Russian-American Long-term Census of the Arctic
(RUSALCA)
Cruise Plan, Leg 2 (Nome – Nome) 1-30 September 2009
Head of Expedition: Vladimir Bakhmutov, Chief Scientist: Terry Whitledge, NOAA representative: Kevin Wood, Group Alliance Representative: Aleksey Ostrovskiy

Cruise Personnel by Group				Citizen	Institution
Carbon Processes					
1.	Marlene Jeffries,	(F)	CO2	Canada	BIOS
Benthic Processes					
2.	Jacqueline Grebmeier	(F)	Benthic Proc.	USA	U. of MD
3.	Elizabeth Carvellas	(F)	Benthic Proc.	USA	U. of MD
Zooplankton Biomass and Processes					
4.	Russell R. Hopcroft	(M)	Zooplankton	Canada	U. of Alaska
5.	Ksenia Kosobokova	(F)	Zooplankton	Russia	Shirshov
6.	Elizaveta Ershova	(F)	Zooplankton	Russia-USA	Shirshov
7.	Cornelia Jaspers	(F)	zooplankton	Germany	UAF
Epibenthos					
8.	Stanislav Denisenko	(M)	Epibenthos	Russia	ZIN
9.	Petr Strelkov	(M)	Epibenthos	Russia	ZIN
10.	Sarah Mincks	(F)	Epibenthos	USA	U. of Alaska
11.	Jared Weems	(M)	Epibenthos	USA	U. of Alaska
Fish Assessments					
12.	Catherine W. Mecklenburg	(F)	fish	USA	Pt. Stephens
13.	Brenda Holladay	(F)	fish	USA	U. of Alaska
14.	Morgan Busby	(M)	fish	USA	NOAA
15.	Christine Gleason	(F)	fish	USA	U. of Alaska
16.	Daria Petrova	(F)	fish	Russia	ZIN
17.	Natalia Chernova	(F)	fish	Russia	ZIN

Hydrography and Video Plankton Recorder

18.	Marshall Swartz	(M)	CTD	USA	WHOI
19.	Robert Pickart	(M)	CTD	USA	WHOI
20.	Daniel J. TORRES	(M)	CTD	USA	WHOI
21.	Elena Bondareva	(F)	CTD	Russia	AARI

Nutrients and Productivity

22.	Terry Whitledge	(M)	Nutrients	USA	U. of Alaska
23.	Michael H. Kong	(M)	Productivity	USA	U. of Alaska
24.	Sang H. LEE	(M)	Productivity	KOREA	KOPRI
25.	Hyoung Min Joo	(M)	Phytoplankton	KOREA	KOPRI

Geology and Geophysics

26.	Boris Smirnov	(M)	NAV ROV SONAR	Russia	SONIC
27.	Alexey Sazonov	(M)	NAV ROV SONAR	Russia	SONIC
28.	Tatiana Matveeva	(F)	Geology	Russia	SONIC
29.	Elisaveta Logvina	(F)	Geology	Russia	VNIIO
30.	Dmitry Korshunov	(M)	Geology	Russia	VNIIO
31	Alexander Bosin	(M)	Geology	Russia	POI
32.	Konstatin Kramchanin	(M)	Geology	Russia	POI
33.	Alexander Kolesnik	(M)	Geology	Russia	POI

Liason and Oversight

34.	NAVY	(M)	Navigation	Russia	NAVY
35.	Kevin Wood	(M)	Oversight+logistics	USA	NOAA
36.	Vladimir Bakhmutov	(M)	Head of Exp.	Russia	NAVY
37.	Aleksey Ostrovskiy	(M)	Oversight	Russia	Group All.

Methane and Microbiology

38.	Alex. Savvichev	(M)	CH4	Russia	IMRAN
39.	Elena Zakharova	(F)	CH4	Russia	IMRAN

Educational Outreach

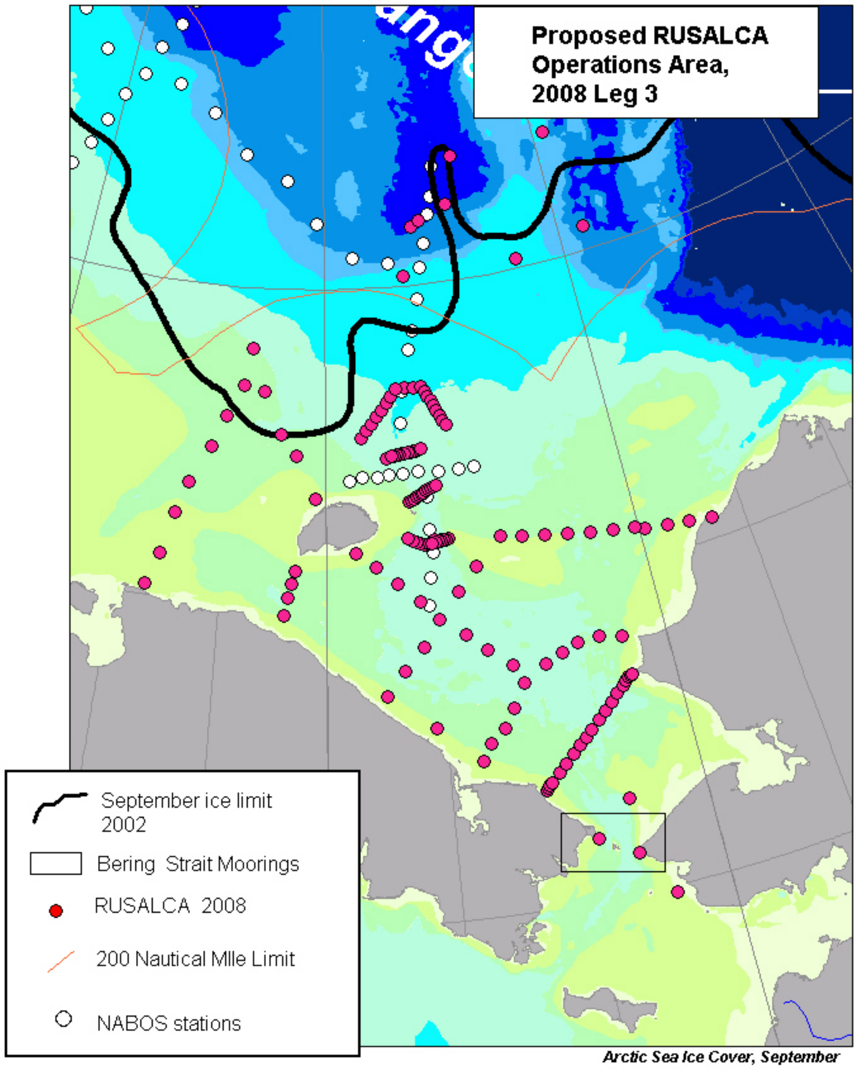
40.	Christine F. Patrick	(F)	Outreach	USA	NOAA/OGP

Scientific Support

41.	Alexey Sherbinin	(M)	equipment	Russia	FERHRI
42.	Sergey Yarosh	(M)	equipment	Russia	FERHRI
43.	Evgeny Vekhov	(M)	equipment	Russia	FERHRI
44.	Iouri Pashchenko	(M)	equipment	Russia	FERHRI

Marine Mammals

45.	Sue Moore	(F)	marine mammals	USA	NOAA



Arctic Sea Ice Cover, September 2002 vs 2007; bathymetry in meters. K. Crane Arctic, CPO

General Cruise Objectives

A series of hydrographic transects will be taken to allow sampling of all water masses during this late summer period (See attached table of station locations and charts) . A high priority of the hydrographic survey is to collect samples across water masses in the Chukchi Sea and a series of high-speed transects across Herald Valley. Biological sampling will occur at selected hydrographic station locations throughout the Chukchi Sea to enhance the knowledge of faunal distributions for census of marine life and to measure biological production rates. Geological/sediment sampling will emphasize sampling on the Chukchi Cap but will also occur at selected hydrographic stations. The long-term goal of the Rusalca program is to obtain comprehensive monitoring within the Bering/Chukchi Sea for several years in order to determine long-term trends. The hydrographic, biochemical, productivity and geological data from US and Russian collaborators will be combined for a joint assessment of climate change, water mass properties, and census of marine life and productivity rates in the Arctic as well as any new features that may be discovered.

CTD/Rosette Water Sampler Profiles

Vertical profiles of temperature, conductivity, fluorescence, light transmission, CDOM fluorescence and water samples along transects of stations will cross major water masses in the northern Bering Sea, western and eastern channels of Bering Strait and several transects across the Chukchi Sea. A SeaBird model SBE911+ profiler from WHOI will equipped with a transmissometer, fluorometer, CDOM fluorometer, altimeter, SBE43 dissolved oxygen sensor, dual 300 KHz lowered ADCP, 21 position rosette with 10 liter Nisken bottles and a mini-video plankton recorder. One or more profiles with water sampling will be collected at all sampling sites.

Included in the CTD sensor package will be a mini-Video Plankton Recorder (VPR) which is an underwater video microscope system designed for rapid quantification of plankton taxonomic composition and abundance. This instrument is manufactured by Seascan, Inc. Falmouth, MA, USA. The VPR consists of an imaging head (CCD camera and strobe), wavelet compression processor and a hard drive for real-time imaging and recording of plankton and particulates. The VPR is mounted as an autonomous instrument on the CTD/rosette and records wavelet compressed video files on an internal hard drive. The VPR is depth rated up to 300 m so it will be removed from the CTD package on stations that are deeper than 300 m. A separate Seabird SBE 37 collects conductivity, temperature and depth data which is associated with each stored video image. After each deployment, the image and CTD data are transferred by an Ethernet link to an on-deck PC. A proprietary software program will inspect each image and determines if and how many in focus targets are present.

Hydrochemical Nutrient Distributions and Dynamics

A coordinated and quantitative study of the primary productivity responses to nutrient and biological processes in the northern Bering and Chukchi Seas will be conducted. Our goals are to:

1. Quantify the range of nutrient, phytoplankton biomass and productivity in water masses distributed in the northern Bering and Chukchi Seas

2. Establish physical and chemical factors that are conducive to maintenance of relatively large rates of primary production.
3. Compare contemporary rates with those obtained in the previous decade for assessment of rate changes under the present warm temperatures.

Nutrient samples will be collected at all hydrographic/biological stations and will analyzed for nitrate, nitrite, phosphate, silicate and ammonium concentrations onboard. Raw data peaks will be recorded for each sample and initial data processing will determine draft concentrations with the goal of having the data available to all cruise participants by the end of the cruise.

Equipment utilized

1. Alpkem Model 300 Rapid Flow Nutrient Analyzer (5 channels for analysis of phosphate, silicate, nitrate, nitrite, ammonium) including 5 photometers, 2 pumps and 1 sampler.

Carbon Processes

Water samples will be collected from the hydrographic stations for dissolved inorganic carbon (DIC), and possibly total organic carbon (TOC). In addition, a SAMI sensor will be installed in the running seawater system to measure pCO2 concentrations.

Productivity, Chlorophyll and Phytoplankton in Bering Strait and Chukchi Sea

To estimate carbon and nitrogen uptake of phyplankton at different locations, daily productivity experiments will be conducted with deck incubations of phytoplankton on the deck for 4-7 hours after inoculation with stable isotopes (^{13}C, $^{15}NO_3$, and $^{15}NH_4$). The daily productivity stations, will have 6 different light depths for each station determined by a PAR sensor. The samples will be collected on GF/F (ø = 25 mm) filters for laboratory isotope analysis at University of Alaska Fairbanks.

Along with the small productivity bottle experiments, large volume productivity experiments will be executed to look at the physiology status of phytoplankton. These filtered (GF/F, ø = 47 m) samples will be chemically analyzed for the photosynthetic end products of phytoplankton such as lipid, protein, polycarbonate and LMWM.

Since the photosynthetic end products are affected by species composition of phytoplankton, phytoplankton samples will be taken from CTD casts at every productivity station for species identification. The phytoplankton samples will be stored in 125 ml plastic bottles with neutral Lugol solution and will be identified under a microscope at the laboratory.

Chlorophyll samples will be collected from CTD casts at every station and filtered onto GF/F filters to be analyzed at the lab. Chl a from these filters will be extracted by the mixture solvent (90 % Acetone) and measured by a fluorometer in our lab. The Chlorophyll *a* concentrations will also be used to calibrate the *in vivo* fluorescence profiles taken by the CTD profiler. The samples were collected with the rosette on upcasts and extracted chlorophyll *a* concentrations will be determined fluorometrically (Parsons et al., 1984).

Census of Arctic Zooplankton communities

A comprehensive survey and census of zooplankton species in the Bering Strait through central Chukchi Sea will be taken to understand the transport patterns of Pacific zooplankton into the Arctic and serve as a baseline for future studies on ecosystem change in this climatically sensitive region.

The census will be conducted using plankton nets of 150 and 53 µm mesh with analysis to involve a combination of traditional taxonomic enumeration and identification, along with comprehensive molecular sequencing to be undertaken by Ann Bucklin (University of New Hampshire). Photographic documentation will be completed for a number the species encountered. To determine why zooplankton biomass remains low despite the incredibly high primary production in much of this region, egg production experiments will be conducted with several of the dominant copepod species in this region (i.e. primarily *Pseudocalanus* spp., with variable contributions by *Metridia pacifica*, *Eucalanus bungii*, and *Calanus marshallae*). These rates are expected to be very sensitive to modification by climate change.

Marine Infaunal Benthic Community Structure and Benthic Carbon Cycling

The objectives of this study are:

1. The determination of macro-infaunal abundance, biomass, and community structure.
2. Measurement of sediment oxygen consumption as an indicator of carbon supply to the benthos.
3. Analysis of sediment chemistry parameters important to these benthic communities (sediment chlorophyll a content, total organic carbon content, sediment grain size, and sedimentation rates using ^{7}Be and ^{137}Cs as indicators of particle settling rate).
4. Analysis of ^{18}O stable oxygen isotope composition in the overlying water column, indicative of water mass variation and freshwater input.
5. The comparison of RUSALCA marine community analyses with those undertaken on previous Russian-U.S. cruises in this same region, particularly the BERPAC sponsored cruises that involved Russian and U.S. scientists in 1989 (*Akademik Koralev*), 1993 (*Okean*), 1995 (*Alpha Helix*) and RUSALCA 2004.

A. Field Sampling, Equipment, Sampling Time, Chemical Inventory, and Space Requirements

1. Water samples will be collected out of the rosette for δ^{18}O value analysis. The oxygen-18/oxygen-16 samples will be collected in small (8 mL) glass vials and sealed for land-based analyses.

2. Quantitative benthic sampling 133-cm^2 HAPS corer and 0.1 m2 van Veen grab), including time requirements: In general we expect that the wire time required for benthic collections will be approximately 1 to 1 1/2 hours per station, assuming a depth of 50 m, with a proportional increasing in deployment time up to a maximum

500m deployment. At least two people are required for gear deployment and HAPS core and grab manipulations after collection.

B. Sampling Protocol

1. We will collect 3 sediment cores using a single barrel HAPS sediment corer as our normal sampling procedure, with the total number of deployments depending upon on sediment conditions.

- Two cores will be collected for shipboard incubation, and these cores will be maintained in the dark at in-situ bottom temperatures (using the CTD for guidance) in a low temperature incubator. Bottom water for these experiments will be collected from bottom water bottles on the CTD rosette. Subsamples from the overlying water in these cores will be analyzed in the shipboard chambers for changes in dissolved oxygen, nutrients, alkalinity, and pH. Subsequent to the end of the experiment, cores will be sieved and fauna preserved with formalin for land-based taxonomic identification.
- One additional core will be collected. Sediments from this core will be sectioned at 1 cm intervals from 0-4 cm depth, 2 cm intervals from 4-20 cm, and 4 cm intervals to the bottom of the core. Ninety (90) cm^3 of each one-cm sediment increment will be added to aluminum cans with calibrated geometries for direct counting, using our land-based gamma spectroscopy system.

2. We will collect sediment from 5 van Veen grabs per station sampled.

- Grab 1. Surface sediment will be collected from the first van Veen grab for sediment chlorophyll, grain size and organic carbon content. The subsamples for grain size and organic carbon will be frozen for land-based analyses. Samples for determination of chlorophyll *a* in surface sediments will be collected from the top 0-1 cm of the grab or HAPS core, depending on station depth. Following dark storage for 12 hr in 90% acetone at 4°C, chlorophyll *a* concentrations associated with small surface area aliquots of sediments will be determined fluorometrically using a Turner Designs 10-AU fluorometer. The remaining sediments will be sieved for the Iken/Bluhm component to evaluate stable C and N isotopes of the infauna.
- The remaining 4 van Veen sediment collections will be sieved for faunal collections. Each van Veen sediment sample will be placed in a 1 mm stainless steel screen box and sieved using seawater, the remaining animals subsequently preserved in 10% sea water formalin, buffered with hexamethylenetetramine, stored in plastic Whirl-pak bags, for later organismal identification and biological community structure analysis at CBL. Post-processing statistical analyses is undertaken for determining faunal composition for similarity clustering of faunal groups, and measurements of benthic faunal biomass.

C. Logistic or Scientific Requirements

We currently have all benthic research equipment needed to undertake the work (van Veen grabs, HAPS benthic corer, sieve boxes, analytical equipment). We will seek to collaborate with other investigators in the use of our data, as well as other data collected during the cruise, such as CTD and general water column data (chlorophyll, nutrients, etc).

1. Chemicals (MSDS forms included with shipment)
   - three 4-Liter bottles of 37% formaldehyde
   - 1-L bottle 10N sulfuric acid, 1-L bottle 0.1N hydrochloric acid
   - hexamethylene tetramine buffer
   - Magnesium chloride, Sodium hydroxide, Sodium iodide, Sodium thiosulfate
2. Space Requirements
   - 4 linear ft in dry lab for oxygen titration rig, pH meter, computer
   - 3 linear ft in wet lab for infauna and sediment processing

Arctic Epibenthic Community Structure and Benthic Food Web Structure

The goal for the Rusalca cruise is to use the Arctic benthic ecosystem as an indicator for long-term climate changes since it acts as an integrator for oceanic processes and as a filter for seasonal fluctuations. Our two main objectives are:

1. To create present-day baseline data of megafauna community structure and diversity,
2. To establish the benthic food web structure and its linkage to the pelagic system in order to establish an observing system for change in bottom-up processes.

Benthic invertebrate epifauna will be sampled with a beam trawl (2.26 m effective opening) by towing between 1-5 minutes bottom-time at 1-1.5 knot; this beam trawl tow also collects fishes for the Larval Fisheries Ecology project. Additionally, a dredge or an otter trawl may provide samples for community structure analysis. The catch will be rinsed and then sorted into species or taxa. Individuals of all species/taxa will be counted and weighed by species. Samples will be preserved in 4% formalin-seawater solution buffered with hexamethylenetetramine. Abundance and biomass can later be determined from the area trawled as catch per unit effort (CPU). In case ROV images of the seafloor are taken at the stations they may be analyzed for epibenthic community composition and will provide supplementary valuable information about the distribution patterns and behavior of the epibenthic organisms.

For food web structure collection of as many members of the pelagic and benthic food web as possible will be done in order to conduct stable isotope analysis on them. Water samples from each station will be taken from the CTD rosette from the chlorophyll maximum as indicated by a fluorescence peak during the CTD cast. Water filtered onto pre-combusted GF/F filters will be frozen for later stable isotope analysis. Zooplankton from the upper water column will be sampled with a handnet or by participating in collections from other plankton trawls (collaboration with plankton group). Surface sediment from the organic layer and infauna will be sampled from Van Veen grabs (collaboration with infauna group, 3 grabs in addition to those required for infauna at each station) and epifauna will be sampled from beam trawls and otter trawls. Stable isotopes will be analyzed using continuous-flow isotope ratio mass spectrometry at the Alaska Stable Isotope Facility.

Larval Fisheries Ecology of the Bering and Chukchi Seas

The main project objective will be to document fishes in the Bering and Chukchi Seas by gathering baseline information about fish species presence, distribution, relative abundance, and association with the environment. Larval and juvenile fishes will be collected using both a plankton net (LF [Larval Fish] Bongo) and a bottom trawl (LF Trawl). Invertebrates caught by the LF Trawl will be utilized by the Arctic Epibenthic Community and Benthic Foodweb studies.

The LF Bongo net will be deployed for one tow per site. The LF Bongo will be a 60 cm diameter Bongo net with paired 0.505-mm mesh plankton nets, fished in an oblique tow from the surface to within 10 m of the bottom. The vessel speed will be approximately1.5- 2 knots during the LF Bongo tow, and will be adjusted to maintain a 45° wire angle. The towing cable will be deployed at 45 m/min, and retrieved at 20 m/min. Plankton collected by the LF Bongo will be preserved in 10% formalin for laboratory identification during the coming year.

The LF Trawl will be deployed for one to two tows per site. A second tow is necessary only if the first tow is determined to be nonquantitative, e.g. full beyond the codend, damaged gear, or fishing above the sea floor. The LF Trawl will be a 3.05 m plumbstaff beam trawl having 7 mm mesh in the body of the net and a 4 mm mesh codend liner; its effective swath is 2.26 m. The vessel speed will be approximately 1-1.5 kt during the LF Trawl’s 1-5 minute tow on the sea floor. Fishes collected by the LF Trawl will be identified and measured on board. Most whole fishes will be frozen for potential laboratory analyses of otoliths, tissues and stomach contents, and 1-10 individuals of each fish species will be preserved in formalin for this project’s voucher collection.

Adult Fish Sampling

The specific cruise objectives of the fish diversity, or “Adult Fish” (AF), project will be (1) to trawl for large juvenile and adult benthic and demersal fishes at the same stations sampled in 2004, as well as additional stations as time and conditions permit; (2) to document the catch for fish identifications and presence by preserving examples of each species caught at each station and archiving them in permanent repositories including the California Academy of Sciences, RAS Zoological Institute, and University of Alaska fish collections; (3) to obtain tissue samples and supporting documentation (photographs and the sampled fish specimens) for DNA sequencing by the Barcode of Life program; (4) to collect fishes of particular interest for taxonomic research; (5) to photograph live and fresh specimens to record life colors and appearance of Arctic species; (6) to obtain data on physical and environmental variables (depth, temperature, salinity, oxygen) at each station trawled; and (7) to characterize net contents from each haul, including general composition of biota and substrate.

It is planned to tow a 9.14-m (30-foot) (headrope length) otter trawl with 1.9-cm (0.75-inch) mesh liner in the codend. The net floats are rated to a depth of 1500 m. One or two tows will be made at each biological station, with the second tow occurring only if the first is not quantitative, at a towing speed of 2 knots and the net 20 minutes on the bottom. All captured individuals will be sorted, measured for total length, and identified, usually to genus and species. Fish to be saved for research or documentation of the catch will be preserved in formalin. Tissue samples will be preserved in ethyl alcohol. Depth and temperature at each station will be obtained using a TDR (temperature and depth recorder) attached to the net's headrope. For salinity and oxygen, the project depends on data from the CTD profiler project (as in 2004).

Marine Mammals

A visual watch for marine mammals will be maintained during daylight hours whenever the ship is underway and during 10-minute periodic scans when the ship is on station. The watch will consist of a single observer using naked eye and handheld binoculars to view a 180º arc forward of the ship when underway, with 360º scans conducted when the ship is on station. The watch will be conducted from the ship's bridge, or other suitable location that affords an unobstructed view.

All marine mammal sightings will be noted by time, location, species identity, number of animals seen and behaviors observed. Associated environmental conditions and (if possible) photographs of distinctive markings will be included in the data record whenever possible. If practical, the primary observer will be assisted by other scientific party personnel, or the ship's crew, with all sighting data combined to a common data file. Additionally, NOAA Platform of Opportunity forms will be provided for any sightings made in the absence of the primary observer.

Geology and Geophysical Sampling

The goal is to collect bottom images to investigate the possible methane releases from the sediments and to determine canyon structure and topography. It is planned to collect sonar images along track lines in Herald Canyon and the Pockmark field on the Chukchi Plateau. Sediment cores will be collected at seven stations in Herald Trough and six stations on the Chukchi Plateau.

Remotely Operated Video Operations

A Remotely Operated Video (ROV) will be an integral part of the cruise. An Intershelf 105 fish, will provide color video to be transmitted over 150 m of coaxial cable up to the ship. Images will be captured on computer and transferred directly into MPEG 4 files for hard drive and CD storage. At most of the ROV stations shallower than 60 meters, the ship will be requested to anchor for ROV operations. At other stations (e.g. Herald Trough), the ROV operations can take place while the ship is drifting with the currents.

Leg 2 Sampling Stations (Draft)

Note that all proposed sampling locations for leg 2 are included in this listing. Ice and weather conditions may prevent sampling at some locations and the order of sampling the stations is somewhat flexible within the constraints of our limited cruise time. Yellow highlighted stations are proposed primary biological sampling sites and blue highlighted stations are primarily geological sampling sites. It is a priority to collect samples at sites sampled in 2004 but new sampling locations are also highly desirable for exploratory purposes.

[O1]

Sta#	Sta Name	Lat (N) North	Long (W). West	Date Arrive	Station Sampling
	Note: Ice and weather may alter schedule significantly				
1	BS2	65.9625	169.5707	9/2/2009	CTD, Wat, VZ, LZ[O2],OZ, PP
2	BS22	65.62467	168.1772	9/2/2009	CTD, Wat,VZ, OZ, LF, AF, G
3	AL24	66.46933	168.1048	9/3/2009	CTD, Wat,VZ, OZ, LF,AF,G, PP
4	CS1	66.83	171.2567	9/4/2009	CTD, Wat,VZ,OZ, LF,AF,G
5	CS2	66.86487	171.1678	9/4/2009	CTD, Wat,VZ, AF, G
6	CS3	66.89973	171.079	9/4/2009	CTD, Wat,VZ
7	CS4	66.9346	170.9902	9/4/2009	CTD, Wat,VZ, AF
8	CS5	67.06221	170.6377	9/4/2009	CTD, Wat,VZ, G, PP
9	CS6	67.18982	170.2853	9/4/2009	CTD, Wat,VZ, AF
10	CS7	67.31103	169.9413	9/4/2009	CTD, Wat,VZ,LZ
11	CS8	67.43225	169.5973	9/4/2009	CTD, Wat,VZ,LF,AF,G
12	CS9	67.53344	169.307	9/4/2009	CTD, Wat,VZ, OZ, LF, AF, G
13	CS10	67.63463	169.0168	9/4/2009	CTD, Wat,VZ,AF
14	CS11	67.75505	168.6652	9/5/2009	CTD, Wat,VZ
15	CS12	67.87547	168.3136	9/5/2009	CTD, Wat,VZ,LF
16	CS13	67.98873	167.9894	9/5/2009	CTD, Wat,VZ,LZ, AF, G
17	CS14	68.10198	167.6653	9/5/2009	CTD, Wat,VZ
18	CS15	68.20078	167.3568	9/5/2009	CTD, Wat,VZ,LZ,LF,AF,G
19	CS16	68.25018	167.2026	9/5/2009	CTD, Wat,VZ
20	CS17	68.29958	167.0483	9/5/2009	CTD, Wat,VZ
21	CS18	68.31563	166.96	9/5/2009	CTD, Wat,VZ, OZ, LF, AF, G, PP
22	CS19	68.33167	166.8717	9/5/2009	CTD, Wat,VZ
23	CL1	68.94987	166.9121	9/5/2009	CTD, Wat,VZ,LZ
24	CL2	69.02253	167.9224	9/6/2009	CTD, Wat,VZ, OZ, LF, AF, G
25	CL3	69.0062	168.8948	9/6/2009	CTD, Wat,VZ, PP
26	CL4	68.88558	169.6071	9/6/2009	CTD, Wat,VZ, OZ, LF, AF, G
27	CL5	68.75793	170.4184	9/7/2009	CTD, Wat,VZ
28	CL6	68.52242	171.4619	9/7/2009	CTD, Wat,VZ, OZ, LF, AF, G, PP
29	CL7	68.15725	172.05	9/7/2009	CTD, Wat,VZ
30	CL8	67.87028	172.5509	9/7/2009	CTD, Wat,VZ, OZ, LF, AF, G
31	CL9	67.67872	173.1917	9/8/2009	CTD, Wat,VZ,LZ
32	CL10	67.40822	173.6028	9/8/2009	CTD, Wat,VZ, OZ, LF, AF, G
33	IC1	70.33333	161.5167	9/9/2009	CTD, Wat,VZ,LZ,Iso
34	IC2	70.38333	162.5833	9/9/2009	CTD, Wat,VZ, OZ, LF, AF, G
35	IC3	70.43333	163.65	9/9/2009	ctd

36	IC4	70.48333	164.7183	9/9/2009	ctd
37	IC5	70.53333	165.17	9/9/2009	ctd
38	IC6	70.595	166.1833	9/9/2009	CTD, Wat,VZ, OZ, LF, AF, G, PP
39	IC7	70.64	167.2417	9/9/2009	ctd
40	IC8	70.69167	168.3367	9/9/2009	ctd
41	IC9	70.74333	169.43	9/9/2009	CTD, Wat,VZ, OZ, LF, AF, G
42	IC10	70.8	170.49	9/10/2009	ctd
43	IC11	70.84333	171.5117	9/10/2009	ctd
44	IC12	70.93167	174.7467	9/10/2009	ctd
45	IC13	70.927	174.4	9/10/2009	ctd
46	HC1	70.92317	174.018	9/10/2009	CTD, Wat,VZ, OZ, LF, AF, G, PP
47	HC2	70.91683	174.156	9/10/2009	ctd
48	HC3	70.91167	174.289	9/10/2009	ctd
49	HC4	70.904	174.428	9/10/2009	ctd
50	HC5	70.89733	174.564	9/10/2009	ctd
51	HC6	70.88983	174.699	9/10/2009	ctd
52	HC7	70.88383	174.833	9/10/2009	CTD, Wat,VZ, OZ, LF, AF, G, V[O3]
53	HC8	70.87867	174.971	9/10/2009	ctd
54	HC9	70.8725	175.11	9/10/2009	ctd
55	HC10	70.87017	175.252	9/10/2009	ctd
56	HC11	70.88767	175.442	9/10/2009	ctd
57	HC12	70.91767	175.617	9/10/2009	ctd
58	HC13	70.951	175.779	9/10/2009	ctd
59	HC14	70.98567	175.98	9/11/2009	ctd
60	HC15	71.5585	175.7882	9/11/2009	CTD, Wat,VZ, OZ, LF, AF, G, PP
61	HC16	71.57983	175.6628	9/11/2009	ctd
62	HC17	71.601	175.5373	9/11/2009	ctd
63	HC18	71.62217	175.4115	9/11/2009	ctd
64	HC19	71.64317	175.2853	9/11/2009	ctd
65	HC20	71.664	175.1588	9/11/2009	ctd
66	HC21	71.68483	175.0322	9/11/2009	ctd
67	HC22	71.70567	174.9052	9/11/2009	ctd
68	HC23	71.72633	174.778	9/11/2009	ctd
69	HC24	71.747	174.6505	9/11/2009	ctd
70	HC25	71.7675	174.5227	9/11/2009	ctd
71	HC26	71.78783	174.3947	9/11/2009	CTD, Wat,VZ, OZ, LF, AF, G, V
72	HC27	72.37083	174.979	9/12/2009	CTD, Wat,VZ, OZ, LF, AF, G, PP, V
73	HC28	72.36033	175.117	9/12/2009	ctd
74	HC29	72.35317	175.254	9/12/2009	ctd
75	HC30	72.34183	175.397	9/12/2009	ctd
76	HC31	72.33383	175.545	9/12/2009	ctd
77	HC32	72.3285	175.691	9/12/2009	ctd
78	HC33	72.32067	175.839	9/12/2009	ctd
79	HC34	72.31467	175.984	9/12/2009	ctd
80	HC35	72.30817	176.132	9/12/2009	ctd
81	HC36	72.30117	176.28	9/13/2009	ctd
82	HC37	72.29733	176.428	9/13/2009	ctd
83	HC38	72.29033	176.512	9/13/2009	ctd
84	HC39	72.2795	176.6443	9/13/2009	ctd
85	HC40	72.26883	176.8018	9/13/2009	CTD, Wat,VZ, OZ, LF, AF, G, PP

86	HC41	72.60933	178.0765	9/13/2009	ctd
87	HC42	72.7155	177.7975	9/13/2009	ctd
88	HC43	72.82133	177.5152	9/13/2009	ctd
89	HC44	72.92683	177.2295	9/14/2009	ctd
90	HC45	73.03183	176.9403	9/14/2009	ctd
91	HC46	73.1365	176.6477	9/14/2009	CTD, Wat,VZ, OZ, LF, AF, G
92	HC47	73.24067	176.3517	9/14/2009	ctd
93	HC48	73.3445	176.0518	9/14/2009	ctd
94	HC49	73.34517	175.5812	9/14/2009	CTD, Wat,VZ, OZ, LF, AF, G, PP, V
95	HC50	73.34483	175.1103	9/14/2009	ctd
96	HC51	73.3435	174.6398	9/14/2009	ctd
97	HC52	73.2635	174.4968	9/14/2009	CTD, Wat,VZ, OZ, LF, AF, G
98	HC53	73.18333	174.3552	9/15/2009	ctd
99	HC54	73.10317	174.2147	9/15/2009	ctd
100	HC55	73.02283	174.0757	9/15/2009	ctd
101	HC56	72.9425	173.9377	9/15/2009	ctd
102	HC57	72.86217	173.8012	9/15/2009	ctd
103	HC58	72.7815	173.6658	9/15/2009	ctd
104	HC59	72.70083	173.5317	9/15/2009	ctd
105	GG01	72.69526	176.5389	9/16/2009	Cores
106	GG02	72.58162	176.3293	9/16/2009	Cores
107	GG03	72.4357	176.0437	9/16/2009	Cores
108	GG04	72.77332	176.8016	9/17/2009	Cores
109	GG05	72.62128	176.507	9/17/2009	Cores
110	GG06	72.44609	176.1764	9/17/2009	Cores
111	GG07	72.28702	175.8678	9/18/2009	Cores
112	GGGT2	71.132	187.5056	9/18/2009	Cores
113	GD1	76.61637	163.9964	9/18/2009	Cores, CTD, Wat,VZ, OZ, LF, AF, PP, V
114	GD2	76.61995	163.9159	9/18/2009	Cores, CTD, Wat,VZ, OZ, LF, AF, V
115	GD3	76.5504	164.1669	9/19/2009	Cores, CTD, Wat,VZ, OZ, LF, AF, PP, V
116	GD4	76.55066	163.9928	9/19/2009	Cores, CTD, Wat,VZ, OZ, LF, AF, V
117	GD5	76.53075	164.1228	9/19/2009	Cores, CTD, Wat,VZ, OZ, LF, AF, PP, V
118	GD6	76.5191	164.177	9/19/2009	Cores, CTD, Wat,VZ, OZ, LF, AF, V
119	LongS1	69.83667	181.9833	9/20/2009	CTD, Wat,VZ, G
120	LongS2	70.11833	181.785	9/20/2009	CTD, Wat,VZ, G
121	LongS3	70.34167	181.6583	9/20/2009	CTD, Wat,VZ, G
122	LongS4	70.53833	181.4733	9/20/2009	CTD, Wat,VZ, OZ, LF, AF, G, PP
123	CEN1	70.795	178.5683	9/20/2009	CTD, Wat,VZ, OZ, LF, AF, G
124	CEN2	70.56667	177.6333	9/21/2009	CTD, Wat,VZ,LZ,PP,LF, G
125	CEN3	70.28333	176.6667	9/21/2009	CTD, Wat,VZ,LF,AF, G
126	CEN4	69.98333	175.6667	9/21/2009	CTD, Wat,VZ, LF, AF, G
127	CEN5	69.68333	174.8333	9/21/2009	CTD, Wat,VZ, OZ, LF, AF, G, PP
128	CEN6	69.4	173.75	9/22/2009	CTD, Wat,VZ, LF, AF, G, V
129	CEN7	69.11667	172.8333	9/22/2009	CTD, Wat,VZ, OZ, LF, AF, G
130	CEN8	68.83333	171.8333	9/22/2009	CTD, Wat,VZ, LF, AF, G, PP
131	CR1	68.55	177.4167	9/22/2009	CTD, Wat,VZ, G
132	CR2	68.91667	176.5833	9/23/2009	CTD, Wat,VZ, G
133	CR3	69.28333	175.6667	9/23/2009	CTD, Wat,VZ, G
134	CR4	70.08333	173.8333	9/23/2009	CTD, Wat,VZ, G, PP
135	CR5	70.43333	172.9	9/24/2009	CTD, Wat,VZ, OZ, LF, AF, G

136	WN1	71.66667	180.5	9/24/2009	CTD, Wat,VZ, OZ, LF, AF, G
137	WN2	72.33333	181.5	9/24/2009	CTD, Wat,VZ, G, PP
138	WN3	72.66667	182.3333	9/25/2009	CTD, Wat,VZ, OZ, LF, AF, G
139	WN4	73.33333	183.3333	9/25/2009	CTD, Wat,VZ, G
140	WN5	74	184.1667	9/25/2009	CTD, Wat,VZ, OZ, LF, AF, G, PP
141	SS1	73.41667	184.5	9/26/2009	CTD, Wat,VZ, G
142	SS2	72.91667	185.3333	9/26/2009	CTD, Wat,VZ, OZ, LF, AF, G
143	SS3	72.41667	186	9/26/2009	CTD, Wat,VZ, G
144	SS4	71.83333	187	9/27/2009	CTD, Wat,VZ, OZ, LF, AF, G, PP
145	SS5	71.33333	187.5	9/27/2009	CTD, Wat,VZ, G
146	SSC1	68	175.4	9/28/2009	CTD, Wat,VZ, OZ, LF, AF, G
	Nome	64.9	167.08	9/28/2009	CTD, Wat,VZ, G, PP

Yellow Color denotes Biological Station but Geological sampling is also possible

Blue Color denotes primary Geological Station but Biological sampling is also possible

Sampling Key:
CTD is CTD/rosette profile
Wat is water sample collection
VZ is vertical zooplankton tow
OZ is oblique zooplankton tow
LF is larval fish tow
AF is adult fish sampling
G is sediment grab sampling
PP is primary production sampling