New Discoveries from Passive Acoustic Monitoring and Future Applications and Directions for its Use

CATHERINE L. BERCHOK
MARINE MAMMAL LABORATORY
ALASKA FISHERIES SCIENCE CENTER
NOAA
Passive Acoustics

Hydrophone
Platforms - Fixed

Dipping Hydrophone
Platforms - Fixed

Dipping Hydrophone

Cabled Hydrophone/Observatory
Platforms - Fixed

Dipping Hydrophone

Cabled Hydrophone/Observatory

Mooring
Platforms - Mobile

SWFSC Towed Hydrophone Array

10 Kts
200 m
6 m
30 m

Towed
Platforms - Mobile

Towed

SWFSC Towed Hydrophone Array

Sonobuoys/drifting sensors

NOAA
FISHERIES
Platforms - Mobile

Towed

Sonobuoys/drifting sensors

Tags
Platforms - Mobile

- SWFSC Towed Hydrophone Array
- Towed
- Sonobuoys/drifting sensors
- Tags
- AUVs
Platforms - Mobile

Towed

Sonobuoys/drift sensors

Tags

AUVs

SWFSC Towed Hydrophone Array

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Benefits

Multiple species
Benefits

Multiple species

And sound sources
Benefits

All the time
Highlights

Long-term Seasonal Distribution

https://www.pmel.noaa.gov/dbo/
Benefits

Better understanding of seasonal ranges

Adapted from Citta et al. 2015, Progress in Oceanography: Bowhead location densities from satellite tagging May 2006-Dec 2012
Highlights

Better understanding of seasonal ranges

From Citta et al. 2015, Progress in Oceanography: Bowhead location densities from satellite tagging May 2006-Dec 2012

Wright et al. 2018 Acoustic detection of the critically endangered North Pacific right whale in the northern Bering Sea. Marine Mammal Science
Better understanding of seasonal ranges

- Crance et al. 2015 Northeasternmost record of a North Pacific fin whale (Balaenoptera physalus) in the Alaskan Chukchi Sea. Polar Biology
Highlights

Better understanding of seasonal ranges
Highlights

Proxies for ice condition?

Directional calling

Blackwell et al. (2012) Marine Mammal Science

General direction of the autumn bowhead whale migration in this area.
Benefits

Highlights

Determining behavioral state


Beluga

Acoustic comparison

![Graph showing acoustic comparison of different vocalizations per hour: Social call, Buzz, Train packet, Terminal buzz, with categories Transiting, Socializing, Presumably feeding.](image-url)
Correlations with oceanographic parameters

Stafford et al. (2013)
MEPS

Strong Alaska Coastal Current may bring better feeding opportunities for Beluga in Barrow Canyon
Differentiate populations

Delarue et al (2013), MMS
From Rankin & Barlow (2005) JASA

Fin
Delarue et al (2013), Arctic

Minke
Differentiate species

From Thode et al (2017) JASA

Upcalls right whale

From Thode et al (2016) JASA

Upcalls bowhead whale
Differentiate populations

From Thode et al (2017) JASA

Upcalls right whale

From Thode et al (2016) JASA

Upcalls bowhead whale
Hearing sensitivity of wild animals (auditory evoked potentials)

Castellote et al. (2014) Journal of Experimental Biology
Highlights

Hearing sensitivity of wild animals (auditory evoked potentials)

Castellote et al. (2014) Journal of Experimental Biology
Future Directions

• Continuing to collect long-term time series
  • Archived data can be reprocessed!!!!
• More work on
  • Population differentiation
  • Behavioral context
  • Noise effects
Future Directions

Collaboration with Alaskan Audubon & Cornell Univ.

Chukchi Plateau (~pristine)

Bering Strait High traffic + many marine mammal spp.

Unimak Pass - very high traffic (lt. gray) + Critically Endangered North Pacific Right Whale (red & black) (Wright et al. (in review) End. Spp. Research)
Future Directions

Abundance estimates

Can’t count non-vocalizing animals; don’t know how many are calling
Abundance estimates

Can’t count non-vocalizing animals; don’t know how many are calling

Estimating animal population density using passive acoustics

Tiago A. Marques¹,²,*, Len Thomas¹, Stephen W. Martin³, David K. Mellinger⁴, Jessica A. Ward⁵, David J. Moretti⁵, Danielle Harris¹ and Peter L. Tyack⁶
Future Directions

New technological advances
Future Directions

New technological advances