Arctic Long Term Integrated Mooring Array (ALTIMA) 2016 Cruise Plan

DATES: 3 - 29 SEPTEMBER 2016

Vessel: F/V *Aquila*

I. Cruise Overview

Cruise Title – ALTIMA 2016

Cruise Dates: 3 – 29 September 2016

Departure – Nome, AK – 3 September

Arrival – Dutch Harbor, AK – 29 September

Operating Area – Bering, Chukchi, and western Beaufort Seas

A. Summary of Objectives

There are eight main objectives for the ALTIMA cruise:

1. Retrieve and/or (re)deploy long-term passive acoustic, oceanographic, and zooplankton moorings in the Bering, Chukchi, and western Beaufort Seas, to continue the year-round multi-disciplinary time series started in the Arctic in 2010.
2. Conduct CTD casts and zooplankton net tows along pre-determined transect lines.
3. Deploy a towed oceanographic instrument that can survey the water column while underway.
4. Conduct 24/7 passive acoustic monitoring for marine mammals using sonobuoys.
5. Conduct marine mammal visual surveys during daylight hours using 25x Big Eye binoculars. Time allowing and species-dependent, photos will be taken for photo-identification purposes.
6. Deploy a satellite ARGOS drifter drogued to 30 m.
7. Survey along additional Distributed Biological Observatory (DBO) transect lines to add to the long-term DBO time series (Funding dependent).
8. Recover two (2) wave gliders.

B. Location of field operations

The primary operating area will be within the Chukchi and western Beaufort Seas. Mooring locations can be seen in Figures 1 and 2. CTD and plankton tow transects will occur on eight separate lines perpendicular, and two lines somewhat parallel, to the coast (Figure 1). One satellite ARGOS drifter will be deployed offshore of Icy Cape, near the IC3 mooring (Figure 1). An additional operating area will be on the Bering Sea shelf. The Pacific Marine Environmental Laboratory's (PMEL's) oceanographic moorings and four additional passive acoustic moorings will be retrieved and redeployed along the 70 m and 50 m isobaths in the Bering Sea (Figure 2). The BS6 mooring was already deployed in Umnak Pass in May 2016. Two wave gliders will also be retrieved in the Bering Sea near either the M4 or M5 site (Figure 2).

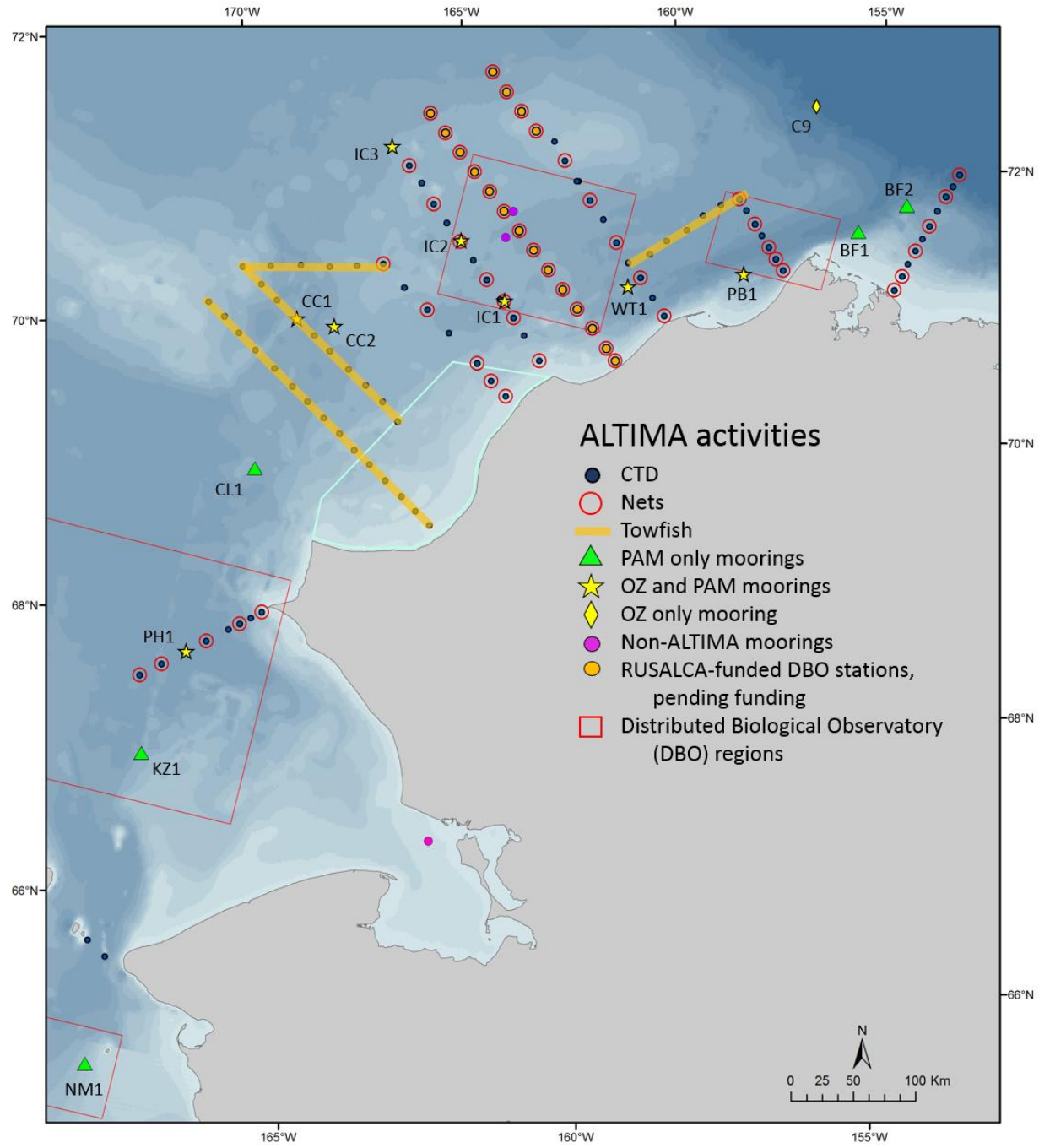

Figure 1. Planned activities in the primary working area during the 2016 ALTIMA cruise. PAM = passive acoustic mooring. OZ = oceanographic mooring.

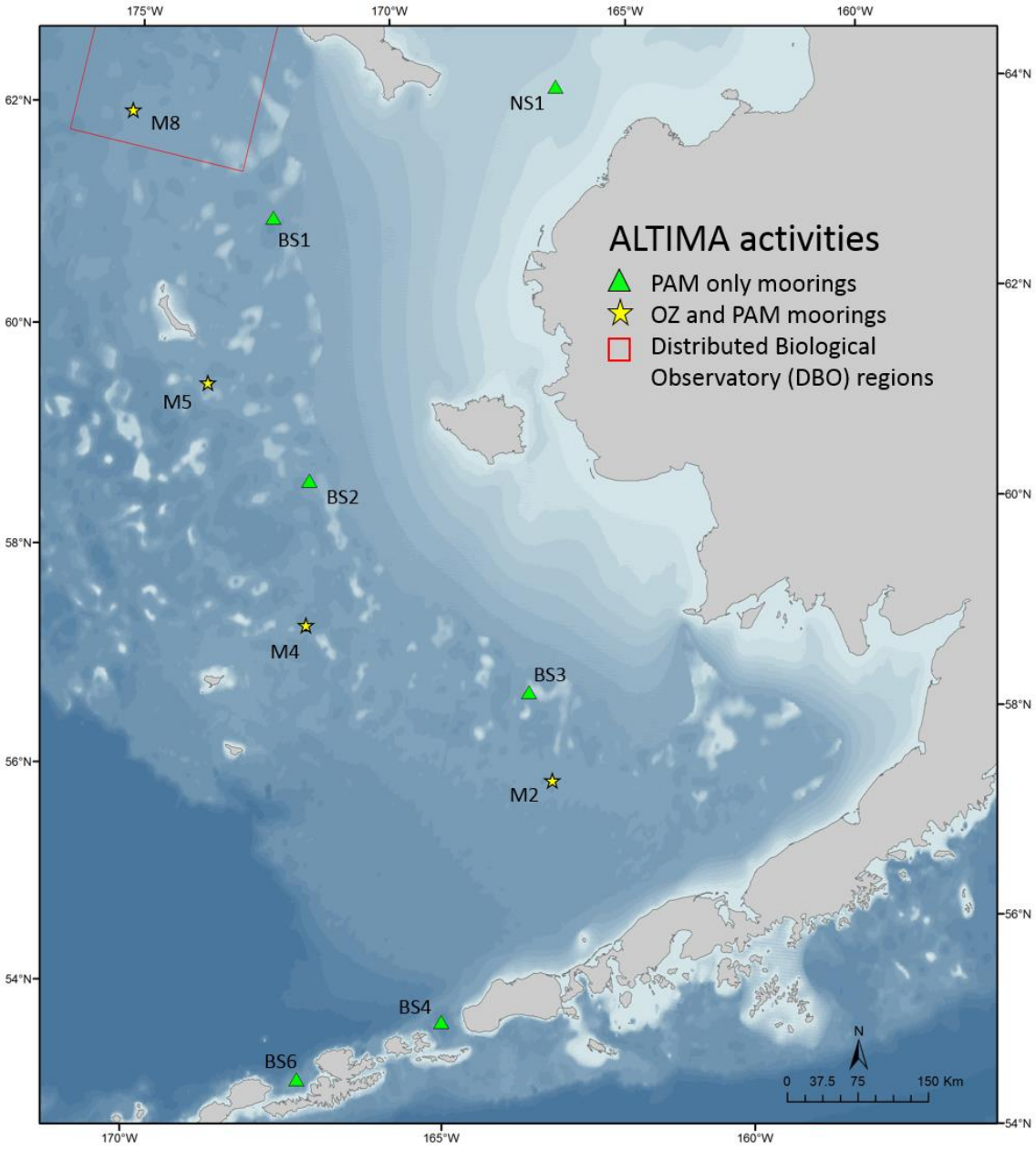

Figure 2. Planned mooring retrieval/redeployments in the Bering Sea during the 2016 ALTIMA cruise. PAM = passive acoustic mooring. OZ = oceanographic mooring.

C. Participating Institutions

The primary participating institutions for this cruise will be the Alaska Fisheries Science Center's Marine Mammal Laboratory (MML) and Resource Assessment and Conservation Engineering (RACE) groups, and the Pacific Marine Environmental Laboratory (PMEL), as well as researchers from the U.S. Fish and Wildlife Service, University of New Hampshire, University of Alaska Fairbanks, BioWaves, Inc., and Provincetown Center for Coastal Studies.

D. Personnel

The Chief Scientist for the cruise will be Dr. Catherine Berchok, who will also be leading the Acoustics component. Geoffrey Lebon will lead the Oceanographic component on behalf of Dr. Phyllis Stabeno. Morgan Busby, on behalf of Dr. Libby Logerwell, will take the lead on the Zooplankton component. Corey Accardo will lead the visual operations on behalf of Brenda Rone. There will also be a person working independently on seabird observations. All personnel sailing on ALTIMA 2016 are listed in Table 1. There will be no more than thirteen (13) scientists on board at any given time. Personnel may need to be modified prior to the cruise due to extenuating circumstances.

E. Administrative

Scientific Operations

Primary point of contact for this cruise is Nancy Friday: Nancy.Friday@noaa.gov, 206-526-6266.

Required clearances: these consist of the following: (i) medical history and emergency info form submitted to captain by all scientific personnel; (ii) research permits to conduct the work (all scientific operations with marine mammals will be conducted under NMFS permit number 14245 issued to NMML with the Chief Scientist identified as the Co-Investigator); and (iii) certification of all small boat operators in accordance with current NOAA requirements for coxswains. It is the Chief Scientist's responsibility to ensure that all clearances are obtained prior to the cruise.

Table 1. Personnel

Position	Name	Institution
Chief Scientist Lead Acoustics Chief Small Boat Officer	Catherine Berchok	MML/AFSC
Lead Oceanography	Geoff Lebon (on behalf of Stabeno)	PMEL
Lead Zooplankton	Morgan Busby (on behalf of Logerwell)	RACE/AFSC
Lead Visual Operations Senior Mammal Observer	Corey Accardo (on behalf of Brenda Rone)	Provincetown Center for Coastal Studies
Acoustician	Jessica Crance	MML/AFSC
Acoustician	Stephanie Grassia	MML/AFSC
Mammal Observer	Shannon Coates	BioWaves, Inc.
Mammal Observer	Bernardo Alps	Independent Contractor
Oceanography	Giovanni Learned	PMEL
Oceanography	Kim Martini	PMEL
Oceanography*	Eric Wisegarver	PMEL
Seabird Observer*	TBD	U.S. Fish and Wildlife Service
Independent Oceanographer*	Dan Naber	Univ. Alaska Fairbanks
Independent Oceanographer*	TBD	University of New Hampshire

*Only on for one leg of the cruise

II. Operations

A. Data to Be Collected

Data to be collected on this cruise include the following: passive acoustic data obtained from long-term acoustic recorder arrays; passive acoustic recordings of species detected on sonobuoy deployments; oceanographic measurements including water temperature, salinity, dissolved nitrate concentration, chlorophyll fluorescence, turbidity, and dissolved oxygen concentration; drifter locations; zooplankton and ichthyoplankton net and acoustic samples; euphausiid stable isotope and fatty acid signatures; date, time and location of all recorded sightings of marine mammals and seabirds as well as group characteristics; and photographic data for individual identification.

B. Staging Plan and Cruise Plan

The staging plan for the cruise will be as follows (all dates and times are approximate):

1 September: Twelve (12) personnel arrive in Nome, AK. Most necessary equipment loading and set-up will have been conducted prior to the vessel's arrival in Nome. Any remaining equipment will be loaded on 2 September.
3 September: Vessel departs Nome 0h00.
3 – 20 September: Operations retrieving and/or deploying 31 passive acoustic and/or oceanographic moorings; oceanographic and plankton sampling including CTDs and net tows; passive acoustic surveys; and visual surveys will be conducted in the Chukchi and western Beaufort Seas.
23 September: In-port at Nome, AK. Two (2) personnel disembark the vessel, two (2) board.
23-29 September: Vessel transits to Dutch Harbor, AK. Remaining fifteen (15) Bering Sea moorings retrieved and/or deployed along transit. Passive acoustic and visual surveys conducted.
29 September: Vessel arrives in Dutch Harbor, AK. All remaining twelve (12) scientists disembark.

Acoustic surveys will be conducted every three hours along the cruise track. Visual surveys will be conducted during daylight hours, weather permitting, throughout the cruise.

The cruise plan is to deploy a total of 40 moorings (18 passive acoustic, 17 oceanographic, 1 zooplankton, 4 passive acoustic/oceanographic). Six moorings (4 passive acoustic, two oceanographic) will be retrieved. Biophysical transects will be conducted at predetermined locations, including within DBO regions 3 and 5; if funding is transferred in time from the former RUSALCA program, additional sampling transects and stations will be included (see Figure 1). Further details of mooring, oceanographic, satellite tagging, and dragging operations are given below.

C. Mooring Deployments

During the 2016 ALTIMA cruise, we will deploy and/or retrieve passive acoustic moorings, biophysical moorings, and combination biophysical/passive acoustic moorings. Biophysical moorings will be deployed in clusters consisting of one to three of the following moorings: 1) "ice mooring" with an ASL upward-looking ice profiler and an RCM9 current meter (that also measures temperature, oxygen, and either salinity or turbidity), 2) a "bio mooring" with either a 300 or 600 KHz RDI ADCP and a linked set of instruments (Seacat, eco-fluorometer, PAR sensor, ISUS nitrate meter), and, at one location (IC2), 3) an upward looking TAPS-6NG (Tracor Acoustic Profiling System, Next Generation) instrument to measure zooplankton bio-volume and size distribution - specifically to detect and quantify euphausiids. These

moorings will collect various oceanographic measurements, including temperature, pressure, depth, salinity, conductivity, and fluorescence.

The passive acoustic recorders will run on a duty cycle of 80 minutes on every 5 hours, at a sampling rate of 16 kHz, for an entire year (365 days). This duty cycle staggers the recording loop so that the recording period advances by one hour each day. This overall pattern repeats every six days, producing a large sample size for all time periods equally.

The locations of all but two recorders (CC1 and CC2, Figure 1) are in conjunction with previous deployments for the BOEM-funded CHAOZ, CHAOZ-X, and ARCWEST projects. Although the aforementioned projects have concluded or are concluding, maintaining the moorings in these locations allows for a continuation of a now 6 - 9 year time series in the Alaskan Arctic. In addition, four of the Bering Sea moorings are PMEL's oceanographic moorings, which have been deployed for over twenty years ("M" moorings, Figure 2), while the passive acoustics moorings have been deployed since 2007.

D. Hydrography and Zooplankton Net Tows

At each mooring site, and along predetermined transect lines in the Chukchi and western Beaufort Seas, hydrographic data (temperature, conductivity, nutrients, chlorophyll, and oxygen) and zooplankton will be collected (Figure 2). All hydrographic casts include high-resolution vertical profiling of water properties (including temperature, salinity, chlorophyll fluorescence, PAR, dissolved O_2) to within 4 m of the bottom using a Seabird 911Plus CTD with dual temperature, conductivity and oxygen sensors. Oxygen samples will be titrated on board to ensure the quality of the data from the CTD oxygen sensors. Nutrient and chlorophyll samples will be collected onboard and frozen for analysis at a later date at the NOAA laboratories in Seattle.

Samples for mesozooplankton and micronekton will be collected with a 1 m^2 Tucker Sled which allows us to collect samples right next to the bottom (and does a better job of capturing larger prey such as euphausiids). The mesh size for the Tucker nets will be 0.500 mm, and the two primary nets will have 25 cm diameter Clarke-Bumpus net frames inside them with 0.150 mm mesh to capture small zooplankton. The net samples will also contain ichthyoplankton (fish larvae) that will be identified and enumerated as part of the study. Organisms will be sorted and either dried (stable isotopes) or quickly frozen at – 80 °C (fatty acids). All processing of the samples will be done after the completion of the cruise.

E. Dragging Operations

In the event a mooring does not release from its anchor, a hydraulic winch, cable, and hooks will be used to drag the bottom to attempt recovery of the mooring. All dragging operations will be time and weather permitting and conducted at the discretion of the Captain and Chief Scientist.

F. Underway Operations (Visual and Acoustic Monitoring)

As noted above, during transit to and from the working area and during non-mooring operations, passive acoustic monitoring and visual searches will be conducted. Directional sonobuoys will be deployed from the vessel and used to obtain cross-bearings to individual vocalizing whales. Visual surveys will be conducted during daylight operational hours, weather permitting, throughout the cruise.

G. Small Boat Operations

We will be bringing one of NMML's rigid hulled inflatable boats (RHIBs). It will be launched in the Bering Sea leg of the cruise, near M4, to retrieve each of the two wave gliders. It will also be available for any other unforeseen needs. All small boat operations, including moving the RHIB on deck and/or launching, must be approved by the Captain and small boat officer in advance and will be subject to weather conditions. The Captain and small boat officer will create a launching protocol before operations begin, and the protocol will be discussed and practiced by all parties involved several times prior to any small boat launch. During launch and retrieval, all appropriate safety procedures shall be maintained.

The small boat crew shall consist of no more than 4 people at any time. Each of these crew members will also be members of the scientific party. The small boat officer will have the final say in the operation of the small boat. The following people have completed the required NOAA small boat certifications and training, qualifying them as either coxswains (cox), or qualified crew, during this cruise:

Catherine Berchok (cox)
Jessica Crance (crew/cox)
Stephanie Grassia (crew/cox)

The small boat may be used to ferry scientists and/or equipment to and from the vessel, as necessary. Shuttling operations will be at the discretion of the Captain and small boat officer. A coxswain and one qualified crew member, plus scientific passengers, will be on board during these operations; the passengers will not participate in the small boat operations unless instructed by the small boat officer.

Safety checks/status reports will be performed by VHF radio every hour, during which each small boat coxswain will provide current location and activity information to the vessel bridge. Small boat operations will be conducted within half a mile of the ship at all times. A Loss of Communication plan will be developed at the start of the cruise with the Captain.

H. De-Staging Plan

Prior to disembarking, scientists will ensure that all staterooms and lab spaces are cleaned. All equipment will be packed, stored, and secured on the vessel for its return to Seattle. Offloading of the vessel will occur in Seattle, WA at the NOAA Sand Point Pier.

III. Facilities

A. Equipment and Capabilities Provided by Ship

Suitable deck space for preparing, assembling, and deploying moorings, preparing and deploying oceanographic equipment, and for installation and operation of 3-4 winches.
A-frame on the stern of the ship with a load capacity of at least 2 tons.
Space on deck for placing a scientific van (10' x 24').
Weather-proof, heated wheelhouse with room for an acoustic recording station inside the wheelhouse.
An outside area suitable for observational work at a height above the water line of at least 15 feet.
Room for a visual observation station inside the wheelhouse or in another interior portion of the ship.

Room for four (4) feet of dry bench space with an AC outlet to be used for computer work and satellite tag assembly.
Electronic navigational and communication equipment in compliance with industry safety standards.
Capability for loading and off-loading the scientific party and a 25-foot RHIB with outboard motor (~3000 lbs) to and from the water.
Deck or crane-accessible outdoor space for storage.
Supply of 220 VAC (20 amp circuit) electrical service to the scientific van.
Secure and easily accessible rail cleats to securely tie a RHIB alongside the vessel.
A watertight 55-gallon drum with a rotary hand pump for gasoline for the RHIBs.
Dry storage areas, readily accessible, providing a minimum of 400 cubic feet for stowage.
A minimum of 10 cubic feet of freezer space for specimens.
Freshwater and seawater (non-firehose) deck hose
An enclosed, weather-proof, temperature controlled area where two lab benches (one 3'x6', one 4'x2') can be installed.
Approximately 6' x 3' of deck space near the saltwater hose
Capability to install one hydraulic winch and two electrohydraulic winches on deck.
Capability of installing one standard VHF antenna and one yagi antenna in the crow's nest.
Knuckle crane capable of lifting up to 2 tons while fully extended.
Crane capable of towing a Tucker sled.
Potable fresh water supply.
Two washers and two clothes dryers.
Muffler on ship must be in compliance with the operational standards specified by the manufacturer.
Arctic-type survival suits.
Category I 406 MHz EPIRB (Emergency Position Indicating Radio Beacon).
Up-to-date emergency trauma first aid kit.

B. Equipment and Capabilities Provided by Scientists

3 Laptop computers for acoustic work
2 Acoustic interfaces
3 VHF receivers
1 Yagi antenna
1 Omni sonobuoy antenna
8 Sonobuoy crates
17 Acoustic recorders
21 Acoustic releases
10 - 30" steel mooring floats
10 - 42" syntactic floats
2 Acoustic release Deck sets
1 CTD (with its frame and Niskin bottles), dual sensors
1 CTD (with no frame and no Niskin bottles), dual sensors
2 CTD deck units
2 CTD PARs
2 CTD fluorometers
2 CTD dissolved oxygen sensors
1 AFSC Electrohydraulic winch
2 PMEL Electrohydraulic winches
1 Tucker sled plankton net

2 PMEL FastCATs
2 PDIMs
2 Deck units for FastCAT
1 Hook and cables for dragging
1 Hydraulic winch
2 25-power (Big Eye) binoculars
2 Aluminum adjusting stands
2 Nikon DSLR cameras
2 Nikon fixed 300 mm f/4 AF-S lens
2 Nikon 80-200mm 2.8 lens
1 Scientific van (10' x 24')
1 -80 deg C Ultracold Freezer
1 -40 deg C freezer
2 Laptop computers for collecting survey data
2 Satellite phones (including PMELs)
1 Laptop computer for e-mail communication
3 Zooplankton Laptops/Desktops
AFSC zooplankton misc. electronic testing equipment
1 Zeiss Stemi- Dissecting Microscope
5 Ice profilers
9 ECO-fluorometers
4 ISUS
2 ISUS, UAF
1 SUNA
16 Microcats
10 RCM9s
11 Seacats
6 Seacat PARs
10 Temp sensors
1 R/V EJ RHIB with 115 hp Yamaha 4 stroke outboard engine
2 crates mooring chain parts
39 anchors

IV. Data and Reports

A. Data Responsibilities

At the end of the field work, the Chief Scientist and project coordinator will submit a cruise data summary to BOEM and to the Project Leaders.

B. Pre- and Post-Cruise Meetings

These shall be arranged at the discretion of the Captain and Chief Scientist.

C. Ship Operation Evaluation Report

After the cruise, a Ship Operation Evaluation form is to be completed by the Chief Scientist with suggestions for improvements to future operations aboard this vessel.

V. Miscellaneous

A. Scientific Berthing

A list of all scientific personnel is given above in Table 1. Specific personnel berthing arrangements will be determined in coordination with the vessel.

B. Medical Forms and Emergency Contacts

All scientific personnel shall have completed and submitted all required medical forms three weeks prior to sailing. A list of emergency contacts for scientific staff will be provided to the Captain prior to the cruise.

C. Shipboard Safety

All scientific staff shall be briefed on shipboard safety procedures and their compliance with these will be monitored by the Captain and the Chief Scientist. Safety drills (person overboard, fire, abandon ship) will be conducted within two days of each leg change.

D. Communications

There will be one satellite phone on board the vessel for limited use. One email will be sent daily to a land based contact at NMML giving our current status and position and a summary of the previous day's activities. Additional emails will be sent/received sparingly at the Chief Scientist's discretion. PMEL's Iridium: 8816-315-33586

Communications between the bridge, deck, small boat, visual observers, and acousticians will be by VHF radio.