

# Arctic Whale Ecology Study (ARCWEST) 2013

DATES: 12 AUGUST - 18 SEPTEMBER 2013

Vessel TBD

## I. Cruise Overview

Cruise Title – ARCWEST 2013

Cruise Dates: August 12 – September 18, 2013

Departure – Kodiak, AK – 12 August 0000 ADT

Arrival – Kodiak, AK – 18 September, 2300 ADT

Operating Area – Bering, Chukchi, and Beaufort Seas, equipment prep and testing in Gulf of Alaska

### A. Summary of Objectives

There are four objectives for this study:

1. Estimate the spatial and temporal patterns of use 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.

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 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 this study include satellite tagging, passive acoustic recorder and oceanographic instrument deployments, as well as biophysical (CTD and plankton tow) stations. In addition, a passive acoustic survey (using sonobuoys) and visual observation survey will be undertaken during transit to and from the mooring sites.

### B. Operating Area

The primary operating area will be within the northern Bering Sea and the Chukchi Sea and transiting to and from these areas. Primary mooring locations will be perpendicular to the coast, in between the Burger and Klondike leases, as well as offshore of Wainwright, Peard Bay, Point Hope, and south Bering Strait (Figure 1). CTD and Tucker tow transects will be on three separate lines perpendicular to the coast and a box of hydrographic and plankton stations around the Barrow Arch (Peard Bay) (Figure 1, green circles). Passive acoustic moorings for the BOEM funded BOWFEST project will be retrieved and redeployed as part of the BOEM funded ARCWEST project off Barrow, AK. PMEL's oceanographic moorings and four additional passive acoustic moorings will be deployed along the 70 m and 50m isobaths in the Bering Sea (Figure 1). The plan includes four mooring sites that could be used for the CHAOZ extension (CHAOZ-X), should this project be funded.

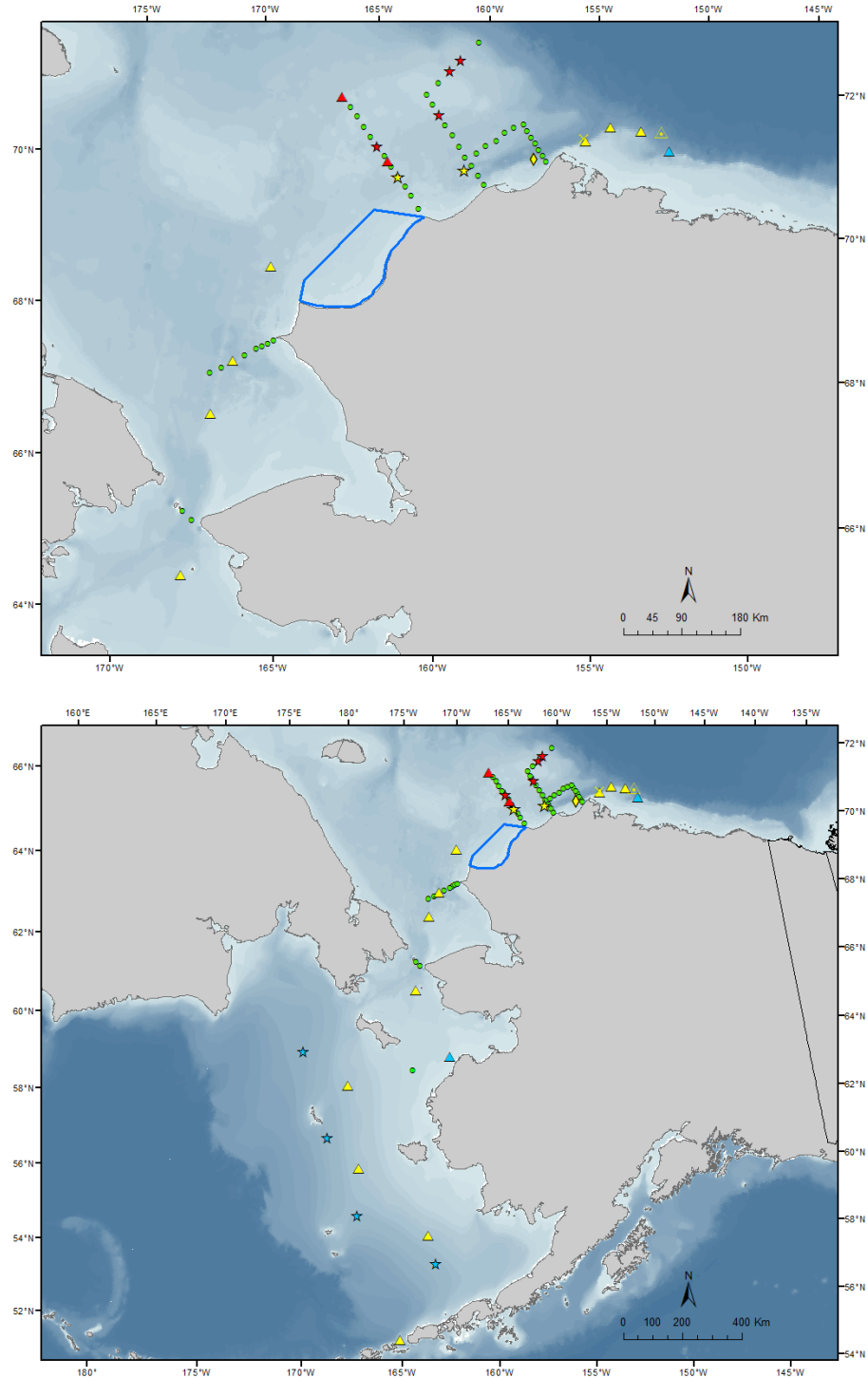


Figure 1. Planned passive acoustic and oceanographic moorings to be deployed in the Chukchi, Beaufort, and Bering Seas (upper panel, zoomed into the Chukchi and Beaufort Seas in the lower panel) for 2013. The yellow moorings will be analyzed under ARCWEST, the red moorings will be analyzed under the CHAOZ extension interagency agreement should it be funded, the blue moorings will be funded from other sources but the acoustic moorings at these locations in the Bering Sea will be funded by ARCWEST. ▲ = acoustics only moorings, ★ = acoustics and biophysical moorings, ◆ = biophysical only moorings, • are biophysical sampling stations, × = drag location, Δ = retrieval only.

The locations for deploying satellite transmitters on humpback, fin, and gray whales will be the northern Bering Sea and southern Chukchi Sea. Satellite tagging will also occur while transiting between oceanographic/acoustic mooring stations and oceanographic sampling stations on an opportunistic basis as time allows. Photographic identification data and biopsy samples of cetacean sightings will also be collected during satellite tagging operations and opportunistically during other sighting events.

During transit to and from stations or the working area, and during non-mooring operations, sonobuoy deployments and visual observations will be made at the chief acoustic scientist's discretion.

### *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, Cornell University, University of Alaska Fairbanks, Penn State University, and Northeast Fisheries Science Center.

### *D. Personnel*

The Chief Scientist for the majority of the cruise will be Dr. Catherine Berchok, who will also be leading the Acoustics component. Dr. Berchok will be disembarking on 11 September, after which Jessica Crance will act as Chief Scientist and lead the Acoustic component. Bill Floering will lead the Oceanographic component on behalf of Dr. Phyllis Stabeno. Dr. Jeffrey Napp will take the lead on the Zooplankton component. Amy Kennedy will lead the satellite tagging component on behalf of Dr. Alex Zerbini and act as the small boat officer. Brenda Rone will lead the visual operations component also on behalf of Dr. Alex Zerbini. There will also be a person working independently on seabird observations. All personnel sailing on ARCWEST 2013 are listed in Table 1. There will be no more than fourteen (14) 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) foreign clearance for all non-US citizens (listed by nationality on Table 1); (iii) 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 (iv) 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 in a timely fashion prior to the cruise.

**Table 1. Personnel**

Position	Name	Nationality	Institution
Chief Scientist (12 Aug–11 Sep) Lead Acoustics	Catherine Berchok	United States	NMML/AFSC
Acoustician Chief Scientist (12–18 Sept)	Jessica Crance	United States	NMML/AFSC
Lead Oceanography	Bill Floering (on behalf of Stabeno)	United States	PMEL
Lead Zooplankton	Jeff Napp	United States	RACE/AFSC
Lead Visual Operations Senior Mammal Observer	Brenda Rone (on behalf of Zerbini)	United States	NMML/AFSC
Lead Satellite Tagging Mammal Observer Small Boat Officer	Amy Kennedy (on behalf of Zerbini)	United States	NMML/AFSC
Acoustician	Stephanie Grassia	United States	NMML/AFSC
Acoustician	Eliza Ives	United States	NMML/AFSC
Mammal Observer	Jenn Gatski	United States	NOAA/NEFSC
Mammal Observer	Ernesto Vazquez Morquecho	Mexico	Independent Contractor
Oceanography	David Strausz	United States	PMEL
Zoo- & Ichthyoplankton	Jay Clark	United States	RACE/AFSC
Zoo- & Ichthyoplankton	Adam Spear	United States	RACE/AFSC
Seabird observer	TBD	United States	U.S. Fish and Wildlife Service
*Double Bubble MARU technician	Jason Michalec	United States	Cornell University BRP
*Independent acoustician	Sam Denes	United States	Penn State Univ.
*Independent oceanographer	Dan Naber	United States	Univ. Alaska Fairbanks

\* Personnel only on board for one leg of the cruise.

## II. Operations

### A. Data to Be Collected

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

### *B. Staging Plan and Cruise Plan*

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

- 10 August: Twelve (12) personnel arrive in Kodiak, AK. Most necessary equipment loading and set-up will have been conducted prior to the vessel's arrival in Kodiak. Any remaining equipment will be loaded on the 10 or 11 August.
- 12 August: Vessel departs Kodiak. Visual and acoustic surveys conducted and moorings retrieved/deployed during transit.
- 19 August: Arrive in Nome, AK. Four (4) additional personnel board the vessel, two (2) disembark.
- 19 – 28 August: Operations deploying satellite tags on individual animals (weather permitting).
- 28 August – 11 September: Vessel in survey area; mooring, oceanographic, and CTD/net tow operations conducted as well as opportunistic satellite tagging.
- 11 September: Vessel stops for in-port at Nome, AK. Five (5) scientific personnel disembark, one (1) additional scientist boards for return transit to Kodiak.
- 11 - 18 September: Vessel transits to Kodiak, AK. Remaining Bering Sea moorings deployed along transit.
- 18 September: Vessel arrives in Kodiak, AK. The remaining ten (10) scientists disembark.

Visual operations and acoustic surveys will be conducted during the transit to/from the working area as well as during non-mooring operations.

The cruise plan is to deploy a total of 49 moorings (21 acoustic, 24 oceanographic, and 4 combination of both), 35 of which will be in the primary working area (16 acoustic, 20 oceanographic), as well as collect various oceanographic measurements. A biophysical transect off Point Hope and across Barrow Canyon as part of the International Distributed Biological Observatory (DBO) initiative will also be conducted. In addition to the mooring and oceanographic work, the vessel will drag for 1 acoustic mooring that lost its flotation in 2009 (but is still responding). Satellite tagging operations will deploy up to 16 satellite tags on humpback, fin, and gray whales. Further details of mooring, oceanographic, satellite tagging, and dragging operations are given below.

### *C. Mooring Deployments*

During the 2012 CHAOZ cruise, we leveraged the existing ship time to redeploy a preliminary set of moorings for ARCWEST. This allowed us to add another year of data to the ARCWEST project and to bridge the gap between CHAOZ and ARCWEST, maintaining a long-term time series of the data. This preliminary set of moorings consisted of 18 passive acoustic and 6 biophysical moorings. The former were deployed from Cape Halkett in the Beaufort Sea to Unimak Pass in the Bering Sea, and the latter off Icy Cape and Wainwright in the Chukchi Sea.

During the 2013 ARCWEST cruise, we will turnaround (retrieve and redeploy in the same place) 16 of the passive acoustic moorings, move the offshore Wainwright mooring closer to Hanna Shoal (this was not possible last year due to ice presence), and deploy two new moorings on Hanna Shoal, for a total of 19 passive acoustic moorings, including the double-bubble MARU (Marine Acoustic Recording Unit) for the Bioacoustics Research Group (Cornell University) used to aid in the development of their noise model for the Chukchi Sea. Two additional moorings will be deployed along our route for other projects, while two passive acoustic recorders for ARCWEST will be deployed off the Healy by another project. All six of the biophysical moorings will be turned around, plus an additional thirteen will be deployed. Additional ship time was purchased by another PMEL project for redeployment of five biophysical and 4 biophysical/passive acoustic moorings in the Bering Sea.

The break down between ARCWEST moorings and CHAOZ-X moorings is as follows: of the 19 passive acoustic moorings, 13 will be deployed for ARCWEST and 6 will be deployed for CHAOZ-X. For the 19 biophysical moorings 9 will be deployed for ARCWEST and 10 will be deployed for CHAOZ-X. The total time required to deploy the CHAOZ-X moorings and complete its stations is 3.5 days which will be paid for by the CHAOZ-X project.

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 creates a staggered recording loop with the recording period advancing by one hour each day, with the overall pattern repeating every six days, so that a large sample size will be equally obtained for all time periods.

The biophysical moorings will be located in seven clusters, all will contain an “ice mooring” with an ASL upward-looking ice profiler and an RCM9 current meter (that also measures temperature, oxygen, and either salinity or turbidity) and 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). A TAPS-6NG mooring will be located at all sites except for the easternmost Hanna Shoal cluster and the middle Icy Cape mooring cluster. The upward-looking TAPS-6NG was built specifically to detect and quantify euphausiids. These moorings will collect various oceanographic measurements, including temperature, pressure, depth, salinity, conductivity, and fluorescence.

#### *D. Hydrography and Zooplankton Net Tows*

At each mooring site, and along the transect between moorings and other 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 1, green circles). All hydrographic casts include high-resolution vertical profiling of water properties (including temperature, salinity, chlorophyll fluorescence, PAR, dissolved O<sub>2</sub>) to within 4m 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 m<sup>2</sup> 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. The majority of these will be accomplished at night during the initial whale tagging period, but will also occur during other times on a not to interfere basis (e.g. in the Beaufort when not dragging). Organisms will be sorted and either dried (stable isotopes) or quickly frozen at – 80 °C (fatty acids).

#### *E. Satellite Tagging Operations.*

Nine days will be dedicated to deploying up to 16 deep implantable satellite tags on humpback, fin, and gray whales in the northern Bering and southern Chukchi Seas. Twelve of the tags are SPOT5 (location only) transmitters, and 4 are MK-10A (location, light, temperature, and depth) transmitters. We will also be deploying up to 8 Low Impact Minimally Percutaneous External-electronic Transmitter (LIMPET on both SPOT5 and MK10A configurations). All tags are made by Wildlife Computers (Redmond, WA).

Satellite tagging will also be conducted opportunistically in the Chukchi Sea as other operations and whale densities allow.

#### *F. Dragging Operations*

In an attempt to recover one of the moorings lost 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*

We will be bringing two of NMML's rigid hulled inflatable boats on this cruise to use during marine mammal operations. The small boat crew shall consist of the small boat officer/tagger and biopsier, a qualified coxswain, a photographer and a tagging assistant. Each of these crew members will also be members of the scientific party. During satellite tagging operations, and as weather and time permits during other operations, the small boat will be deployed in the presence of whales at the discretion of the Chief Scientist and Captain. Small boat operations shall consist of approaching the whale and maneuvering into position to obtain photographs and biopsy samples, and to deploy satellite transmitters. The small boat officer and coxswain will have final say in the operation of the small boat, but as long as he/she feels that safety is not compromised, will take direction from the lead scientist in the vessel. The following people have completed the required NOAA small boat certifications and training:

Amy Kennedy  
Brenda Rone  
Catherine Berchok

Prior to the cruise, Jessica Crance will complete her CPR training, Stephanie Grassia will complete her First Aid training, and both will be NOAA small boat certified.

The small boat may also 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. The small boat officer (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 the small boat coxswain will provide current location and activity information to the Bridge. Small boat operations will be conducted within visual range of the ship at all time. A loss of communication plan will be developed at the start of the cruise with the Captain.

Launching of the small boat will be subject to weather conditions and undertaken only at the discretion of the Captain and small boat officer. During launch and retrieval, all appropriate safety procedures shall be maintained.

### *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 in Seattle, WA at the NOAA Sand Point Pier.

### III. Facilities

#### *A. Equipment and Capabilities Provided by Ship*

A-frame on the stern of the ship with a load capacity of at least 2 tons.

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 (~3000lbs) 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.

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 one electrohydraulic winch and to secure a back-up electrohydraulic winch on deck.

Capability of installing one standard VHF antenna and one yagi antenna.

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.

A weatherproof area to store all spare gear and packaging.

Access to email communication for the scientific crew

#### *B. Equipment and Capabilities Provided by Scientists*

3 Laptop computers for acoustic work

2 Acoustic interface.

3 VHF receivers

8 Sonobuoy crates

20 Acoustic recorders

10 Acoustic releases

10 Mooring floats

1 Deck set



- 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
- 1 PMEL Electrohydraulic winch
- 1 Tucker sled plankton net
- 2 PMEL FastCATs
- 2 PDIMs
- 2 Deck units for FastCAT
- 1 Hooks and cables for dragging
- 1 Hydraulic winch
- 20 Satellite tags
- 2 Satellite tag delivery carriers (delivery rockets)
- 2 Satellite tag delivery systems (ARTS)
- 2 Compressed air tanks and associated equipment for deployment of tags
- 2 25-power (Big Eye) binoculars
- 2 Aluminum adjusting stands
- 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 freezers
- 2 Laptop computers for collecting survey data
- 2 Satellite phones (including PMELs)
- 1 Laptop computer for e-mail communication
- 3 Zooplankton Laptops/Desktops
  - AFSC Zoopl Misc. Electronic testing equip
- 5 TAPS-6NG moored instruments (including floats)
- 1 TAPS-6 Self Contained Instruments
- 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
- 26 Releases
- 8 Floats
- 1 R/V Radar RHIBs with 150hp Yamaha 4 stroke outboard
- 1 R/V EJ RHIBs with 115hp Yamaha 4 stroke outboard engine

#### IV. Disposition of 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*

Berths shall be made available as follows:

2 rooms: 1 male  
2 rooms: 2 females  
1 room: 3 females  
1 room: 3 males  
1 room: 4 males

A list of all scientific personnel is given above. Preferred specific personnel berthing arrangements will be coordinated with 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 monitored by the Captain and the Chief Scientist.

##### *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.