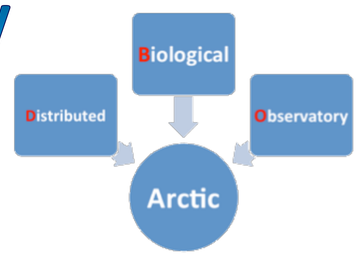
Marine mammal occurrence in the Distributed Biological Observatory (DBO) from ship-based visual and passive acoustic surveys



Catherine L. Berchok[1], Jessica L. Crance[1], Brenda Rone[1], Sue E. Moore[2]

[1]National Marine Mammal Laboratory, AFSC/NMFS/NOAA, 7600 Sand Point Way NE, Seattle, WA 98115,

[2]Office of Science and Technology, NMFS/NOAA, 7600 Sand Point Way NE, Seattle, WA 98115

Corresponding author: Catherine.Berchok@noaa.gov

ABSTRACT

The Alaska Fisheries Science Center, in conjunction with the Pacific Marine Environmental Laboratory has contributed to biophysical sampling in all five regions of the Distributed Biological Observatory (DBO) since 2010, as part of the BOEM-funded CHAOZ, CHAOZ-X, and ARCWEST projects. The DBO is an international collaboration among scientists conducting research in the Bering, Chukchi, and Beaufort Seas, wherein biophysical data (i.e., temperature, salinity, sea ice seasonality and thickness, chlorophyll, nutrients, and zooplankton occurrence) are sampled along a pre-described line of sampling stations whenever possible (see http://www.arctic.noaa.gov/dbo/index.html for more information). Marine mammal sightings and call detections from passive acoustic sampling are also recorded in each DBO region. Here, we describe the occurrence of marine mammals in each DBO region, as obtained from our ship-based visual (25x big-eye and handheld binocular) and passive acoustic (sonobuoy) surveys. The most common species found in each region were: fin and humpback whales in Region 1 (SW of St. Lawrence Island), gray whales in Region 2 (South of Bering Strait), gray, fin, and humpback whales in Region 3 (Point Hope to Bering Strait), walruses and bowhead whales in Region 4 (Icy Cape), and bowhead and gray whales in Region 5 (Barrow Canyon). An inter-annual comparison of results among the DBO regions will be presented, and correlations with a few basic oceanographic parameters will be explored. [Work supported by the Bureau of Ocean Energy Management]

YEAR	CRUISE DATES	VESSEL
2010	24 August – 20 September 20	F/V Alaskan Enterprise
2011	12 August – 11 September	F/V Mystery Bay
2012	8 August – 7 September	R/V Aquila
2013	13 August – 18 September	R/V Aquila
2014	7 September – 20 October	R/V Aquila

DBO Summary

- International biophysical sampling effort centered on areas of high biological importance
- Regional "hotspot" transect lines and stations located along a latitudinal gradient

NMML Contributing Projects

- CHAOZ: Chukchi Acoustics, Oceanography, and Zooplankton
- ARCWEST: Arctic Whale Ecology Study
- CHAOZ-X: Chukchi Acoustics, Oceanography, and Zooplankton Extension

Region 4

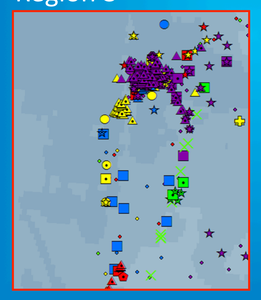
Region 5

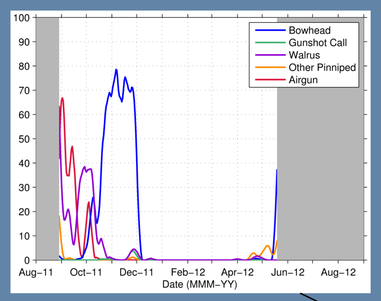
See poster by Garland et al., this session: 'Beluga whale (Delphinapterus leucas) vocalizations from the eastern Beaufort Sea population.'

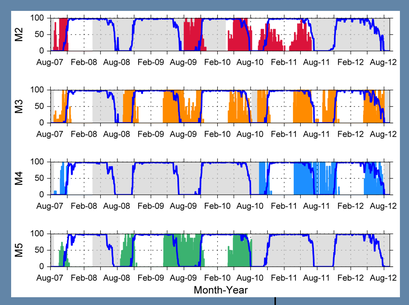
Marine Mammal Surveys

- Visual surveys:
  - Rotating team of 3 observers
  - 25x Big Eye binoculars
  - WinCruz software
- Passive acoustics:
  - 24 hr sonobuoy monitoring
  - Multi-channel recording
  - Localization using DiFAR demultiplexing software (Greeneridge Sciences, Inc.) and custom interface (Mark McDonald)

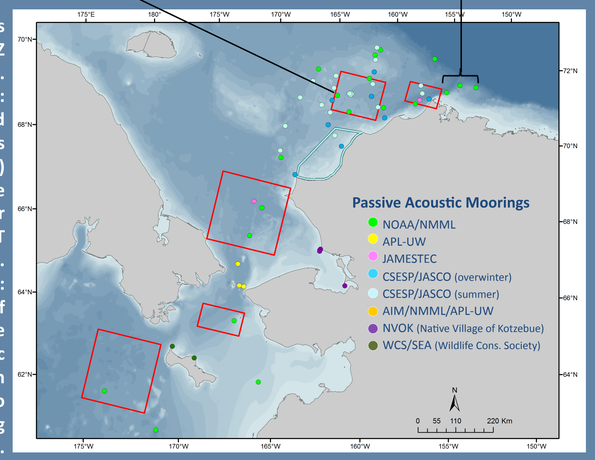
Region 3



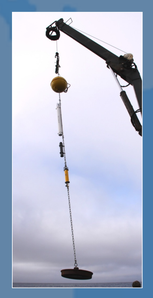




Top left: Results from 2011 CHAOZ IC6 mooring. Top right: Bowhead detections (colored lines) and ice coverage (blue line) for BOWFEST moorings. Bottom right: Location of NMML passive acoustic moorings (green dots relative to other mooring locations.

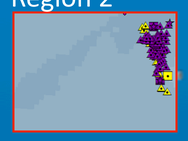


Long-Term Acoustic Monitoring



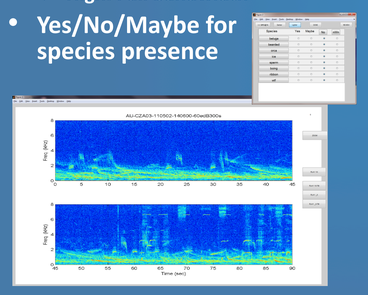
- AURAL (Autonomous Underwater Recorder for Acoustic Listening, Multi-Électronique, Rimouski, QC)
- 30% duty cycle
- Sampling rate 8kHz or 16kHz
- Co-located with oceanographic and biophysical moorings

Region 2

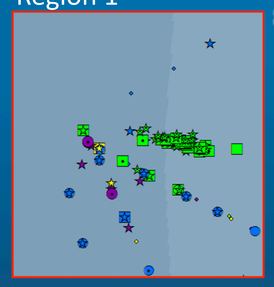


Data Analysis

- SoundChecker (designed by Berchok)
- Two frequency bands
  - Regular: 0-800 Hz
  - High: Full bandwidth
- Yes/No/Maybe for species presence



Region 1



Acoustic and visual detections

- Bowhead whale
- Gray whale
- Fin whale
- Humpback whale
- Killer whale
- Minke whale
- Walrus
- Bearded seal
- Ribbon seal
- Polar bear
- Gunshot call
- Seismic airguns
- No detections
- Acoustic detection
- Visual sighting
- 2010
- 2011
- 2012
- 2013
- 2014
- DBO region

CONCLUSIONS

Shipboard surveys:

- Region 1: Fin, humpback, and killer whales most common
- Region 2: Gray whales most common
- Region 3: Gray, fin, and humpback most common
- Region 4: Walrus and bowhead whales
- Region 5: Gray and bowhead whales most common

Long-term recorders:

- Correlate marine mammal vocalizations with ice presence and other environmental variables.
- Track population migration and movement
- Distinguish among populations of certain species (see poster by Garland et al.)

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The recommendations and general content presented in this poster do not necessarily represent the views or official position of the Department of Commerce, the National Oceanic and Atmospheric Administration, or the National Marine Fisheries Service