

ARCTIC WHALE ECOLOGY STUDY
(ARCWEST):
USE OF THE CHUKCHI SEA BY
ENDANGERED BALEEN AND
OTHER WHALES
(WESTWARD EXTENSION OF THE BOWFEST)

Nancy A. Friday¹, Ph.D.
Phillip J. Clapham¹, Ph.D.
Catherine L. Berchok¹, Ph.D.
Jessica L. Crance¹, M.S.
Alexandre N. Zerbini^{1,4}, Ph.D.
Brenda K. Rone¹, M.S.
Amy S. Kennedy¹
Phyllis J. Stabeno², Ph.D.
Jeffrey M. Napp³, Ph.D.

¹National Marine Mammal Laboratory
Alaska Fisheries Science Center

²Pacific Marine Environmental Laboratory

³Resource Assessment and Conservation Engineering Division
Alaska Fisheries Science Center

7600 Sand Point Way NE
Seattle, WA 98115

⁴Cascadia Research Collective
218 ½ W 4th Ave.
Olympia, WA 98501

Annual Report
Submitted to the Bureau of Ocean Energy Management (BOEM)
under Inter-Agency Agreement Number M12PG00021 (AKC 108)
January 2013

Executive Summary

Through an Inter-Agency agreement (IA) between the National Marine Mammal Laboratory (NMML) and the Bureau of Ocean Energy Management (BOEM), NMML is conducting a dedicated multi-year study to determine relationships between dominant currents passing from the Bering Sea into and through the Chukchi Sea and prey resources delivered to the Barrow Arch area (an area of high bowhead whale and prey concentrations between Wainwright and Smith Bay), and to provide information about the dynamic nature of those relationships relative to whale distribution and habitat utilization in the eastern Chukchi and extreme western Beaufort Seas. This study will also provide important baseline data on the occurrence, distribution and habitat use of large whales in an area that is subject to rapid change in climate and human industrial development. This annual report covers the first year of this study between March and December 2012.

The major activity during this period consisted of planning for the 2013 vessel survey.

Introduction and objectives

The western Arctic physical climate is rapidly changing. The 2012 Arctic summer minimum ice extent (3.4 million km²) was the lowest ice extent recorded, 18% below the previous minimum in 2007 and 49% below the 1979 to 2000 average. The speed of this ice loss was unexpected, as the consensus of the climate research community was that this level of ice reduction would not be seen for another thirty years. As sea temperature, oceanographic currents, and prey availability are altered by climate change, parallel changes in baleen whale species composition, abundance and distribution are expected (and evidenced already by local knowledge and opportunistic sightings). In addition, the observed northward retreat of the minimum extent of summer sea ice has the potential to create opportunities for the expansion of oil and gas-related exploration and development into previously closed seasons and localities in the Alaskan Arctic. It will also open maritime transportation lanes across the Arctic adding (to a potentially dramatic degree) to the ambient noise in the environment. This combination of increasing anthropogenic impacts, coupled with the steadily increasing abundance and related seasonal range expansion by bowhead (*Balaena mysticetus*), gray (*Eschrichtius robustus*), humpback (*Megaptera novaeangliae*) and fin whales (*Balaenoptera physalus*), mandates that more complete information on the year-round presence of large whales is needed in the Chukchi Sea planning area. Timing and location of whale migrations may play an important role in assessing where, when or how exploration or access to petroleum reserves may be conducted, to mitigate or minimize the impact on protected species.

The ARCWEST study has five component projects: visual observation, satellite tagging, passive acoustics, lower trophic level sampling, and physical oceanographic sampling. Each component project is a technical discipline and is coordinated by a Project Leader with extensive experience in that discipline. Visual surveys, along with sonobuoy deployments, will provide distributional data on baleen whales and other marine mammals. Satellite tagging will provide valuable information on both large- and fine-scale movements and habitat use of baleen whales. Passive acoustic moorings will provide year-round assessments of the seasonal occurrence of baleen whales. Concurrently deployed bio-physical moorings offer the potential of correlating whale distribution with biological and physical oceanographic conditions and indices of potential prey density. Satellite-tracked drifters will examine potential pathways to the areas of high biological importance. Our goal is to use these tools to understand the

mechanisms responsible for the high biological activity so that we can predict, in a qualitative way, the effects of climate change on these preferred habitats.

The overall goal of this multi-year IA is to use passive acoustic recorder deployments, visual and passive acoustic surveys, and satellite tagging to explore the distribution and movements of baleen whales in the Bering and Chukchi Seas, particularly the Chukchi Sea planning areas. In addition, oceanographic and lower trophic level sampling and moorings will be used to explore the relationships between currents passing through the Bering Strait and resources delivered to the Barrow Arch area (an area of high bowhead whale and prey concentrations between Wainwright and Smith Bay), and the dynamic nature of those relationships relative to whale distribution and habitat utilization in the eastern Chukchi and extreme western Beaufort Seas.

The specific objectives are:

1. Assess patterns of spatial and temporal use of the Chukchi Sea by endangered bowhead, fin and humpback whales, and beluga and gray whales.
2. Assess the population structure and origin of whales in the region.
3. Evaluate ecological relationships for the species, including physical and biological oceanography that affect critical habitat for these species.
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 Arch area.

Cruise activities and summary

Planning for the 2013 vessel survey has begun. Sampling and mooring locations have been determined. A tentative schedule of survey activities has been drafted. The paperwork necessary to charter a vessel has been drafted and sent to the Western Regional Center's contracting office.

Post-cruise data analysis results and planning

Visual Observations Component:

Sightings collected in 2012 are part of the Chukchi Sea Acoustics, Oceanography, and Zooplankton (CHAOZ) project. Planning for the 2013 vessel survey was begun.

Satellite Tagging Component:

During the 2012 CHAOZ survey, Satellite telemetry was conducted on an opportunistic basis at the discretion of the chief scientist, taking weather, time of day, and oceanographic operations into consideration. Satellite tagging operations were conducted following the protocols approved under permit #14245 issued by the National Marine Fisheries Service (NMFS) to the NMML. One gray whale was tagged 16 miles offshore from Wainwright, Alaska, on 25 August. This whale was judged to be a juvenile based on size. This whale transmitted for 48 days until 11 October 2012 (Fig. 1). The animal

remained within 25nm of the deployment site for the duration of the tag and occupied relatively shallow waters (20-50m in depth) to the south of Hanna Shoal. Given that there were several animals in the area during deployment and many visible mud plumes, it is highly likely that this whale had been feeding in a particularly dense prey patch during tag transmission. Additional details on the tagging operation are available in the CHAOZ cruise report and the October 2012 ARCWEST Quarterly report.

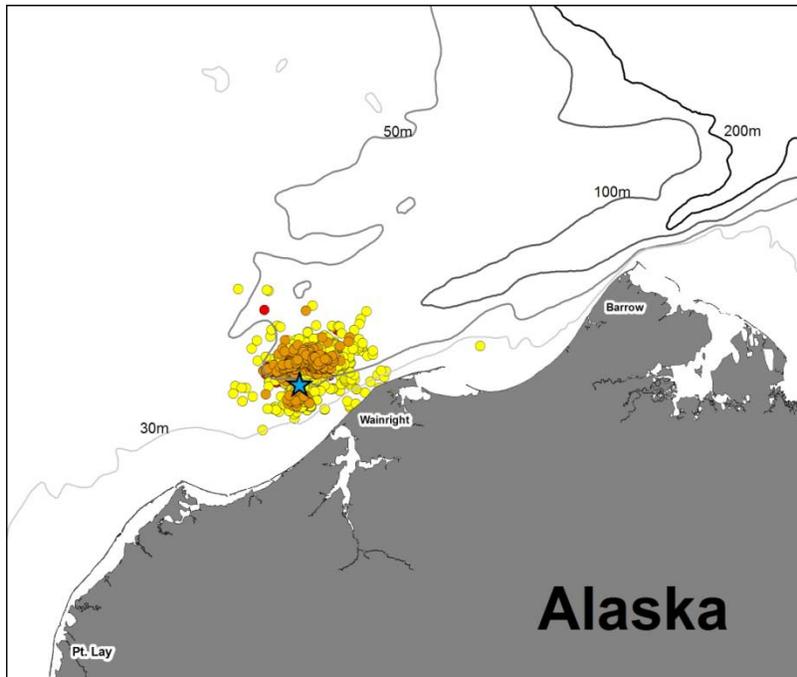


Figure 1: August (red), September (yellow) and October (orange) locations of a gray whale satellite tagged off Wainwright, AK during the CHAOZ 2012 survey. The blue star marks the tagging location of this individual (70.8N, 160.5W).

Passive Acoustic Component:

NMML Long-term moorings:

The first deployment of ARCWEST passive acoustic recorder moorings (Fig. 2) was completed on the 2012 CHAOZ survey cruise, and those will be retrieved during the 2013 ARCWEST survey with analysis commencing in the fall of 2013. Recorders retrieved during the 2012 CHAOZ cruise are currently being analyzed under the CHAOZ project.

Planning for the 2013 vessel survey was begun: 2013 mooring locations (Fig. 3) were determined in coordination with the oceanographic and lower trophic level components of ARCWEST and a tentative vessel schedule was drafted.

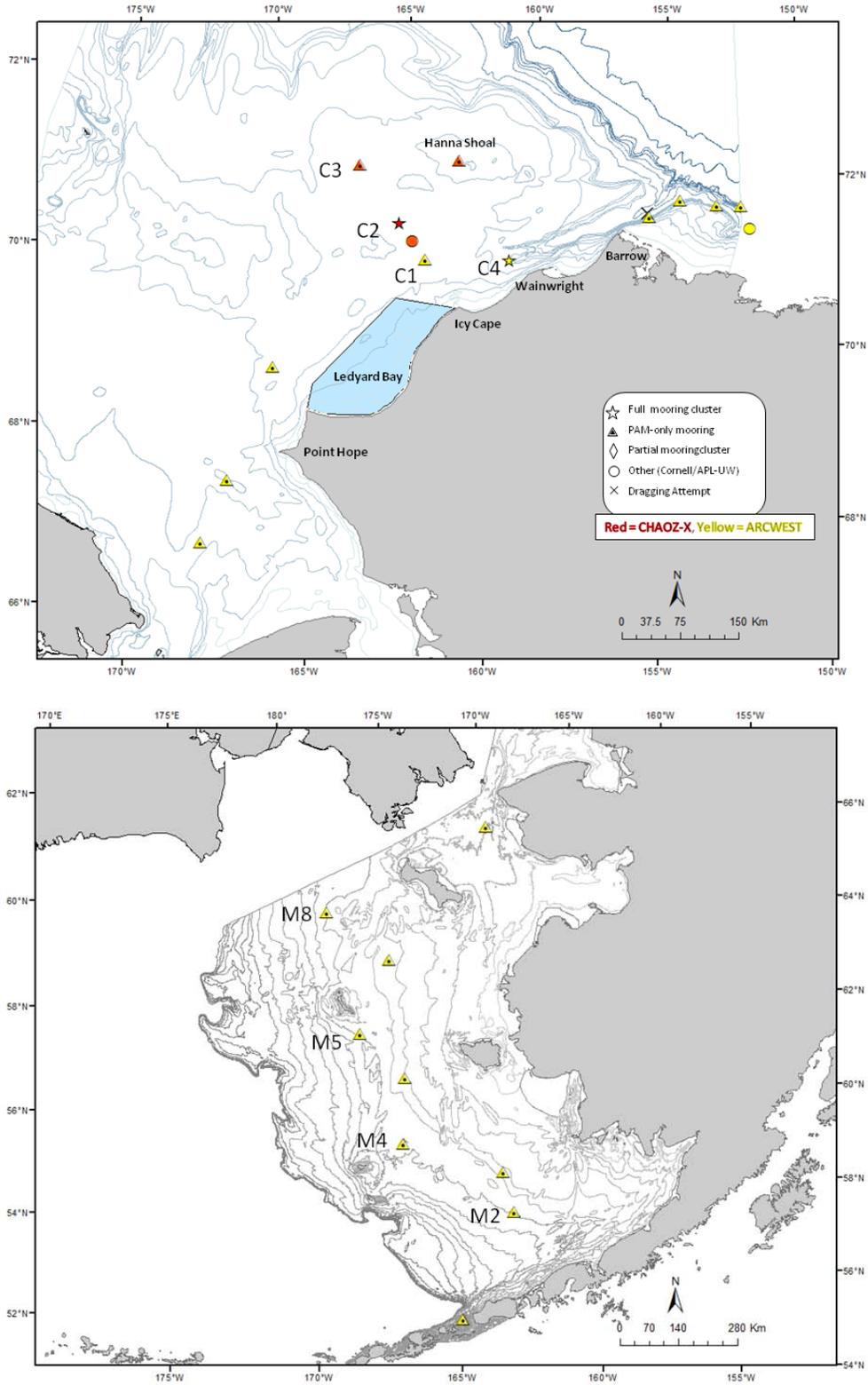


Figure 2. Passive acoustic and oceanographic moorings deployed in the Chukchi and Beaufort Seas in (upper panel) and in the Bering Sea (lower panel) during the 2012 CHAOZ survey cruise. The yellow moorings will be analyzed under ARCWEST, and the red mooring will be analyzed under the CHAOZ extension interagency agreement should it be funded.

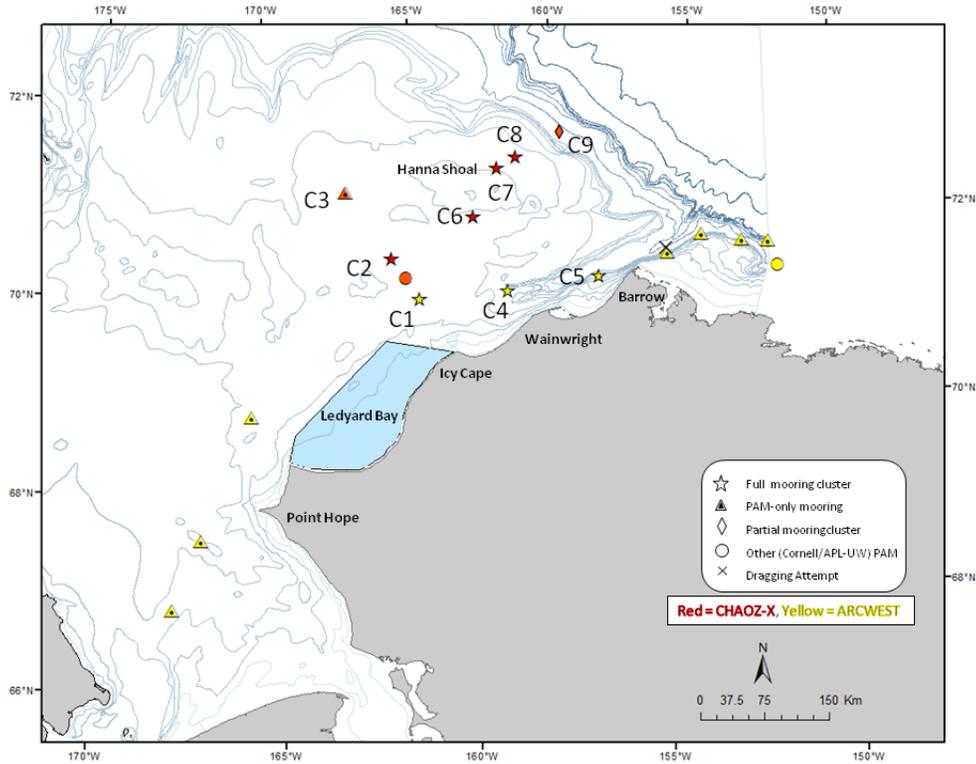


Figure 3. Planned passive acoustic and oceanographic moorings to be deployed in the Chukchi and Beaufort Seas for 2013. For planned Bering Sea deployments, please see Fig. 2 (lower panel).

Sonobuoys:

Analysis of the 2012 sonobuoy acoustic detection data will be completed under the CHAOZ project.

Oceanographic and Lower Trophic Level Component:

Moorings:

All CHAOZ moorings deployed in 2011 were successfully retrieved (C1, C2, and C3), as well as the retrieval and redeployment of the Bering Sea oceanographic moorings (M2, M4, M5, and M8) (Fig. 2). The analyses of the 2011-2012 oceanographic data sets are part of CHAOZ.

Two clusters of moorings were deployed for ARCWEST (Fig. 2). Site C2, midway along the Icy Cape Line, is a redeployment to continue the time series begun during CHAOZ. Site C4 is a new deployment, just west of the Wainwright Line, along the axis of Barrow Canyon and was placed at that location to determine when and how often the flow up the canyon reaches the shelf. Each cluster of moorings contains the following: (1) 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); (2) a “Bio mooring” with either a 300 or 600 KHz RDI ADCP, a linked set of instruments (Seacat, eco-fluorometer,

PAR sensor, ISUS nitrate meter), and 3 a zooplankton mooring with a n upward looking TAPS-6NG (Tracor Acoustic Profiling System Next Generation) instrument to measure zooplankton bio-volume and size distribution. These moorings collect their various oceanographic measurements for a full year.

Satellite Tracked Drifters:

At twelve locations in the northern Bering and Chukchi seas, ARGOS-tracked drifters were deployed off of either the F/V *Aquila* (8 drifters) or the Coast Guard icebreaker Healey (4 drifters; Fig. 4). These free-floating instruments were drogued at 30 m and drift along with the currents. The first drifter was deployed in the northern Bering Sea, near the site of the M8 oceanographic mooring. These drifters measure the advection of water from the Bering into the Chukchi Sea. The purpose of the farthest offshore drifter deployed near Hanna Shoal was to examine the circulation around this bathymetric feature. A movie of the drifters can found at <http://www.pmel.noaa.gov/foci/visualizations/drifter/chuk2012.html>. The first month of the movie, January 2012, shows the trajectory of drifters deployed in 2011 and trapped in the ice. The length of the "tail" of each drifter is five days. Analysis of the 2012 satellite tracked drifter data set is part of CHAOZ.

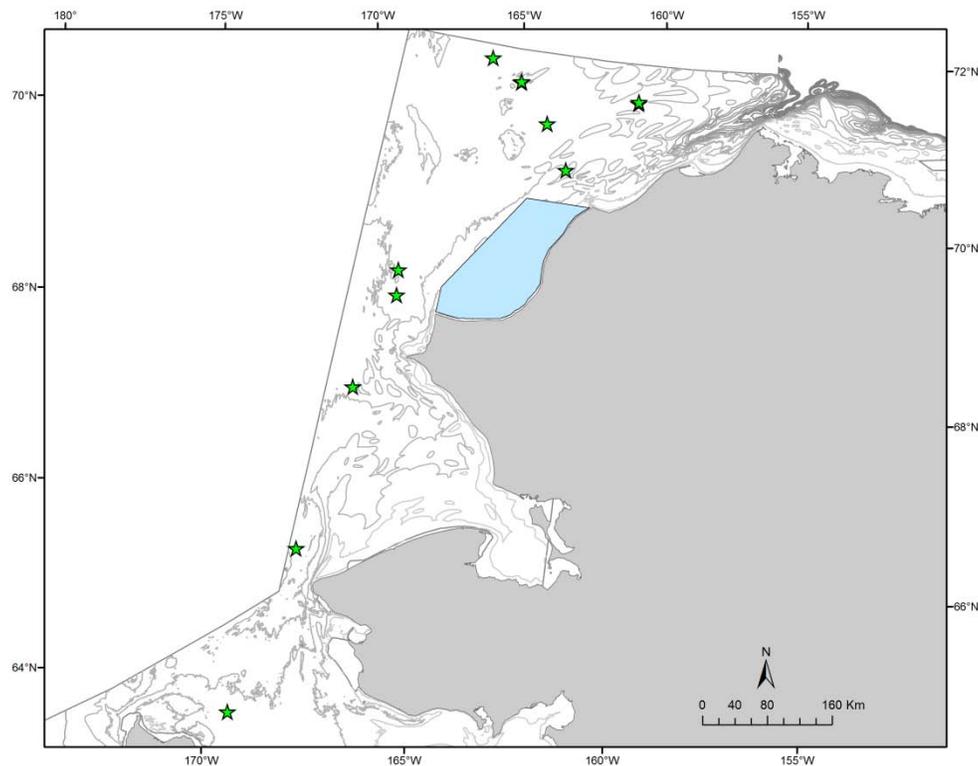


Figure 4. Deployment locations of ARGOS drifters in 2012 (green stars).

Active Acoustics:

All CHAOZ TAPS-6NG instruments deployed in 2011 were successfully retrieved. Analysis of the 2011-2012 data is part of CHAOZ.

Newly constructed TAPS-6NG instruments were deployed at both C2 and C4 (one each) (Fig. 2). A Purchase Order was issued to obtain 5 additional sets of transducers to begin to build the next set of instruments. In addition, Purchase Orders were successfully awarded to attempt to improve the controller board for the TAPS-6NG. We anticipate that the new design will use much less power than the present board and will provide enough data storage capacity to store the returns from each ping rather than ensembles as we presently do.

Lower Trophic Level Sample and Data Analyses:

No lower trophic level sampling or data analyses occurred as part of ARCWEST in 2012.

Physical/Chemical Oceanographic Sampling:

No physical/chemical oceanographic sampling occurred as part of ARCWEST in 2012.

2013 Field Season Planning:

Planning for the 2013 vessel survey has begun: 2013 mooring locations (Fig. 3) for oceanographic and active acoustic mooring have been determined in coordination with the passive acoustic component of ARCWEST. 2013 locations for lower trophic level and physical/chemical oceanographic sampling have been determined. A tentative vessel schedule was drafted. The plan for ARCWEST in 2013 is for three moorings sites, fewer onshore/offshore transects, and a box of hydrographic and plankton stations around the Barrow Arch (Peard Bay). The plan includes an additional four mooring sites should the CHAOZ extension interagency agreement be funded.

Significant technical, schedule, or cost problems encountered

Challenges for the 2013 field season include: obtaining a contract for a research vessel, paying for increases in fuel costs that have occurred since the ARCWEST proposal was written and approved, and obtaining the additional mooring instruments required for the 2013 field season. The last issue is a challenge because the MOU was signed so late in the last fiscal year, that no expenditures or obligations could be made using Year 1 funds. We could not use or access these funds until late in the first quarter of FY13.

Costs for a vessel charter are projected to be higher than anticipated in 2011 when the ARCWEST budget was submitted. The draft vessel schedule for 2013 has reduced the number of days dedicated to satellite tagging large whales to meet the projected vessel costs.

Significant meetings held or other contacts made

13 December 2012 – Friday, Zerbinj, Rone, Kennedy, Crance, Berchok, and Stabeno met to discuss the vessel contract and ARCWEST field logistics.

Presentations and Publications

None