

# Chukchi Acoustic, Oceanographic, and Zooplankton (CHAOZ) Study 2011

DATES: 5 AUGUST - 4 SEPTEMBER 2011

## *F/V Mystery Bay*

### I. Cruise Overview

Cruise Title – CHAOZ 2011

Cruise Dates: August 5 – September 4, 2011

Departure – Dutch Harbor, AK – 5 August 1800 L

Arrival – Dutch Harbor, AK – 4 September, 2100 L

Operating Area – Bering, Chukchi, and Beaufort Seas

#### *A. Summary of objectives*

There are three goals for this study:

1. Determine general presence and detailed movements of bowhead, fin, gray, and humpback whales in oil and gas lease areas using long-term passive acoustic recorder arrays, sonobuoys, shipboard visual observations, and opportunistic satellite tracking.
2. Monitor ecosystem change through the use of long-term biophysical moorings, shipboard observations and climate numerical models.
3. Assess the response of the whales to environmental changes (including climate and anthropogenic use of the area) by integrating the biophysical, passive acoustic, and large whale biology data sets.

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 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.

The specific objectives are:

1. Assess the year-round seasonal occurrence of bowhead, gray, fin, and other whale calls in the Chukchi Sea.
2. Track individual whales through a hydrophone array to estimate relative abundance whenever practicable.

3. Evaluate whether changes in seasonal sea ice extent is resulting in a northward shift of Bering Sea cetacean species such as fin, humpback and North Pacific right whales.
4. Provide long-term estimates of habitat use for large whale species and compare this with annual ice coverage in order to establish predictive variables to describe large whale occurrence.
5. Estimate the extent to which variability in environmental conditions such as oceanic currents, water temperature and salinity, and prey abundance influence whale distribution and relative abundance.

#### *B. Operating area*

The primary operating area will be within and transiting to and from the Chukchi Sea. Primary mooring locations will be perpendicular to the coast, in between the Burger and Klondike leases (Figure 1). CTD and Tucker tow transects will be at five separate locations perpendicular to the coast, extending out for approximately 100 km. Passive acoustic moorings for the BOEMRE funded BOWFEST project will also be retrieved and redeployed off Barrow, AK (sea time for these moorings is paid for by the BOWFEST project) and along the 70 m and 50m isobaths in the Bering Sea.

During transit to and from stations or the working area, and during non-mooring ops, sonobuoy deployments and visual observations will be made at the chief acoustic scientist's discretion. On the final return transit (Nome to Dutch Harbor), any remaining time will be spent conducting a survey for the North Pacific Right Whale (NPRW) in the Bering Sea critical habitat.

#### *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 NMFS Office of Protected Resources Permits, International Fund for Animal Welfare (IFAW) Marine Mammal Research and Rescue Team, U.S. Fish and Wildlife Service, and Cornell University.

#### *D. Personnel*

The Chief Scientist of the cruise is Dr. Catherine Berchok who will also be leading the Acoustics component. Bill Floering will lead the Oceanographic component on behalf of Phyllis Stabeno, Dr. Jeffrey Napp will take the lead on the Zooplankton component, and Brenda Rone will lead the visual operations. Andy Bankert will be working independently on seabird observations. All personnel sailing on CHAOZ 11 are listed in Table 1. There will be no more than twelve (12) scientists on board at any given time. Personnel may need to be modified prior to the cruise due to extenuating circumstances.

**Table 1. Personnel**

Position	Name	Nationality	Institution
Chief Scientist Lead Acoustics	Catherine Berchok	United States	NMML/AFSC
Lead Oceanography	Bill Floering (on behalf of Stabeno)	United States	PMEL
Lead Zooplankton	Jeff Napp	United States	RACE/AFSC
Acoustician	Jessica Crance	United States	NMML/AFSC

Acoustician	Laura Morse	United States	NMFS/OPRP
Senior Mammal Observer	Brenda Rone	United States	NMML/AFSC
Mammal Observer	Jessica Thompson	United States	NMML/AFSC
Mammal Observer	Misty Niemeyer	United States	IFAW
Mammal Observer	Stephanie Grassia	United States	NMML/AFSC
Oceanography	Sigrid Salo	United States	PMEL
Zoo- & Ichthyoplankton	Colleen Harpold	United States	RACE/AFSC
Zoo- & Ichthyoplankton	Adam Spear	United States	RACE/AFSC
Double Bubble technician	Jason Michalec	United States	Cornell University BRP
Seabird observer	Andy Bankert	United States	U.S. Fish and Wildlife Service
Mammal Observer*	Amy Kennedy	United States	NMML/AFSC
Mammal Observer*	Alex Zerbini	Brazil	NMML/AFSC

\* Personnel embarking in Nome for return transit only.

### *E. Administrative*

#### Scientific Operations

Primary point of contact for this cruise is Catherine Berchok: Catherine.Berchok@noaa.gov, 206-526-6331.

Required clearances: these consist of the following: (i) medical clearance for 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 782-1719 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.

## II. Operations

### *A. Data to be collected*

Data to be collected on this cruise include the following: acoustic data and whale tracks 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; date, time and location of all sightings of marine mammals and seabirds as well as group characteristics; photographic data for individual identification; data associated with satellite data of individual animals; and data associated with biopsy sampling of individual animals.

See Appendix A for NMML Standard Operating Instructions.

### *B. Staging plan and cruise plan*

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

3<sup>rd</sup> August: Personnel arrive in Dutch Harbor, AK. Most necessary equipment loading and set-up will have been conducted prior to the vessel's arrival in Dutch Harbor. Any remaining equipment will be loaded on the 3<sup>rd</sup> or 4<sup>th</sup>.

5<sup>th</sup> August: Vessel departs Dutch Harbor. Visual and acoustic surveys conducted during transit.

8<sup>th</sup> August: Arrive in Nome, AK. Any additional personnel board the vessel.

10<sup>th</sup> – 23<sup>rd</sup> August: Vessel in survey area; mooring, oceanographic, and CTD/net tow ops conducted.

23<sup>rd</sup> – 26<sup>th</sup> August: Vessel in seas off Barrow, AK for mooring and dragging ops. Personnel exchange will occur at earliest opportunity (weather dependent).

26<sup>th</sup> August: Vessel begins transit to Nome, AK.

29<sup>th</sup> August: Vessel stops for in-port at Nome, AK. Some scientific personnel debark, two additional scientists board for return transit to Dutch Harbor.

29<sup>th</sup> August - 4<sup>th</sup> September: Vessel transits to Dutch Harbor, AK. Bering Sea PMEL and EAR moorings deployed along transit. Remaining time spent conducting survey for North Pacific Right Whale.

4<sup>th</sup> September: Vessel arrives in Dutch Harbor, AK. All remaining scientists disembark. Vessel is offloaded for gear shipment to Seattle.

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

The cruise plan is to deploy 22 moorings in the working area (15 acoustic, 7 oceanographic), as well as collect various oceanographic measurements. A biophysical transect off Point Hope 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 transit to Barrow, AK to deploy 4 additional passive acoustic moorings, as well as attempt the recovery of 4 moorings lost the previous year. A biophysical transect across Barrow Canyon as part of the International Distributed Biological Observatory initiative will also be conducted. During the return transit (Nome to Dutch Harbor), 6 additional moorings will be retrieved and 5 redeployed. Further details of mooring, oceanographic, and dragging operations are given below.

### *C. Mooring deployments*

During the 2010 CHAOZ cruise, three tight arrays of long-term acoustic recorders were deployed in the Chukchi Sea (Figure 1, purple pentagons). During the 2011 CHAOZ cruise, these recorders will be retrieved and redeployed in the same location. These recorders are based on a proven cold and shallow water design and will be run on a duty cycle of 1.583 hours on and 5 hours off, 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. There are five recorders in each array to reduce localization errors and increase the chance of localizations in the event of multiple recorder failures. Pingers placed on the moorings will provide the calibration signals needed for calculating localization errors.

Although deployment of the auto-detection buoy has been postponed until 2012, a double-bubble MARU (Marine Acoustic Recording Unit) for the Bioacoustics Research Group (Cornell University) was deployed in the original location chosen for the auto-detection buoy (Figure 1, red triangle). This mooring will be retrieved and redeployed in the same location during the 2011 CHAOZ cruise. The BRP will use the data recorded on this unit to fine-tune their auto-detection buoy in 2012.

In the middle of each array, a cluster of oceanographic moorings were deployed (Figure 1, yellow/blue dots). These moorings will be retrieved and redeployed in the same location. These moorings will collect

various oceanographic measurements, including temperature, pressure, depth, salinity, conductivity, and fluorescence. The middle acoustic array will also have two separate TAPS moorings to measure zooplankton bio-volume and size distribution. One will contain an upward looking TAPS-8 and the other will contain a brand new upward looking TAPS-6NG. The new TAPS-6NG was built specifically to detect and quantify euphausiids. Both moorings will be very close to each other and will have enough battery power to sample 12-13 months.

After all moorings have been retrieved and redeployed and all oceanographic data are collected, the vessel will transit to Barrow, AK to retrieve and redeploy four passive acoustic moorings and attempt to recover four moorings lost in previous field seasons (see below). During the final transit from Nome, AK to Dutch Harbor, AK, the vessel will retrieve 2 (M8 and M5) and redeploy 1 (M8) PMEL and 4 EAR (Ecological Acoustic Recorder) moorings (Figure 2).

#### *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, hydrographic data (temperature, conductivity, nutrients, chlorophyll, and oxygen) and zooplankton will be collected (dark green pentagons, Fig. 1). 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 0.333 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.

#### *E. Dragging operations*

In an attempt to recover four moorings lost in 2009, a hydraulic winch, cable, and modified scallop dredge will be used to drag the bottom to recover the moorings. All dragging ops 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 ops, 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.

#### *G. Small boat operations*

We will be bringing one of our own rigid hulled inflatable boats (previously discussed with the Captain) on this cruise to use during marine mammal operations. The small boat crew shall consist of a qualified coxswain (who is a member of the scientific party), a photographer, and a biopsier/tagger. Weather and time permitting, 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, biopsy samples, and satellite tagging. The coxswain will have final say in the operation of the vessel, but as long as he/she feels that safety is not compromised will take direction from the lead scientist in the boat. The following people have completed the required NOAA Small boat certifications and training:

Amy Kennedy  
Brenda Rone  
Catherine Berchok  
Jessica Crance  
Stephanie Grassia

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. During launch and retrieval, all appropriate safety procedures shall be maintained.

#### *G. De-staging plan*

Prior to disembarking, scientists will ensure that all staterooms and lab spaces are cleaned. All equipment will be offloaded in Dutch Harbor for shipment back to Seattle.

## VII. Facilities

### *A. Equipment and capabilities provided by ship (itemized)*

Outlet on the bridge to provide power to the acoustic monitoring station and visual survey computer.  
Immersion suits for all scientists on board  
Satellite communications and internet access, if available  
Storage space on deck for 6 crates of sonobuoys, 24 recorders and 7 oceanographic instruments (each 6' long), 34 - 800 lb anchors, 36 acoustic releases (each 3' long), all necessary mooring equipment, 1 RHIB, and one van for laboratory and working space.  
Deck space for two oceanographic winches and one hydraulic winch (see below) including the necessary electrical (480 VAC 3 phase) and hydraulic power supply.  
Deck Crane: Self contained 40HP electro-hydraulic power pack and controls: 18,000lb. w/ 65' lift; 4,000lb. lift capacity at full extension

### *B. Equipment and capabilities provided by scientists (itemized with estimate of weights included)*

24 acoustic recorders (200 lbs and 6' each)  
7 oceanographic moorings (200 lbs and 6' each)  
36 acoustic releases (50 lbs and 3' each)  
34 anchors (20 x 800 lbs each, 10 x 1600 lbs each)  
20 - 30" steel floats (150 lbs each)  
CTD cage (800 lbs and 4' x 4')  
Tucker sled for plankton tow ops (200 lbs, 4' x 6')  
One single drum hydraulic winch for dragging ops (3,000lbs; 4' x 4').  
Two single drum electric/hydraulic winches for CTD and net tow ops (3,000 lbs; 6' x 4').  
6 crates of sonobuoys (6500-7500lbs)

Associated sonobuoy equipment including extraction tools and 3 redeployable units.  
Sonobuoy receiver system, including antennas, masts, mounting brackets, preamplifiers, cables, receivers, laptop, hard drives, plus spares and necessary assembly tools  
One van for laboratory and working space.  
One 22' Zodiac RHIB (*Radar*) w/115hp Yamaha 4-stroke outboard engine and trailer (3,000lbs)  
Big eye binoculars (2 pairs), stands and mounts  
GPS receivers and antennas for survey computer  
GPS and antenna for van  
Hand-held VHF radios  
Laptop computers  
Camera equipment  
Biopsy collection gear  
Satellite tagging equipment, including 2 compressed air tanks  
Mustang flotation suits for all small boat participants and watch-standers  
All required lab materials and supplies

## VIII. 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 BOEMRE 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.

## VI. Miscellaneous

### *A. Scientific berthing*

Berths shall be made available as follows:

1 room: 4 males  
2 rooms: 4 females each

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 phone call will be made every day to a land based contact at NMML giving our current status and position. Emails will be sent/received sparingly at the Chief Scientist's discretion.

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

### F/V *Mystery Bay*

PMEL's Iridium: 8816-314-62459

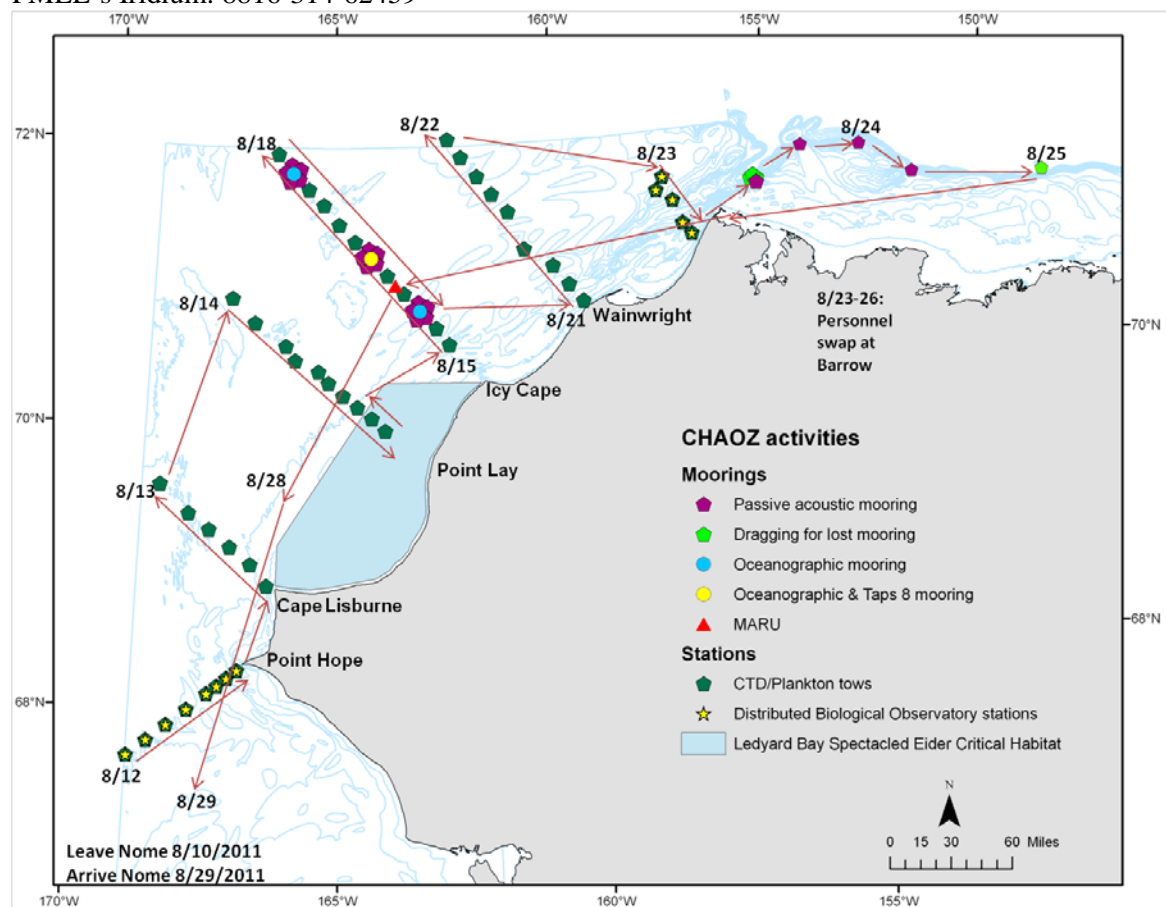


Figure 1. Detailed map of the main research area of the study showing the location of the mooring deployments and CTD/net tow stations. Purple pentagons represent the acoustic moorings. Blue dots represent the oceanographic moorings. The yellow dot represents the oceanographic mooring with the TAPS-8 instrument. Dark green pentagons represent the CTD and Tucker tow stations. Stations marked with a yellow star are part of the Distributed Biological Observatory. Lime green pentagons represent the four lost moorings that we will attempt to recover.



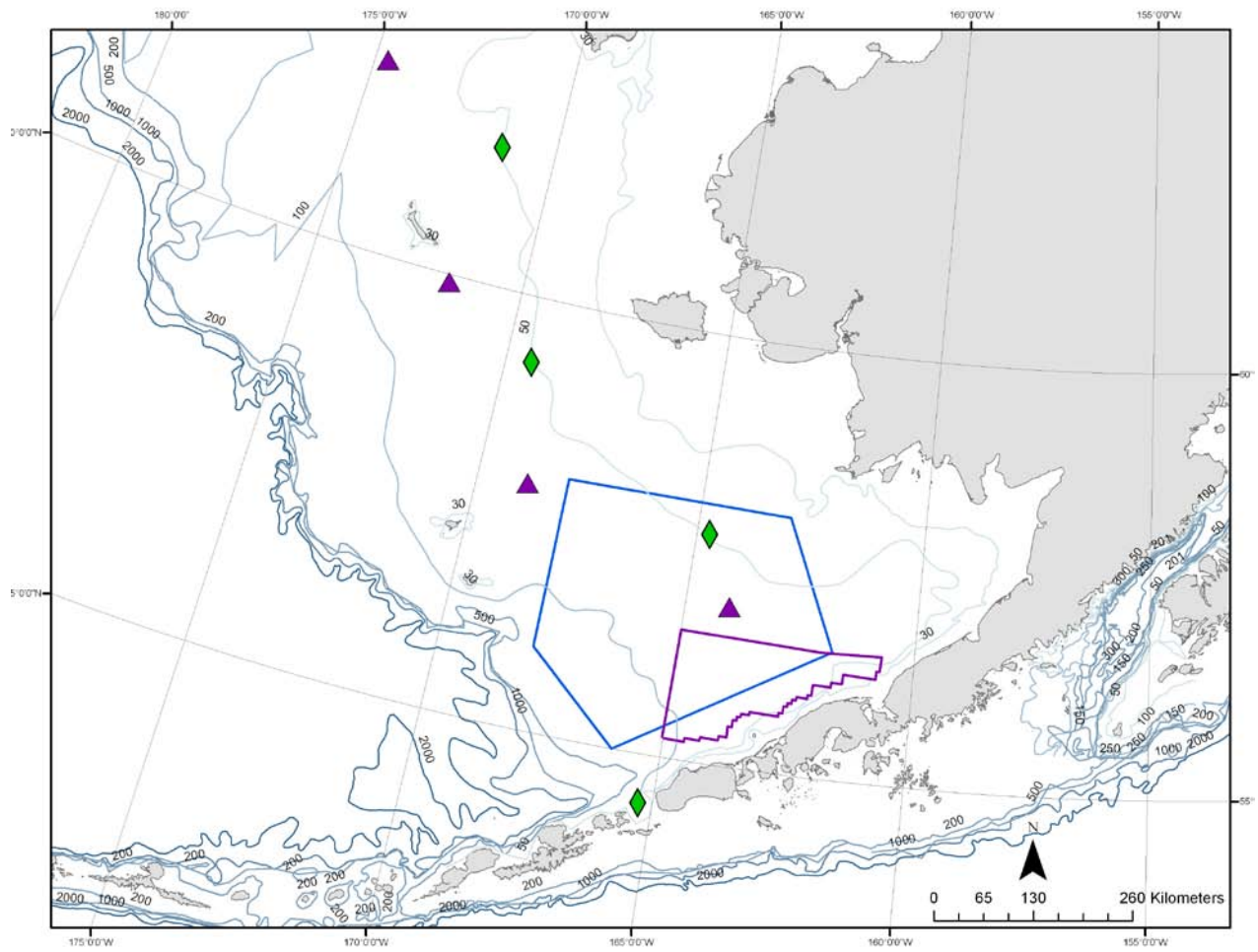


Figure 2. Map of the Bering Sea showing location of PMEL and EAR moorings that will be retrieved and redeployed during the return transit to Dutch Harbor. Green diamonds represent EAR (Ecological Acoustic Recorder) moorings. Purple triangles represent PMEL moorings. Note: only the northern-most PMEL mooring will be retrieved and redeployed on the CHAOZ cruise.