

# Geographic variation in Blainville's beaked whale (*Mesoplodon densirostris*) echolocation signal

- <sup>1</sup> Scripps Institution of Oceanography
- <sup>2</sup> NOAA Pacific Islands Fisheries Science Center
- <sup>3</sup> NOAA Southeast Fisheries Science Center
- <sup>4</sup> Bedford Institute of Oceanography
- <sup>5</sup> Duke University Marine Laboratory
- <sup>6</sup> NOAA Northeast Fisheries Science Center

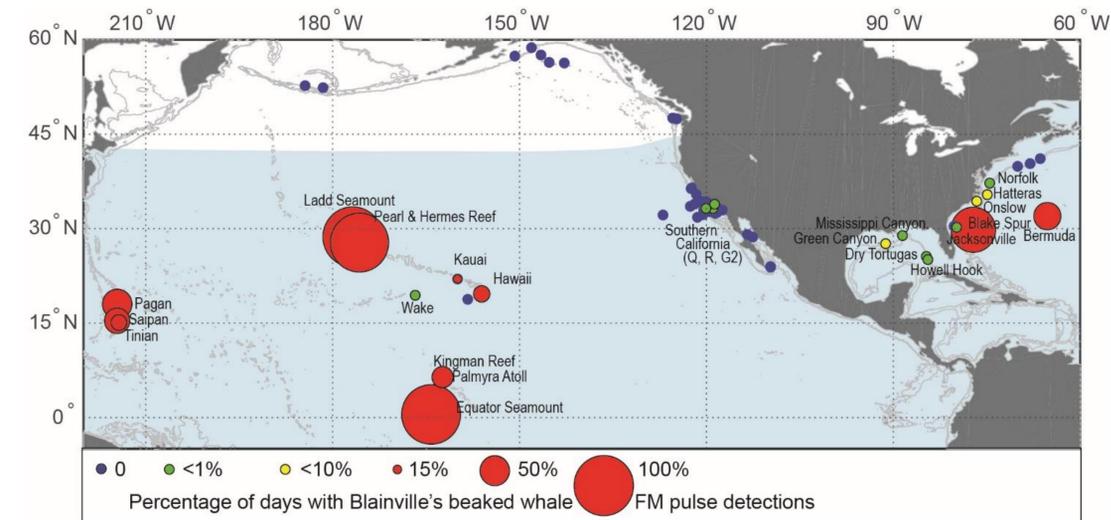
\*jtrickey@ucsd.edu



Jennifer S. Trickey<sup>1\*</sup>, Kaitlin E. Frasier<sup>1</sup>, John A. Hildebrand<sup>1</sup>, Erin M. Oleson<sup>2</sup>, Melissa S. Soldevilla<sup>3</sup>, Joy Stanistreet<sup>4</sup>, Lynne E. W. Hodge<sup>5</sup>, Andrew J. Read<sup>5</sup>, Danielle M. Cholewiak<sup>6</sup>, Sofie M. Van Parijs<sup>6</sup>, Simone Baumann-Pickering<sup>1</sup>

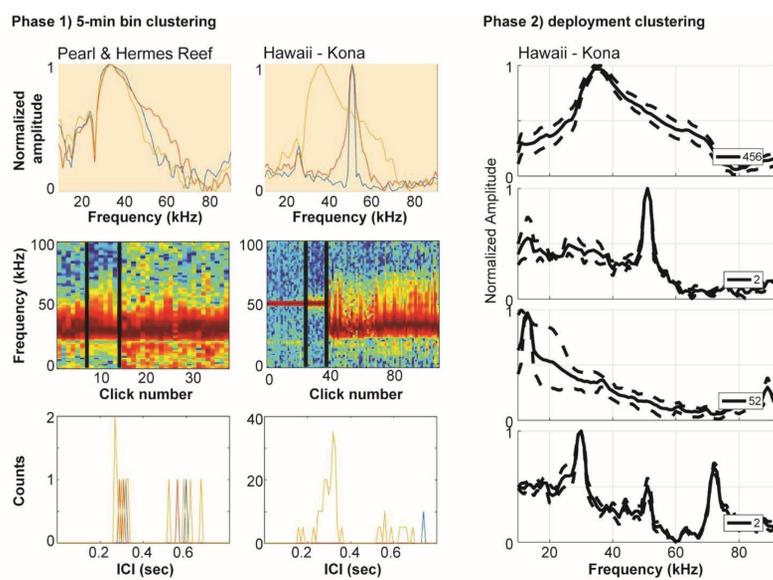
## Summary

Blainville's beaked whales (*Mesoplodon densirostris*, Md) have a cosmopolitan distribution but are classified as "Data Deficient" under the IUCN Red List. We investigated geographic differences in Md echolocation clicks from recording sites across the Northern Hemisphere as a potential tool for population-level discrimination. Quantification of the variability in spectral shapes and inter-click intervals measured within and between encounters was achieved through weighted network clustering (Frasier et al., 2017). We observed differences in spectral structure between ocean basins and also identified a latitudinal cline, with higher peak frequencies occurring in lower latitudes. The observed variability may have several possible origins, potentially related to differences in body size or prey type/size. These findings provide insight into the geographic distribution of a rarely observed species, and also suggest that this variability in echolocation signal frequency may be a first indication of acoustic delineation between population-level boundaries of Blainville's beaked whales that have not been identified previously.



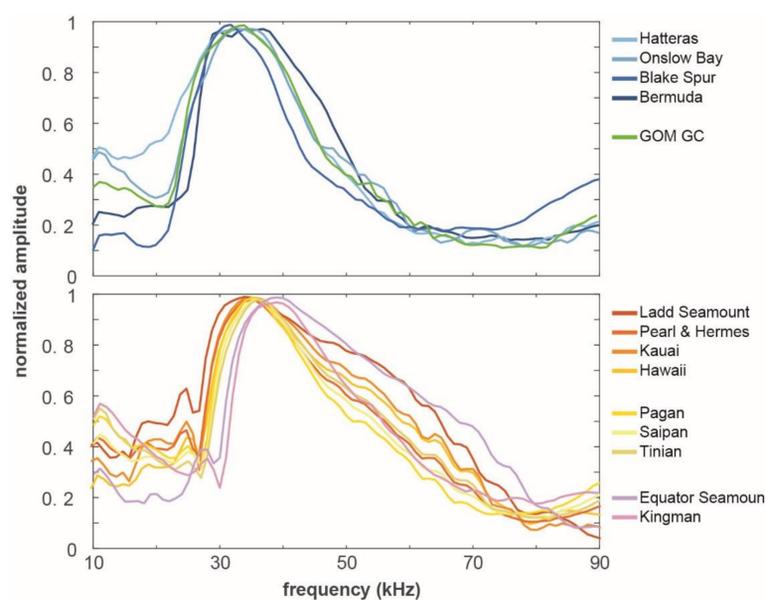
**Figure 1.** Deployment locations of High-frequency Acoustic Recording Packages (circles). Sites are marked in varying colors and sizes dependent on percentage of days with Md acoustic detections. Light blue background shading indicates known range of this species based on the IUCN Red List map (Taylor et al., 2008).

## Clustering

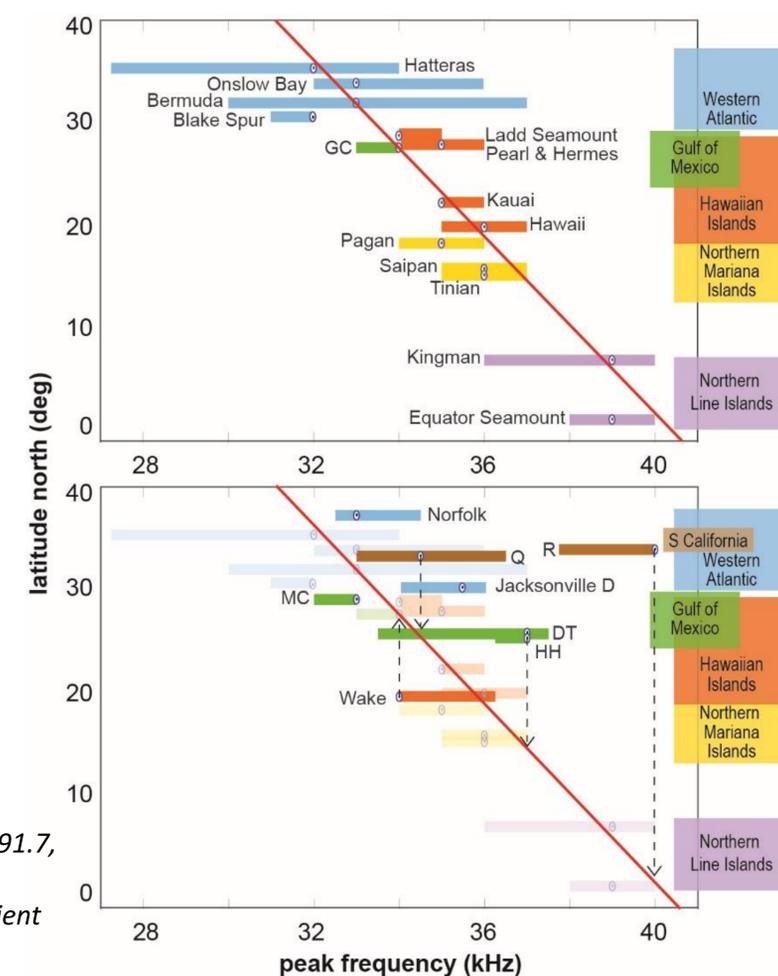


**Figure 2.** Examples for clustering phase 1 (5-min bin, click-based) and phase 2 (spectral average- and ICI mode-based). Phase 1 at Pearl and Hermes Reef: 3 Md click spectral averages (top), concatenated spectra of all clicks in these averages (middle), and corresponding ICI distribution (bottom); Hawaii-Kona: 2 clusters of echosounders and one cluster of Md clicks. Phase 2 (Hawaii-Kona, 1 deployment): most 5-min bin spectral averages and ICI modes were clustered within the Md click type while several different echosounder categories occurred as well.

## Geographic patterns in spectral structure



**Figure 3.** Spectral averages of primary clusters at sites in the Western Atlantic and Gulf of Mexico (top) and the North Pacific (bottom) with regular Md acoustic occurrence.



**Figure 4.** Increasing peak frequency (median with 25<sup>th</sup> and 75<sup>th</sup> percentiles) with lower latitudes (red regression line:  $y = -4.8x + 191.7$ ,  $R^2 = 0.93$ ) at sites with regular Md presence (top). Sites with low numbers of detections (<1% of recorded days) may indicate transient whales from other regions (arrows, bottom).

## Acknowledgements and References

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Photo: Suzanne Yin

Taylor, B. L., Baird, R., Barlow, J., Dawson, S. M., Ford, J., Mead, J. G., Notarbartolo di Sciara, G., Wade, P., and Pitman, R. L. (2008). "Mesoplodon densirostris," in *The IUCN Red List of Threatened Species 2008*.

Frasier, K. E., Roch, M. A., Soldevilla, M. S., Wiggins, S. M., Garrison, L. P., and Hildebrand, J. A. (2017). "Automated classification of dolphin echolocation click types from the Gulf of Mexico", *PLoS Comp. Biol.* **13**, e1005823.



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