (departure delay to 1630 July 22 due to weather)
July 26	**Arrive Nome**, AK 1600: disembark Brenda Holladay; embark COMIDA PIs-Phase 1, depart same day
July 25/26	Start data collection, Chukchi Sea (COMIDA and Shell fishing)

Aug 12 **Arrive Barrow** am, offloaded some COMIDA and Shell components (10 people: Harvey, M. Harvey, Taylor, Konar, Schuster, Gleason, Chenelot, Rooney, and Prentki, and Captain Seville-end Phase 1

Aug 12 **Depart Barrow noon,** continue data collections in Chukchi Sea (Shell)-Phase 2

C. Field Program

We occupied 48 stations during the successful COMIDA 2009 cruise (Figure 1, Table 1). We proceeded chronologically through the stations, averaging 3-4 stations/day, until Stn. 20 when we became weathered out for a day. We determined station sites via two methods: 1) a general randomized tessellation stratified design (GRTS) in the core COMIDA area, and 2) a spatially-oriented, nearshore-to-offshore, south to north grid overlaying the GRTS design. This arrangement allowed for putting the core station sites in a spatial grid. Of the 30 GRTS stations, 10 were chosen as overlap stations to cross-calibrate and provide QA/QC between the UTMSI and CBL benthic labs (Fig. 1). We were weathered out on Aug. 2 at Stn 19 and sailed to the Alaska coastline, then began again the following morning (Aug. 3) at Stn 28. All stations retained their number and name as in the cruise plan, although the order we occuppied them depended on weather and ice conditions. Note that we did occupy COMIDA station #50 at the start of Phase II after we offloaded Phase I participants, and that station is presented here in this report. More details on individual components are provided below in the next section (D).

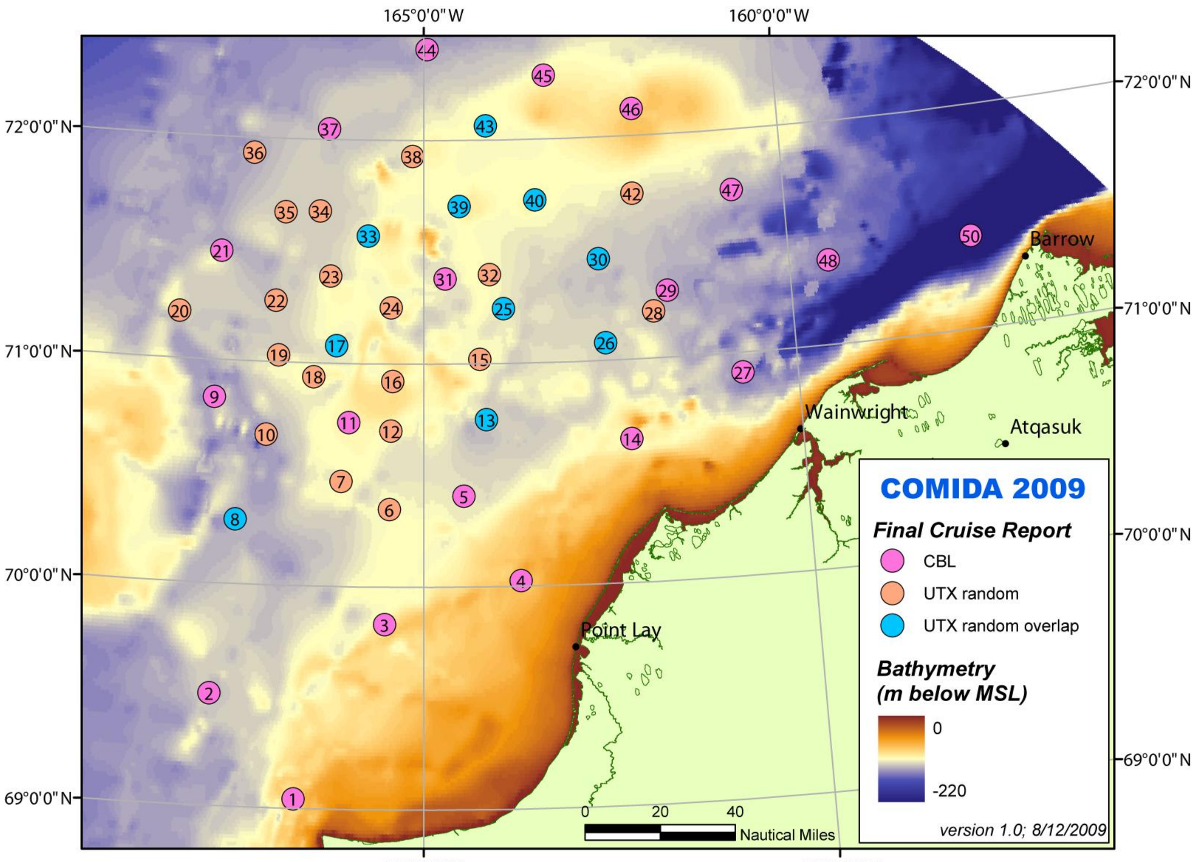

Figure 1. Station locations and type occupied during the COMIDA 2009 cruise in the Chukchi Sea, Alaska.

Table 1. Station number, name, type, date, time, latitude, longitude and depth.

Station Number	Station Name	Station Type	Date	Time (ADT)	Latitude (°N)	Longitude (°W)	Depth (m)
1	CBL1	CBL	7/27/09	7:12	69 02.380	166 35.608	38
2	CBL2	CBL	7/27/09	16:03	69 30.126	167 40.513	49
3	CBL3	CBL	7/28/09	7:05	69 49.747	165 29.974	41
4	CBL5	CBL	7/28/09	15:14	70 01.383	163 45.670	28
5	CBL6	CBL	7/28/09	19:45	70 24.285	164 28.940	44
6	UTX29	UTX random	7/29/09	7:02	70 20.706	165 27.024	46
7	UTX28	UTX random	7/29/09	13:22	70 28.122	166 05.168	46
8	UTX30	UTX random overlap	7/29/09	18:38	70 17.233	167 26.609	51
9	CBL4	CBL	7/29/09	23:26	70 49.881	167 47.204	58
10	UTX27	UTX random	7/30/09	7:15	70 40.275	167 04.990	54
11	CBL7	CBL	7/30/09	13:37	70 43.965	165 59.800	42
12	UTX26	UTX random	7/30/09	21:02	70 41.833	165 26.437	45
13	UTX24	UTX random overlap	7/31/09	7:10	70 44.803	164 10.534	51
14	CBL9	CBL	7/31/09	14:57	70 38.490	162 15.976	42
15	UTX19	UTX random	7/31/09	22:00	71 01.089	164 15.281	45
16	UTX22	UTX random	8/1/09	7:11	70 55.151	165 25.232	44
17	UTX20	UTX random overlap	8/1/09	13:37	71 04.636	166 10.708	45
18	UTX25	UTX random	8/1/09	16:31	70 56.115	166 28.442	45
19	UTX23	UTX random	8/1/09	19:55	71 01.669	166 57.162	47
28	UTX14	UTX random	8/3/09	8:00	71 12.492	161 53.392	49
29	CBL13	CBL	8/3/09	10:24	71 17.891	161 41.321	51
25	UTX15	UTX random overlap	8/3/09	20:37	71 14.549	163 55.317	45
26	UTX18	UTX random overlap	8/3/09	7:11	71 04.641	162 33.503	47
27	CBL12	CBL	8/4/09	14:24	70 54.512	160 44.450	52
24	UTX16	UTX random	8/5/09	8:48	71 14.952	165 26.871	44
23	UTX13	UTX random	8/5/09	15:24	71 23.228	166 16.588	46
22	UTX17	UTX random	8/5/09	20:35	71 16.328	167 00.865	48
20	UTX21	UTX random	8/6/09	7:06	71 12.399	168 18.676	51
21	CBL8	CBL	8/6/09	13:27	71 29.079	167 46.900	51
36	UTX3	UTX random	8/6/09	18:51	71 55.815	167 23.351	51
35	UTX10	UTX random	8/6/09	22:11	71 40.150	166 55.039	48
37	CBL11	CBL	8/7/09	7:18	72 02.744	166 20.404	48
34	UTX6	UTX random	8/7/09	14:30	71 40.587	166 26.627	47
33	UTX9	UTX random overlap	8/7/09	18:02	71 34.123	165 46.127	44
44	CBL20	CBL	8/8/09	7:29	72 24.238	164 57.482	51
43	UTX1	UTX random overlap	8/8/09	14:24	72 03.702	164 07.836	41
38	UTX2	UTX random	8/8/09	20:26	71 55.614	165 09.650	53
32	UTX5	UTX random	8/9/09	11:03	71 23.759	164 06.542	47
31	CBL10	CBL	8/9/09	16:50	71 22.732	164 42.710	45
39	UTX5	UTX random overlap	8/9/09	20:26	71 42.117	164 30.898	40
45	CBL19	CBL	8/10/09	7:15	72 16.942	163 17.333	42
46	CBL18	CBL	8/10/09	12:00	72 06.989	162 03.279	28
42	UTX9	UTX random	8/10/09	16:55	71 44.311	162 06.210	45
40	UTX8	UTX random overlap	8/10/09	21:38	71 43.527	163 27.370	41
30	UTX11	UTX random overlap	8/11/09	7:06	71 27.180	162 36.643	47
47	CBL15	CBL	8/11/09	13:45	71 43.642	160 43.097	48
48	CBL14	CBL	8/11/09	18:54	71 22.610	159 28.066	54
50	CBL16	CBL	8/12/09	14:08	71 24.741	157 29.495	130

The standard 0700 COMIDA "long" station included the sondes, plankton nets, benthic camera, pumping for water samples, grabs, cores and epibenthic trawl. The subsequent 2-3 "short" stations per day deployed the sonde, HAPS corer, single or double grab, and epibenthic trawl. The number of epibenthic trawls depended on the status of sorting by the team of prior trawls and evaluation of sediment structure at the site, resulting in about 2-3 benthic trawls/day. The evening mid-water trawl work commenced between 2300-0100, with 2-3 net tows per night. The final deployment brought the ship into position for the next "long station" at 0700 for the COMIDA group.

There were seven main event categories at long stations including 1) sonde, phytoplankton measurements, and dissolved oxygen/light measurement, 2) seawater pumping, 3) benthic camera deployments, 4) benthic grab and corer sediment collections, 5) double van Veen grab collections, 6) box core collections (pending), and 7) fisheries trawling operations (beam trawl for epibenthic organisms and mid-water trawling. Seabird observations also occurred in transit between stations. A brief description of sample collections for each principal investigator (PI)'s program follows this first summary section.

We were able to undertake all field operations from the start of the cruise, except the box core which needed a larger block for launch and recovery. This block was ordered in transit and we picked it up in Wainwright on Tuesday, August 4. Additional science supplies were also sent to Wainwright for pick-up the same day. A list of ship operational events issues and recommendations for improvement are provided in section E.

We would like to express our gratitude to Captain John Seville, who provided excellent ship leadership, along with First Mate Lance Wiskowski, 2nd mate Rich Soderbloom, ABs Jamie Boston and Jason Giery, and Chief Engineer Dave Bean and Associate engineer Matt Caddock for their assistance and support for science operations. We are extremely grateful to the cook Pete Shannon, for excellent food that kept moral high, and India Grammatica for general ship housing operations. Financial support for the research cruise was provided by the US Minerals Management Service.

D. Below are specific summaries of each COMIDA component:

D1. Dunton Component: Ken Dunton, Susan Schonberg, Nathan McTigue and Eric Hersh- (University of Texas at Austin)

This component provided vertical profiles of station hydrography and quantitative estimates of infaunal biomass in conjunction with co-PIs Trefry and Grebmeier, respectively. The primary focus of our effort is to elucidate the trophic structure of the northeastern Chukchi benthic system and define the linkages to the overlying water column as related to carbon transfer. This objective is accomplished through the collection of common primary and secondary consumers throughout the region (those representing the major marine phyla) that are analyzed isotopically to acquire $\delta^{13}C$ and $\delta^{15}N$ signatures. During the 2009 COMIDA field season we collected over 1500 specimens for analysis. We completed the taxonomic analysis of the quantitative samples collected at most of the 30 UTX stations. The UT-Austin group led by Eric Hersh (David Maidment, PI) also provided digital shape files for mapping and began the coordination of data input for the MMS data management system.

Station	CTD Vertical Profiles	Light Attenuation (k)	POM and Plankton (20µ/330µ)	Quantitative van Veen	Sediment Chemistry (NH^4, C:N)	Infauna for $^{13}C/^{15}N$	Epibenthic fauna for $^{13}C/^{15}N$

1	x	x	x		x	x	x
2	x	x			x	x	x
3	x	x	x		x	x	x
4	x	x			x	x	x
5	x	x			x	x	
6	x		x	x	x	x	x
7	x			x	x	x	x
8	x			x	x	x	
9	x				x	x	
10	x		x	x	x	x	x
11	x				x	x	
12	x			x	x	x	x
13	x		x	x	x	x	x
14	x	x			x	x	x
15	x			x	x	x	
16	x	x	x	x	x	x	x
17	x	x		x	x	x	x
18	x	x		x	x	x	x
19	x			x	x	x	
20	x		x	x	x	x	x
21	x	x			x	x	x
22	x			x	x	x	
23	x	x		x	x	x	x
24	x		x	x	x	x	x
25	x			x	x	x	
26	x		x	x	x	x	x
27	x	x			x	x	
28				x	x	x	
29	x	x	x		x	x	x
30	x		x	x	x	x	x
31	x				x	x	
32	x		x	x	x	x	x
33	x		x	x	x	x	x
34	x	x		x	x	x	x
35	x			x	x	x	
36	x	x		x	x	x	

37	x		x		x	x	x
Station	CTD Vertical Profiles	Light Attenuation (k)	POM and Plankton (20µ/330µ)	Quantitative van Veen	Sediment Chemistry (NH^4, C:N)	Infauna for $^{13}C/^{15}N$	Epibenthic fauna for $^{13}C/^{15}N$
38				x	x	x	
39	x			x	x	x	
40	x			x	x	x	
41							
42	x			x	x	x	x
43	x			x	x	x	x
44	x		x		x	x	x
45	x				x	x	x
46	x	x	x		x	x	
47	x	x			x	x	x
48	x				x	x	x
49							
50		x	x		x	x	

Summary: Vertical profiles revealed the presence of distinct water masses based on T-S measurements. A relatively warmer (up to 7 C) and less saline water layer 10-15 m thick generally overlain over a much colder and more saline layer that extended to the seabed. In areas of drift ice or near drift ice, we witnessed a three-layered system that was characterized by a warm layer sandwiched between two cold water masses. Samples from phytoplankton and zooplankton net tows reflected considerable diversity among stations. Common components in the 20µ net included dinoflagellates, cyanobacteria, chain forming pinnate diatoms, and centric diatoms. Crab larvae were very abundant in the 335µ net tows, along with calanoid copepods, pteropods, mysids, and chaetognaths. A great variety of infaunal and epifaunal invertebrate species were collected for isotopic analysis, along with several species of fish common throughout the study area (arctic staghorn sculpin, arctic cod, slender eelblenny, Bering flounder, kelp snailfish, and fish doctor). Some stations were distinctive with respect to their high levels of benthic diversity and abundance (eg. Sta 30, 50), while others were much more depauperate.

D2. **Grebmeier/Cooper Water Column Chlorophyll and Benthic Infaunal and Sediment Tracer Component: Jackie Grebmeier, Lee Cooper, Marisa Guarinello, Regan Simpson (Chesapeake Biological Laboratory/University of Maryland Center for Environmental Science)**

We collected data on both the water column and the benthos for chemical and biological evaluation. Water column samples were collected each morning at the "long" station for the day. Water pumped by the Trefry lab was used for chlorophyll and nutrient analyses. These samples were collected throughout the water column at 2-6 different depths. Chlorophyll-a samples were extracted and processed on-board. Nutrient samples will be analyzed at CBL's Nutrient Analytical Services Laboratory in Solomons, MD. Surface sediment samples were collected at both "long" and "short" stations for chlorophyll, total organic carbon, and grain size analysis. Two samples of the upper 1cm of sediment were removed from a van Veen grab sample and processed for chlorophyll-a content. The upper layer of sediment was bagged, frozen, and will be analyzed for grain size and organic carbon content at CBL. Surface sediment samples for a USGS ostracod project were also collected at select stations. Four van Veen grab samples, two at each UTX/CBL overlap stations, were taken for quantitative biological samples at each CBL station and preserved. Infaunal abundance and biomass will be measured at CBL and compared with UTX measurements at overlap stations. A HAPS core was collected, sectioned, canned, and frozen at each station for radioisotope analysis at CBL. An underwater benthic video camera was used to record 10 min of qualitative habitat data for each station possible. Fast bottom currents, ship drift, or large swells precluded the recording of decent footage at some stations. In addition to providing habitat information, these videos proved useful to the UAF epibenthic trawl team in planning their deployments.

Several habitats were captured on the benthic camera during this cruise. They include:

1. abundant brittle stars blanketing the sea floor (e.g., Station #s: 15, 25, 32)
2. abundant brittle starts blanketing the sea floor paired with diverse mobile and sessile epifauna- sea cucumbers, crabs, sea stars, anemones (e.g., Station #s: 26, 30, 31)
3. abundant and diverse mobile and sessile epifauna- brittle stars, crabs, soft coral, anemones (e.g. Station #s: 40, 42, 48)
4. abundant sand dollars and disciform bryozoans (Station #s: 4, 14)
5. abundant and diverse sessile epifauna, plus mobile epifauna (e.g., Station #s: 8, 11, 24, Wainwright)
6. mobile and sessile epifauna-crabs, gastropods, sea stars, tunicates, anemones, soft coral (e.g., Station #s: 3, 7, 34)
7. mobile epifauna -crabs, gastropods, sea stars (e.g., Station #s: 22, 35)
8. mixed mud and sand, little evidence of epibenthic life, articulated bivalve shells on surface (Station #46)

Particularly fascinating to watch was the video from Wainwright (impromptu station during equipment pick-up on August 4) that exhibited very diverse sessile epifauna, along with diverse mobile epifauna. The sea floor was varied at the station as well with some rocky areas. This site included tall soft corals, several species of sea star, and burrowing animals. At several other stations we saw high amounts of material in the water column near the sea floor indicating available food. Active filter feeding was also seen at these sites, such as Station #27 (sea cucumbers, *Solis*). At this station we also saw zooplankton (Chaetognaths) in the water column.

Table 1. Sample collection by the Grebmeier/Cooper lab. ‘x’ = samples were collected for the given variable or instrument; ‘xo’ = “UTX/CBL overlap station,” 4 vanVeen grab samples split between the two labs; “-“ = sampling attempted but unsuccessful due to conditions; “x-“ =video collected but short duration and poor quality. “SurfSed” samples = for USGS ostracod project

Order	Stn #	Stn Name	Date	Water Chla	Water -Nuts	Sed-Chla	TOC	van Veens	HAPS	Ben Cam	Surf Sed
1	1	CBL1	7/27/09	x	x	x	x	x	x		
2	2	CBL2	7/27/09			x	x	x	x		
3	3	CBL3	7/28/09	x	x	x	x	x	x	x	
4	4	CBL5	7/28/09			x	x	x		x	
5	5	CBL6	7/28/09			x	x	x	x	x	
6	6	UTX29	7/29/09	x	x	x	x		x	x	x
7	7	UTX28	7/29/09			x	x		x	x	
8	8	UTX30	7/29/09			x	x	xo	x	x	

9	9	CBL4	7/29/09			x	x	x	x	x	
10	10	UTX27	7/30/09	x	x	x	x		x	x-	x
11	11	CBL7	7/30/09			x	x	x	x	x	
12	12	UTX26	7/30/09			x	x		x	-	
13	13	UTX24	7/31/09	x	x	x	x	xo	x	-	
14	14	CBL9	7/31/09			x	x	x	-	x	
15	15	UTX19	7/31/09			x	x		x	x	x
16	16	UTX22	8/1/09	x	x	x	x		x	x	
17	17	UTX20	8/1/09			x	x	xo	x	x	
18	18	UTX25	8/1/09			x	x		x	x	
19	19	UTX23	8/1/09			x	x		x	-	
20	28	UTX14	8/3/09			x	x				
21	29	CBL13	8/3/09	x	x	x	x	x	x		
22	25	UTX15	8/3/09			x	x	xo	x	x-	
23	26	UTX18	8/4/09			x	x	xo	x	x	
24	27	CBL12	8/4/09	x	x	x	x	x	?	x	
25	24	UTX16	8/5/09			x	x		x	x	
26	23	UTX13	8/5/09			x	x		x	x-	
27	22	UTX17	8/5/09			x	x		x	x-	
28	20	UTX21	8/6/09	x	x	x	x		x		
29	21	CBL8	8/6/09			x	x	x	x		
30	36	UTX3	8/6/09			x	x		x	x-	
31	35	UTX10	8/6/09			x	x		x	x-	
32	37	CBL11	8/7/09	x	x	x	x	x	x	x	
33	34	UTX6	8/7/09			x	x		x	x	x
34	33	UTX9	8/7/09			x	x	xo	x	x	
35	44	CBL20	8/8/09	x	x	x	x	x	x	x-	
36	43	UTX1	8/8/09			x	x	xo	x	x-	
37	38	UTX2	8/8/09			x	x				
38	32	UTX12	8/9/09	x	x	x	x		x	x-	
39	31	CBL10	8/9/09			x	x	x	x	x-	
40	39	UTX5	8/9/09			x	x	xo	x	x-	
41	45	CBL19	8/10/09			x	x	x	x	x	
42	46	CBL18	8/10/09	x	x	x	x	x		x	x
43	42	UTX7	8/10/09			x	x		x	x	
44	40	UTX8	8/10/09			x	x	xo	x	x	
45	30	UTX11	8/11/09			x	x	xo	x	x	
46	47	CBL15	8/11/09			x	x	x	x	x	
47	48	CBL14	8/11/09			x	x	x	x	x	
48	50	CBL16	8/12/09			x	x	x		x	

D3. Harvey Chemical Component: Rodger Harvey, Karen Taylor, Matt Harvey (Chesapeake Biological Laboratory/University of Maryland Center for Environmental Science)

As part of the chemical analysis group of the project, multiple types of samples have been collected and archived for analysis in shore-based laboratory. The first is particulate material collected onto combusted GF/F filters at multiple water column depths. Water depths (3-4 discrete depths per station) for particulate samples were not fixed but determined after initial water column SONDE profiling by the Trefry group. This allowed major distinctions among water masses to be accurately determined at each site and collected accordingly. Sample sites and depths are described in Table 1 below. At the majority of sites where particles were collected, matching underlying sediments were also obtained using either box core or HAPS core. Cores were treated in one of two ways: sliced on board into 1 cm sections (with interface at 0.0-0.5 and 0.5-1.0cm sections) for each site and frozen in precleaned and certified ICHEM jars or frozen as intact cores for later sectioning. Downcore sediments for organic biomarker profiles were collected at total of 11 sites. At all other sites visited, surface sediments (0-1 cm) were collected from undisturbed surfaces of grab samples to provide a spatial survey of hydrocarbon and PAH distributions over the study area (see table below). At all sites for sediment collections, pooled samples have been split with the Trefry group for parallel measures of trace elements in sediments and biota. At several visited sites. Subsamples of phytoplankton tows were collected and frozen to ascertain chemical constituents of dominant phytoplankton.

Table 1 – Summary of particulate and sediment collected through August 11 for chemical analysis

Date	Station No.	Targeted sample depth (m)	Sample type (containments, POC)	Filter Size (25mm or 47mm)	No. of filters	Bottom depth (m)	Sediment (?)
27-Jul-09	1	2	contaminants	47	3	37	Y – surface
27-Jul-09	1	10	contaminants	47	3	37	Y – surface
27-Jul-09	1	26	contaminants	47	3	37	Y – surface
27-Jul-09	1	2	POC	25	2	37	Y – surface
27-Jul-09	1	10	POC	25	2	37	Y – surface
28-Jul-09	3	5	contaminants	47	2	39	Y – surface
28-Jul-09	3	20	contaminants	47	2	39	Y – surface
28-Jul-09	3	35	contaminants	47	4	39	Y – surface
28-Jul-09	3	5	POC	25	2	39	Y – surface
28-Jul-09	3	20	POC	25	1	39	Y – surface
28-Jul-09	3	35	POC	25	2	39	Y – surface
29-Jul-09	6	5	contaminants	47	2	45	Y – downcore
29-Jul-09	6	20	contaminants	47	2	45	Y – downcore
29-Jul-09	6	30	contaminants	47	2	45	Y – downcore
29-Jul-09	6	40	contaminants	47	3	45	Y – downcore
29-Jul-09	6	5	POC	25	2	45	Y – downcore
29-Jul-09	6	20	POC	25	2	45	Y – downcore
29-Jul-09	6	30	POC	25	2	45	Y – downcore
29-Jul-09	6	40	POC	25	2	45	Y – downcore
29-Jul-09	n/a	n/a	BLANK	47	1	n/a	n/a
29-Jul-09	n/a	n/a	BLANK	47	1	n/a	n/a

29-Jul-09	n/a	n/a	BLANK	47	1	n/a	n/a
30-Jul-09	10	10	contaminants	47	2	54	Y – downcore
30-Jul-09	10	30	contaminants	47	2	54	Y – downcore
30-Jul-09	10	40	contaminants	47	2	54	Y – downcore
30-Jul-09	10	10	POC	25	2	54	Y – downcore
30-Jul-09	10	30	POC	25	2	54	Y – downcore
30-Jul-09	10	40	POC	25	2	54	Y – downcore
31-Jul-09	13	10	contaminants	47	2	50	Y – downcore
31-Jul-09	13	30	contaminants	47	2	50	Y – downcore
31-Jul-09	13	40	contaminants	47	2	50	Y – downcore
31-Jul-09	13	10	POC	25	2	50	Y – downcore
31-Jul-09	13	30	POC	25	2	50	Y – downcore
31-Jul-09	13	40	POC	25	2	50	Y – downcore
31-Jul-09	n/a	n/a	contaminants/lipids	47	3	n/a	N
1-Aug-09	16	20	contaminants	47	2		Y – downcore
1-Aug-09	16	30	contaminants	47	2		Y – downcore
1-Aug-09	16	40	contaminants	47	3		Y – downcore
1-Aug-09	16	20	POC	25	2		Y – downcore
1-Aug-09	16	30	POC	25	2		Y – downcore
1-Aug-09	16	40	POC	25	2		Y – downcore
3-Aug-09	29	8	contaminants	47	2		Y – downcore
3-Aug-09	29	20	contaminants	47	2		Y – downcore
3-Aug-09	29	40	contaminants	47	3		Y – downcore
3-Aug-09	29	8	POC	25	2		Y – downcore
3-Aug-09	29	20	POC	25	2		Y – downcore
3-Aug-09	29	40	POC	25	2		Y – downcore
4-Aug-09	27	20	contaminants	47	2		Y – surface
4-Aug-09	27	30	contaminants	47	2		Y – surface
4-Aug-09	27	40	contaminants	47	2		Y – surface
4-Aug-09	27	20	POC	25	2		Y – surface
4-Aug-09	27	30	POC	25	2		Y – surface
4-Aug-09	27	40	POC	25	2		Y – surface
6-Aug-09	20	10	contaminants	47	2		Y – downcore
6-Aug-09	20	20	contaminants	47	2		Y – downcore

6-Aug-09	20	40	contaminants	47	2		Y – downcore
6-Aug-09	20	10	POC	25	2		Y – downcore
6-Aug-09	20	20	POC	25	2		Y – downcore
6-Aug-09	20	40	POC	25	2		Y – downcore
6-Aug-09	n/a	n/a	BLANK	47	1	n/a	n/a
7-Aug-09	37	10	contaminants	47	2		Y – downcore
7-Aug-09	37	20	contaminants	47	2		Y – downcore
7-Aug-09	37	40	contaminants	47	2		Y – downcore
7-Aug-09	37	10	POC	25	2		Y – downcore
7-Aug-09	37	20	POC	25	2		Y – downcore
7-Aug-09	37	40	POC	25	2		Y – downcore
7-Aug-09	33	integrated	phytoplankton	47	1		Same as above
7-Aug-09	33	integrated	phytoplankton	47	1		
7-Aug-09	33	integrated	phytoplankton	25	1		
7-Aug-09	33	integrated	phytoplankton	25	1		
7-Aug-09	33	integrated	phytoplankton	25	1		
8-Aug-09	44	10	contaminants	47	2		Y - intact core, surface
8-Aug-09	44	20	contaminants	47	2		Y - intact core, surface
8-Aug-09	44	40	containments	47	2		Y - intact core, surface
8-Aug-09	44	10	POC	25	2		Y - intact core, surface
8-Aug-09	44	20	POC	25	2		Y - intact core, surface
8-Aug-09	44	40	POC	25	2		Y - intact core, surface
9-Aug-09	32	10	contaminants	47	2		Y - intact core, surface
9-Aug-09	32	20	contaminants	47	2		Y - intact core, surface
9-Aug-09	32	10	POC	25	2		Y - intact core, surface
9-Aug-09	32	20	POC	25	2		Y - intact core, surface
9-Aug-09	32	integrated	phytoplankton	47	3		as above
9-Aug-09	32	integrated	phytoplankton	47	1		
9-Aug-09	32	integrated	phytoplankton	47	2		
9-Aug-09	32	integrated	phytoplankton	47	1		
9-Aug-09	32	integrated	phytoplankton	25	6		
9-Aug-09	32	integrated	phytoplankton	25	3		
10-Aug-09	46	8	contaminants	47	2		N – sandy
10-Aug-09	46	15	contaminants	47	2		N – sandy

10-Aug-09	46	24	contaminants	47	3		N – sandy
10-Aug-09	46	8	POC	25	2		N – sandy
10-Aug-09	46	15	POC	25	2		N – sandy
10-Aug-09	46	24	POC	25	2		N – sandy
10-Aug-09	n/a	n/a	BLANK	47	1	n/a	n/a
10-Aug-09	n/a	n/a	BLANK	47	1	n/a	n/a
11-Aug-09	30	integrated	phytoplankton	47	1		Y – surface
11-Aug-09	30	integrated	phytoplankton	47	1		Y – surface
11-Aug-09	30	integrated	phytoplankton	47	1		Y – surface
11-Aug-09	30	integrated	phytoplankton	25	3		Y – surface

Date	Station No.	Sample depth (m)	Sample type (contaminants, POC)	Filter Size (25mm or 47mm)	Total vol. filtered (L)	No. of filters	Bottom depth (m)	Sediment
27-Jul-09	1	2	contaminants	47	10	3	37	Y - surface
27-Jul-09	1	10	contaminants	47	16	3	37	Y - surface
27-Jul-09	1	26	contaminants	47	13	3	37	Y - surface
28-Jul-09	3	5	contaminants	47	17	2	39	Y - surface
28-Jul-09	3	20	contaminants	47	18	2	39	Y - surface
28-Jul-09	3	35	contaminants	47	11	4	39	Y - surface
29-Jul-09	6	5	contaminants	47	17	2	45	Y - downcore
29-Jul-09	6	20	contaminants	47	16	2	45	Y - downcore
29-Jul-09	6	30	contaminants	47	11	2	45	Y - downcore
29-Jul-09	6	40	contaminants	47	11	3	45	Y - downcore
29-Jul-09	n/a	n/a	AIR BLANK	47	n/a	1	n/a	n/a
29-Jul-09	n/a	n/a	LAB BLANK	47	n/a	1	n/a	n/a
29-Jul-09	n/a	n/a	Water BLANK	47	n/a	1	n/a	n/a
30-Jul-09	10	10	contaminants	47	17	2	54	Y - downcore
30-Jul-09	10	30	contaminants	47	15	2	54	Y - downcore
30-Jul-09	10	40	contaminants	47	13	2	54	Y - downcore
31-Jul-09	13	10	contaminants	47	15	2	50	Y - downcore
31-Jul-09	13	30	contaminants	47	15	2	50	Y - downcore
31-Jul-09	13	40	contaminants	47	12	2	50	Y - downcore

**All sea water samples were collected with a peristaltic pump. Suspended particles were filtered onto pre-combusted Whatman GF/F filters and frozen.

Box core samples were limited early in the cruise (see mid cruise report) where it was discovered that the ship was not equipped with appropriate wire blocks on the stern U-frame for safe recovery of equipment. The HAPS corer was used for a portion of the sampling grid off the port winch to recover sediment cores needed for deeper sediment profiles. An adequate block was shipped to Wainwright and the box core was subsequently used effectively on 7 deployments to obtain sediments with depths over 30 cm on most.

Toxicology

As a component of the project two target species (Arctic cod and Staghorn sculpin) were identified for collection of important toxicological measures. Unfortunately, these species or other adult fish were not collected by the fisheries group for chemical analysis. Adaptive sampling was introduced in the hopes of obtaining baseline values for other resident species with a focus on benthic inhabitants. Samples for toxicological analysis employed collections of the mollusk (*Neptunia heroes*) as a replacement for target fish species which was found widespread among trawl sites. Little baseline information is available for this species and muscle tissue from the larger (>8cm) animals collected in epibenthic trawls has been archived for hydrocarbon and trace element analysis. In select animals, liver tissue has been frozen in LN_2 and archived for enzymatic analysis after the cruise conclusion. In addition, we also sampled the widespread clam (*Astartde borealis*) obtained in trawls across the sampling grid for potential use as an indicator species. For clams, hemolymph was obtained by syringe in fresh animals collected in trawls at multiple stations as shown in Table 2 below. For all internal tissues, clams were dissected and frozen for subsequent analysis of important anti-oxidative enzymes and contaminant burdens.

Table 2. COMIDA 2009 *Astarte borealis* (clam) collections.

Date	Station No.	No. of animal	length (cm)	Tissue Type Removed
4-Aug-09	26	1	3.8	hemolymph, body
4-Aug-09	26	2	3.9	hemolymph, body
4-Aug-09	26	3	4.0	hemolymph, body
4-Aug-09	26	4	3.7	hemolymph, body
4-Aug-09	26	5	3.7	hemolymph, body
4-Aug-09	26	6	4.0	hemolymph, body
4-Aug-09	26	7	4.0	hemolymph, body
4-Aug-09	26	8	3.9	hemolymph, body
4-Aug-09	26	A	n/a	hemolymph, body
4-Aug-09	26	6 total	n/a	n/a
5-Aug-09	23	4 total	n/a	n/a
7-Aug-09	33	1	3.5	hemolymph, body
7-Aug-09	33	2	3.5	hemolymph, body
9-Aug-09	32	1	3.6	hemolymph, body
9-Aug-09	32	2	3.4	hemolymph, body

10-Aug-09	45	1	3.1	hemolymph, body
10-Aug-09	45	2	2.9	hemolymph, body
10-Aug-09	45	3	2.9	hemolymph, body
10-Aug-09	45	4	2.9	hemolymph, body
10-Aug-09	45	5	2.9	hemolymph, body
10-Aug-09	45	6	2.6	hemolymph, body

**All animals were collected from the epibenthic trawl

D4. Konar Epibenthic Component: Brenda Konar, Martin Schuster (University of Alaska Fairbanks)

The epibenthic component of COMIDA had a very successful cruise. The epibenthic goal for this field season was to survey epibenthic organisms at 25 stations within the COMIDA study area. This field season, a total of thirty stations were successfully sampled. This should allow for some stations to be re-sampled in 2010 to examine inter-annual variation. The goal of the epibenthic component is to describe community structure of the organisms that inhabit the top of the substrate within the COMIDA study area. Each trawl was immediately sorted on the ship and abundance and biomass were taken for all dominant organisms larger than approximately 10mm. Dominance is defined by organisms that are either numerically abundant, have a large amount of biomass, or are ecologically important. For organisms that can be measured (length), size frequencies were also recorded. Crabs (excluding hermit crabs) were sexed and all data collected were recorded by sex.

Between Aug 1 (noon) and the evening of August 11, 19 benthic trawls were completed. Thirteen other stations were visited during this time period but we were unable to trawl them because of time constraints. These will be done next year (see below). Most trawls dragged the bottom for 2.5 minutes, although some had shorter trawls (1 minute 15 seconds) due to anticipated rich epibenthic communities and thick mud. Five trawls were subsampled due to high catches. Two sites were not visited during this field season (49 and 50). It is anticipated that these will be sampled in 2010.

Station	sorted	abundance	biomass	size frequency
1	X	X	X	X
2	X	X	X	X
3	X	X	X	X
4	X	X	X	X
5	To be done 2010	To be done 2010	To be done 2010	To be done 2010
6	X	X	X	X
7	X	X	X	X
8	To be done 2010	To be done 2010	To be done 2010	To be done 2010
9	To be done 2010	To be done 2010	To be done 2010	To be done 2010
10	X	X	X	X
11	To be done 2010	To be done 2010	To be done 2010	To be done 2010
12	X	X	X	X
13	X	X	X	X

14	X	X	X	X
15	To be done 2010	To be done 2010	To be done 2010	To be done 2010
16	X	X	X	X

Station	sorted	abundance	biomass	size frequency
17	X	X	X	X
18	X	X	X	X
29	X	X	X	X
26	X	X	X	X
24	X	X	X	X
23	X	X	X	X
21	X	X	X	X
37	X	X	X	X
34	X	X	X	X
33	X	X	X	X
44	X	X	X	X
43	X	X	X	X
32	X	X	X	X
45	X	X	X	X
42	X	X	X	X
30	X	X	X	X
47	X	X	X	X
48	X	X	X	X
19	To be done 2010	To be done 2010	To be done 2010	To be done 2010
28	To be done 2010	To be done 2010	To be done 2010	To be done 2010
25	To be done 2010	To be done 2010	To be done 2010	To be done 2010
27	To be done 2010	To be done 2010	To be done 2010	To be done 2010
22	To be done 2010	To be done 2010	To be done 2010	To be done 2010
35	To be done 2010	To be done 2010	To be done 2010	To be done 2010
36	To be done 2010	To be done 2010	To be done 2010	To be done 2010
38	To be done 2010	To be done 2010	To be done 2010	To be done 2010
31	To be done 2010	To be done 2010	To be done 2010	To be done 2010
39	To be done 2010	To be done 2010	To be done 2010	To be done 2010
46	To be done 2010	To be done 2010	To be done 2010	To be done 2010
45	To be done 2010	To be done 2010	To be done 2010	To be done 2010
40	To be done 2010	To be done 2010	To be done 2010	To be done 2010
49	To be done 2010	To be done 2010	To be done 2010	To be done 2010
50	To be done 2010	To be done 2010	To be done 2010	To be done 2010

D5. Trefry Component: Inorganic Chemistry-John Trefry and Bob Trocine (Florida Institute of Technology)

At all 48 stations, we obtained vertical profiles in the water column for salinity, temperature, dissolved oxygen, turbidity and pH using a YSI SONDE 6600. Water samples (n = 50) were collected at 3 to 5 depths at 12 stations. The water samples were filtered to obtain samples for dissolved and particulate metals and particulate organic carbon. Surface sediments (0-1 cm) were collected from van Veen grab samples at all 48 stations. Sediment cores were obtained at 12 stations using the HAPS corer or a box corer; the cores were sub-sectioned in layers at 0-0.5 cm, 0.5-1 cm and in 1-cm thick layers to the base of the 10 to 30 cm cores. One 8-cm core was collected from a van Veen grab and sectioned into 0.5-cm thick layers. Samples of muscle tissue from the gastropod *Neptunia heroes* (n = 15) were obtained using pooled samples from 10 locations and grouped by length, where possible, into the following categories: 3-5 cm, 5-8 cm and 8 cm. Samples of Astarte borealis (clam) were collected at 11 locations.

Table 1. Overall summary of data and samples collected.

Sample Type	# of stations
Vertical profiles S, T, O_2, Turb., pH	48
Surface sediments (16 samples)	48
Water samples (50) samples)	12
Suspended Sediment (50 samples)	12
Sediment cores	12
Neptunea heroes (15 samples)	10
Astarte borealis (11 samples)	11

Table 2. Detailed summary of data and samples collected.

Station	SONDE Vertical Profiles	Water for Dissolved Metals	Suspended Sediment for Metals	Surface Sediment for Metals	Sediment Core for Metals	Clams (*Astarte Borealis*)	Welk (*Neptunia heroes*)
1	x	5	5	x			
2	x			x			1
3	x	5	5	x			
4	x						1
5	x			x			
6	x	5	5	x	1		3
7	x			x			3
8	x			x			
9	x			x			
10	x	4	4	x	1		
11	x			x			
12	x			x		1	1
13	x	4	4	x	1	1	2
14	x			x			
15	x			x			
16	x	4	4	x	1		
17	x			x			
18	x			x		1	
19	x			x			
20	x	4	4	x	1		
21	x			x			
22	x			x			
23	x			x	1	1	
24	x			x		1	
25	x			x			
26	x			x		1	1
27	x	4	4	x			
28	x			x			
29	x	4	4	x	1		
30	x			x		1	
31	x			x			
32	x			x	1	1	
33	x			x	1		1
34	x			x			
35	x			x			
36	x			x			
37	x	4	4	x	2		1

38	x			x			
39	x			x			
40	X			x			
42	x			x	1		
43	x			x		1	
44	x	3	3	x	1		
45	x			x		1	1
46	x	4	4	x			
47	x			x		1	
48	x			x			
50	x			x			
TOTAL	48	50	50	48	13	11	15

D6. Norcross Fisheries Component: Christine Gleason (shipboard lead), Heloise Chenelot, Sean Rooney (University of Alaska Fairbanks)
Demersal and pelagic fish of various life stages have been collected and quantified for 57 trawls in the Chukchi Sea for COMIDA (n=27 midwater and n=30 bottom trawls). Bottom tows were used to catch demersal fish and epibenthos for 2.5 minutes on the seafloor with occasional 1 minute tows if fauna was dense. The most abundant demersal fish have been Arctic staghorn sculpin and Arctic cod in bottom water trawls. The midwater trawl consists of an undulating cycle of surface to near-bottom (10 meters of the seafloor) collection of fish and zooplankton in the water column for about 1.5 miles. The midwater trawls have been effective at catching Arctic cod juveniles, while about sculpins and snailfishes have been present at some stations. Fish caught using these two trawling methods were classified, vouchered, quantified, weighed, measured for length, and sampled for isotope analysis (Dr. Ken Dunton) and stored frozen for laboratory analysis. Both nets were equipped with temperature depth recorders (TDR) prior to deployment.

D7. Richard Prentki Component, MMS- COMIDA CAB Pelagic Seabird Surveys
Observations of Pelagic Seabirds were made under the protocols of the US Fish and Wildlife's North Pacific Pelagic Seabird Observer Program (US Fish and Wildlife Service, 2008) using the updated software program DLOG3. The protocol provided quantitative counts of seabirds along a 300-m wide transect. During the COMIDA CAB cruise, 75 transects were conducted while the *Alpha Helix* transited between stations. Transects totaled 64 hours and covered 314 km^2. The data have completed first review and edit. These data have been provided to the COMIDA CAB database and will also be provided to US Fish and Wildlife Service for their North Pacific Seabird Database.

Preliminary analysis for transects identified 20 species of birds with total count 2409 on transect. A total of 10 pinnipeds (seal or sea lion) and 22 whales were also recorded on the transects. All whales were in the Alaska Coastal Current (ACC) transects. Only 22 walruses were counted away from the on-ice concentration estimated in thousands found on August 11.

COMIDA CAB Transects (Distribution per $km^{2})$

Species	Overall Number	ACC	Central High	BSW	Hanna Shoal	Arctic Water
Northern Fulmar	549	3.58	2.02	0.58	1.24	0.57
Short-tailed Shearwater	9	0.01	0.06	0.00	0.03	0.03
Fork-tailed Storm-petrel	8	0.11	0.00	0.00	0.00	0.00
Common Eider	100	1.36	0.00	0.00	0.00	0.00

Phalarope (most-to-all Red-necked)	152	0.62	0.03	0.00	0.26	1.21
Pomarine Jaeger	41	0.07	0.19	0.04	0.20	0.10
Parasitic Jaeger	2	0.03	0.00	0.00	0.00	0.00
Long-tailed Jaeger	7	0.07	0.01	0.00	0.00	0.01
Glaucous Gull	63	0.70	0.01	0.07	0.11	0.00
Black-legged Kittiwake	43	0.15	0.15	0.11	0.22	0.03
Sabine's Gull	32	0.00	0.30	0.00	0.15	0.01
Arctic Tern	12	0.00	0.01	0.11	0.04	0.07
Common Murre	125	0.76	0.12	2.20	0.00	0.00
Thick-billed Murre	239	1.87	0.61	1.81	0.09	0.04
All Murre's*	500	3.69	1.06	5.23	0.11	0.06
Black Guillemot	2	0.03	0.00	0.00	0.00	0.00
Kittlitz's Murrelet	1	0.01	0.00	0.00	0.00	0.00
Crested Auklet	811	0.50	0.61	0.00	8.92	0.82
Least Auklet	37	0.00	0.03	0.00	0.44	0.03
Horned Puffin	1	0.00	0.00	0.00	0.00	0.01
Tufted Puffin	4	0.01	0.03	0.00	0.00	0.01
All birds*	2409	11.18	4.70	6.17	11.74	3.00

*including those not identified to species

E. Operational Events Summary and Recommendations

1. We worked through deployment issues of the scientific gear. In particular, we had deployment challenges for the trawls, involving both the winch operators and on-deck team, and deployment /recovery of the box corer. Both sampling type issue were resolved to complete the requirements of the cruise.

2. We had a few cases of double blocking on the deep sea winch, one that resulted in the loss of a beam trawl. We discussed the causes in several safety de-briefings and initiated a discussion period prior to trawling events with the winch operator and lead deck personnel (Brenda Konar for beam trawls, Christy Gleason for mid-water trawls). These discussions before each station increased communication and streamlined deck operations, resulting in subsequent overall successful trawling operations.

3. Only one box core was originally collected at Station 1 where it was discovered that the ship was not equipped with appropriate wire block on the stern U-frame for safe recovery of this equipment. We then ordered a larger block to facilitate box corer recovery, which we picked up in Wainwright on Aug. 2. The ship and science personnel then successfully deployed and recovered 4 box corers and completed this mission.

4. In the future, we recommend a pre-cruise meeting between the Captain of the vessel, and if possible, deck winch operators, the Chief Scientist, and lead scientists to review cruise operational aspects prior to deployment. This type of meeting would highlight the requirements for ship operations and allow for pre-cruise discussions, evaluate ship and equipment limitations, and allow for problem solving before deployment to streamline at-sea operations.

5. For future deployments, the following ship-board equipment would allow for safer deck operations and efficient gear deployment:

- video feed of back-deck operations to the bridge
- working fume hood
- meter wheels on both the port and starboard mid-ship winches.