

Arctic Whale Ecology Study (ARCWEST)/Chukchi Acoustics, Oceanography, and Zooplankton Study-extension (CHAOZ-X) 2015 Cruise Plan

DATES: 6 - 26 SEPTEMBER 2015

Vessel R/V *Aquila*

I. Cruise Overview

Cruise Title – ARCWEST/CHAOZ-X 2015

Cruise Dates: 6 – 26 September 2015

Departure – Nome, AK – 6 September 2015

Arrival – Dutch Harbor, AK – 26 September 2015

Operating Area – Bering, Chukchi, and Beaufort Seas

A. Summary of Objectives

There are four objectives for the ARCWEST study:

1. Estimate the spatial and temporal use patterns of the Chukchi Sea by endangered bowhead, fin and humpback whales as well as gray, minke and beluga whales.
2. Assess population structure and stocks of origin of these animals via genetic analysis of tissue biopsy samples and as appropriate, individual photo identification records.
3. Evaluate ecological relationships for the species, including physical and biological oceanography.
4. Conduct physical and biological oceanographic sampling to further understand the transport and advection of krill and nutrients from the northern Bering Sea through the Bering Strait and to the Barrow Canyon.

And six objectives for the CHAOZ-X study:

1. Refocus the passive acoustic and biophysical monitoring begun under the study “COMIDA: Factors Affecting the Distribution and Relative Abundance of Endangered Whales” from the initial lease areas to Hanna Shoal.
2. Describe patterns of current flow, hydrography, ice thickness, light penetration, and concentrations of nutrients, chlorophyll, and large crustacean zooplankton around the Shoal.
3. Assess the spatial and temporal distribution of marine mammals in the region of Hanna Shoal.
4. Evaluate the extent to which variability in environmental conditions such as sea ice, oceanic currents, water temperature and salinity, and prey abundance influence whale distribution and relative abundance.
5. Develop a quantitative description of the Chukchi Sea’s noise budget, as contributed by biotic and abiotic sound sources, and continuous, time-varying metrics of acoustic habitat loss for a suite of arctic marine mammal species.
6. Continue development of a near-real-time passive acoustic monitoring system that can be used as an impact mitigation tool.

These findings will be useful for formulating designs of mitigation for human activities in the region. In particular, these data will be used to support National Environmental Policy Act analysis and documentation for Chukchi Sea Lease Sales, Draft Proposed Programs, and monitoring, as well as ESA consultations, Marine Mammal Protection Act permitting, and preparation of Biological Evaluations and Biological Opinions. The main components of both studies include satellite tagging (ARCWEST only, in 2013 and 2014), passive acoustic recorder and oceanographic instrument deployments, and biophysical (CTD and plankton tow) sampling stations. In addition, a passive acoustic survey (using sonobuoys) and a visual observation survey will be undertaken throughout the survey. Although 2015 is the last year of field work for both ARCWEST and CHAOZ-X, a subset of moorings will be redeployed in order to continue the long time series; tentative plans have been made to retrieve moorings off the NOAA Ship *Ronald Brown* in 2016.

For 2015, field work will be split between the R/V *Aquila* and the NOAA Ship *Ronald Brown* to reduce costs. The R/V *Aquila* will conduct the main survey activities from 6 to 26 September 2015: mooring retrieval and deployment, passive acoustic and visual observations, and occasional CTD casts to calibrate moorings. The NOAA Ship *Ronald Brown* will conduct ARCWEST and CHAOZ-X biophysical (CTD and plankton tow) sampling from 6 August to 4 September as part of a vessel sharing effort with other NOAA funded work.

B. Operating Area

The primary operating area will be within the northern Bering Sea, the Chukchi Sea, and the western Beaufort Sea. 34 of the 35 moorings (biophysical and passive acoustic clusters) deployed in the Chukchi and Beaufort Seas in 2014 will be retrieved with the Haruphone retrieved in 2016 (Figure 1). 20 moorings will be redeployed. CTD and Tucker tow transects will be conducted off the NOAA Ship *Ronald Brown* on three separate lines perpendicular to the coast, one line parallel to the coast through Hanna Shoal, and also along a 'box' near Barrow (Peard Bay) (Figure 2). Eight Pacific Marine Environmental Laboratory's (PMEL's) oceanographic moorings (two at each location plus a passive acoustic recorder) and five additional passive acoustic moorings will be retrieved and redeployed along the 70 m and 50 m isobaths in the Bering Sea; totaling 13 moorings (Figure 1).

C. Participating Institutions

The primary participating institutions for this cruise will be the National Marine Mammal Laboratory (NMML), Resource Assessment and Conservation Engineering (RACE), and the Pacific Marine Environmental Laboratory (PMEL) as well as researchers from the U.S. Fish and Wildlife Service, and University of Alaska Fairbanks.

D. Personnel

The Chief Scientist for the cruise will be Dr. Catherine Berchok. All personnel sailing on ARCWEST/CHAOZ-X 2015 are listed in Table 1. There will be no more than nine (9) scientists on board at any given time. Personnel may need to be modified prior to the cruise due to extenuating circumstances.

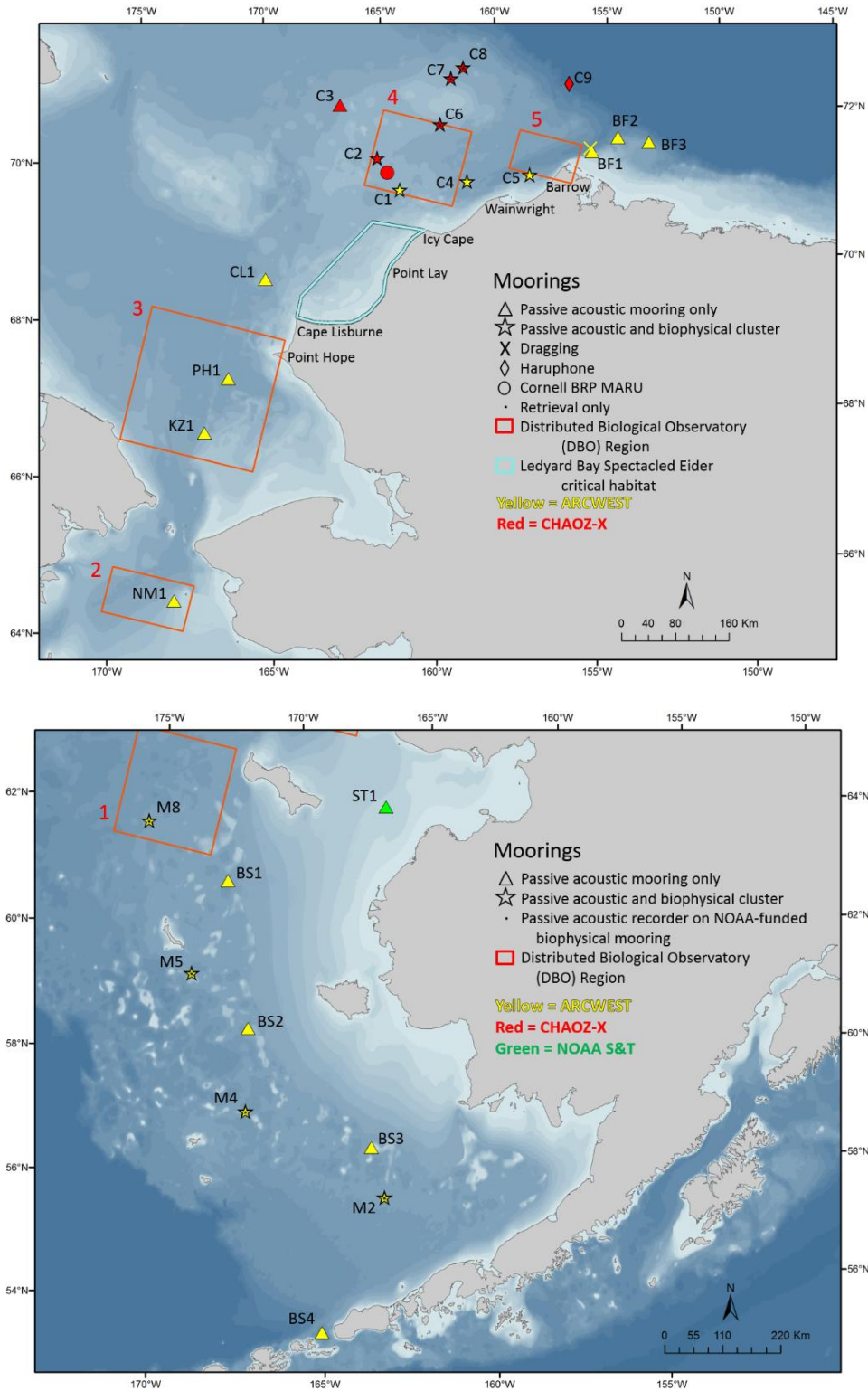


Figure 1. Planned passive acoustic moorings and biophysical mooring clusters to be retrieved and/or deployed during the 2015 ARCWEST/CHAOZ-X cruise. Yellow symbols indicate ARCWEST moorings. Red symbols indicate CHAOZ-X moorings. C6, C7, and C8 are retrievals only, and C9 will be retrieved in 2016. The top panel is the primary operating area of the northern Bering Sea, the Chukchi Sea, and the western Beaufort Sea. The bottom panel is the Bering Sea.

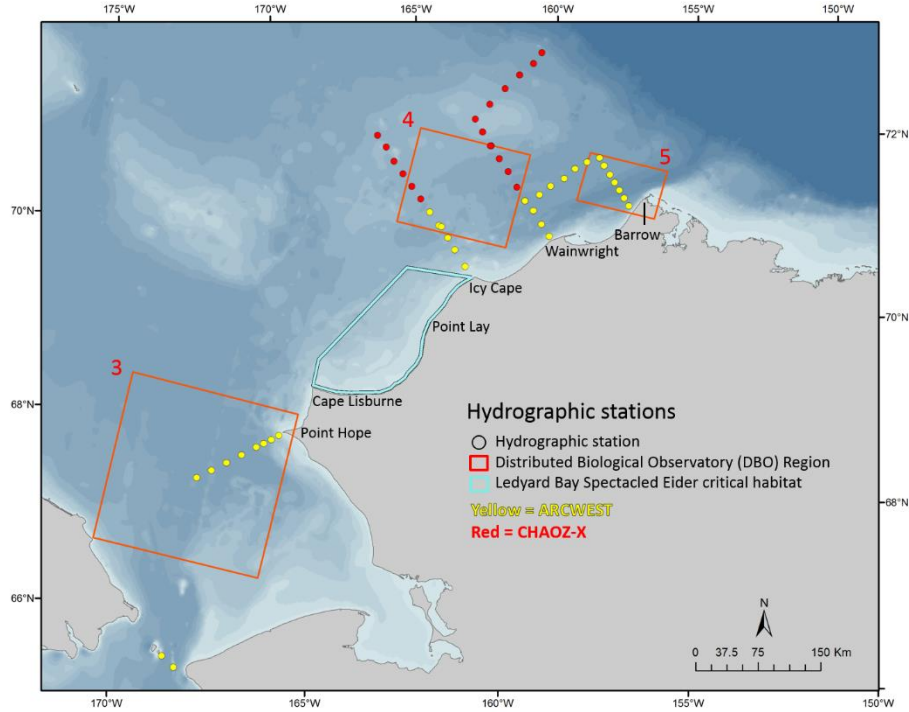


Figure 2. Planned biophysical stations to be sampled by the NOAA Ship *Ronald Brown*. Yellow symbols indicate ARCWEST stations. Red symbols indicate CHAOZ-X stations.

Table 1. Personnel

Position	Name	Nationality	Institution	Leg
Chief Scientist Lead Acoustics	Catherine Berchok	United States	NMML/AFSC	1, 2
Acoustician	Jessica Crance	United States	NMML/AFSC	1, 2
Acoustician	Stephanie Grassia	United States	NMML/AFSC	1, 2
Acoustician/ Mammal Observer	Eliza Ives	United States	NMML/AFSC	1, 2
Acoustician/ Mammal Observer	Alexandra Ulmke	United States	NMML/AFSC	1, 2
Oceanography	Geoff Lebon	United States	PMEL	1, 2
Oceanography	Dan Langis	United States	PMEL	1, 2
Seabird Observer	TBD	United States	U.S. Fish and Wildlife Service	1, 2
Independent Oceanographer	Dan Naber	United States	Univ. Alaska Fairbanks	2
Acoustician	Don Ljungblad	United States	Volunteer	1

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 Senior Mammal Observer 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.

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; date, time and location of all recorded sightings of marine mammals and seabirds as well as group characteristics; and opportunistic photographic data for individual identification.

Data to be collected on the NOAA Ship *Ronald Brown* include the following: oceanographic measurements including water temperature, salinity, dissolved nitrate concentration, chlorophyll fluorescence, turbidity, and dissolved oxygen concentration; drifter locations; zooplankton and ichthyoplankton acoustic samples; and euphausiid stable isotope and fatty acid signatures.

B. Staging Plan and Cruise Plan

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

- 24 August: The R/V Aquila will be loaded at the NOAA Sand Point Pier in Seattle, WA. All equipment will be stored and secured on the vessel for its transit to Nome, AK
- 6 September: Nine (9) personnel arrive in Nome, AK. Most necessary equipment loading will have occurred in Seattle, WA. Any remaining equipment will be loaded and set-up on 6 September.
- 6-17 September: Operations retrieving 34 passive acoustic and/or oceanographic moorings, redeploying 24 passive acoustic and/or oceanographic moorings, occasional CTDs, passive acoustic surveys, and visual surveys will be conducted in the Chukchi Sea.
- 17 September: In-port at Nome, AK. One (1) additional personnel board the vessel, one (1) disembark.
- 17-24 September: Vessel transits to Dutch Harbor, AK. Thirteen (13) Bering Sea moorings retrieved and redeployed along transit. Passive acoustic and visual surveys conducted.
- 24 September: Vessel arrives in Dutch Harbor, AK. The remaining nine (9) scientists disembark.

Acoustic surveys will be conducted by deploying sonobuoys approximately every three hours along the cruise track throughout the cruise. Visual observations will also occur throughout the cruise with a two person team rotating through observer and recorder positions with 30 minutes at each station followed by a 30 minute break when not at a mooring station.

The cruise plan is to retrieve a total of 47 moorings (20 passive acoustic moorings and 27 oceanographic moorings (four with passive acoustic recorders)), 34 of which will be in the primary working area (15 passive acoustic and 19 oceanographic moorings) and 13 in the Bering Sea (five passive acoustic moorings and eight oceanographic moorings (four with passive acoustic recorders)). Of these, 37 moorings (17 passive acoustic, and 16 oceanographic) will be redeployed, 20 of which will be in the primary working area (12 passive acoustic, eight oceanographic). In addition to the mooring work, if time allows, the vessel will drag for one acoustic mooring off Barrow that lost its flotation in 2009 (but is still responding). Further details of mooring, oceanographic, and dragging operations are given below. As noted above, the biophysical sampling will be conducted on the NOAA Ship *Ronald Brown*.

C. Mooring Deployments

During the 2015 ARCWEST/CHAOZ-X cruise we will deploy and/or retrieve passive acoustic moorings and biophysical moorings. Biophysical moorings will be deployed in clusters consisting of two to three 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 3) an upward looking TAPS-6NG (Tracor Acoustic Profiling System, Next Generation) instrument to measure zooplankton bio-volume and size distribution (at C2 only, Figure 1). These moorings will collect various oceanographic measurements, including temperature, pressure, depth, salinity, conductivity, and fluorescence.

The passive acoustic recorders (AURALS) 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.

For ARCWEST, 14 passive acoustic moorings and 8 biophysical moorings in three clusters of two to three moorings will be retrieved. Most of these (14 passive acoustic moorings and six biophysical moorings in three clusters) will all be redeployed to maintain long time series of data. Ten of the passive acoustic moorings are in the primary study area. Four of the passive acoustic moorings are in the Bering Sea, plus four acoustic recorders co-located with PMEL’s NOAA-funded oceanographic moorings.

For CHAOZ-X, five passive acoustic moorings and 11 biophysical moorings in four clusters of two to three moorings will be retrieved. Two of the AURALS and two of the biophysical mooring will be redeployed. The Haruphone will be retrieved in 2016.

The remaining moorings are funded by other projects, one passive acoustic and eight biophysical moorings. Additional ship time was funded by these other projects for these turnarounds.

D. Hydrography and Zooplankton Net Tows

ARCWEST and CHAOZ-X biophysical sampling (CTD and plankton tow) will be conducted on the NOAA Ship *Ronald Brown* from 6 August to 4 September 4 as part of a vessel sharing effort with other NOAA funded work. The R/V *Aquila* will conduct occasional CTD casts to calibrate moorings.

At selected stations in the northern part of the Bering Sea and in the Chukchi Sea, 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 O₂) 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 quality of 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 m² 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. All processing of the samples will be done after the completion of the cruise.

In addition, Tucker Sled tows will be conducted on an ad hoc basis to obtain samples of euphausiids for stable isotope and fatty acid signatures. Organisms will be sorted and either dried (stable isotopes) or quickly frozen at – 80 °C (fatty acids).

E. Satellite Tagging Operations.

Satellite tagging operations occurred in 2013 and 2014, but will not occur in 2015.

F. Dragging Operations

In an attempt to recover one of the moorings lost off Barrow in 2009, a hydraulic winch, cable, and modified scallop dredge will be used to drag the bottom for a couple of hours to attempt recovery of the mooring as we transit over the area where it was lost. All dragging operations will be time and weather permitting, and conducted at the discretion of the Captain and Chief Scientist.

G. 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.

H. Small Boat Operations

No small boat operations are planned during this cruise, but we will be bringing one of NMML's rigid hulled inflatable boats in case it is needed. All small boat operations, including moving the small boats on deck and/or launching, must be approved by the captain and chief scientist in advance. The captain and chief scientist will create a launching protocol before small boat operations begin. The launching protocol will be discussed and practiced by all parties involved several times prior to any small boat launch. Launching of the small boat will be subject to weather conditions and undertaken only at the discretion of the Captain and chief scientist. During launch and retrieval, all appropriate safety procedures shall be maintained.

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 chief scientist. 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 chief scientist.

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)
Alex Ulmke (crew/cox)

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.

I. 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 at the NOAA Sand Point Pier in Seattle, WA.

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 two 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.

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 RHIB.

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

Enclosed, weather-proof, temperature controlled area where a 3'x6' and a 4'x2' lab bench are installed.

Approximately 6' x 3' of deck space near the saltwater hose

Capability to install one hydraulic winch and one electrohydraulic winch 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.

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
5 VHF receivers
8 Sonobuoy crates
26 Acoustic recorders
36 Acoustic releases
18 Mooring floats
2 Deck sets
1 CTD (with its frame and Niskin bottles), dual sensors
1 CTD deck units
1 CTD PARs
1 CTD fluorometers
1 CTD dissolved oxygen sensors
1 PMEL Electrohydraulic winch
1 PMEL FastCATs
1 PDIMs
1 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 Nikon DSLR cameras
2 Nikon fixed 300 mm f/4 AF-S lens
2 Nikon 80-200mm 2.8 lens
2 Laptop computers for collecting survey data
1 Scientific van (10' x 24')
1 -40 deg C freezer
2 Satellite phones (including PMELs)
1 Laptop computer for e-mail communication
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
57 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. 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. A second satellite phone will be on board as a backup. 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.