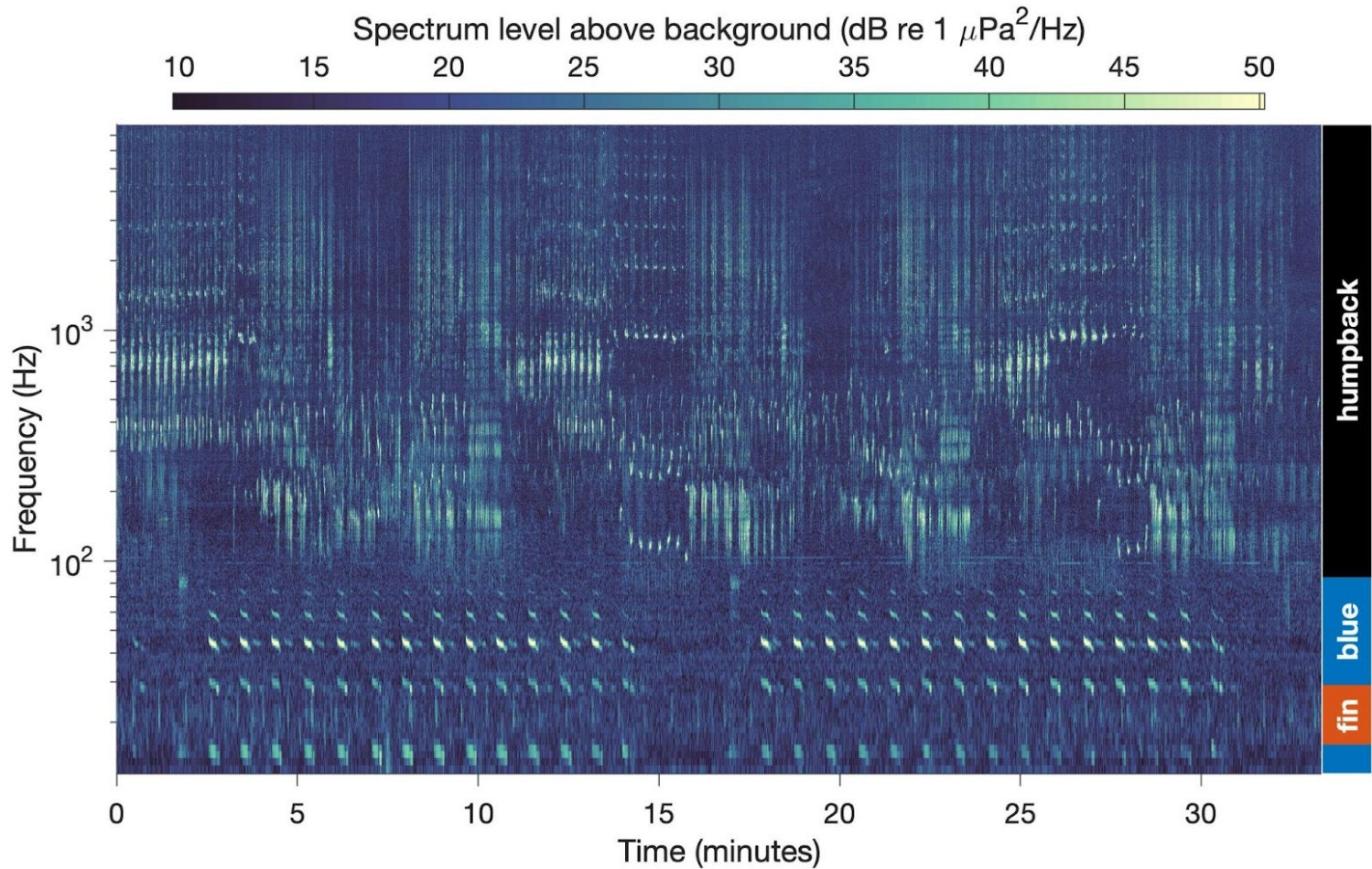
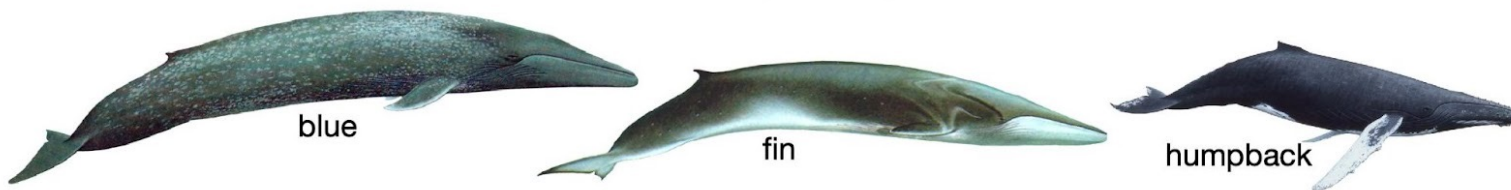


# Integrative Passive Acoustic Monitoring to Support Offshore Wind Energy Development



John Ryan  
Monterey Bay Aquarium  
Research Institute

& many collaborators



Whale artist: Larry Foster



To inform protection, we must know where and how species live.

# ECOLOGY LETTERS



Volume 25 Number 11 | November 2022  
ISSN 1461-023X



WILEY

# ECOLOGY LETTERS

LETTER | Open Access |

## Oceanic giants dance to atmospheric rhythms: Ephemeral wind-driven resource tracking by blue whales

John P. Ryan , Kelly J. Benoit-Bird, William K. Oestreich, Paul Leary, Kevin B. Smith, Chad M. Waluk, David E. Cade, James A. Fahlbusch, Brandon L. Southall, John E. Joseph, Tetyana Margolina, John Calambokidis, Andrew DeVogelaere, Jeremy A. Goldbogen  
... See fewer authors ^

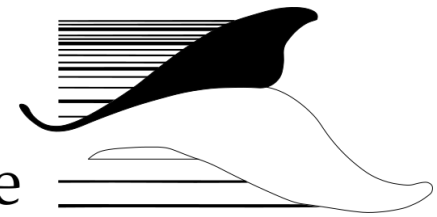
First published: 05 October 2022 | <https://doi.org/10.1111/ele.14116>



Monterey Bay Aquarium  
Research Institute



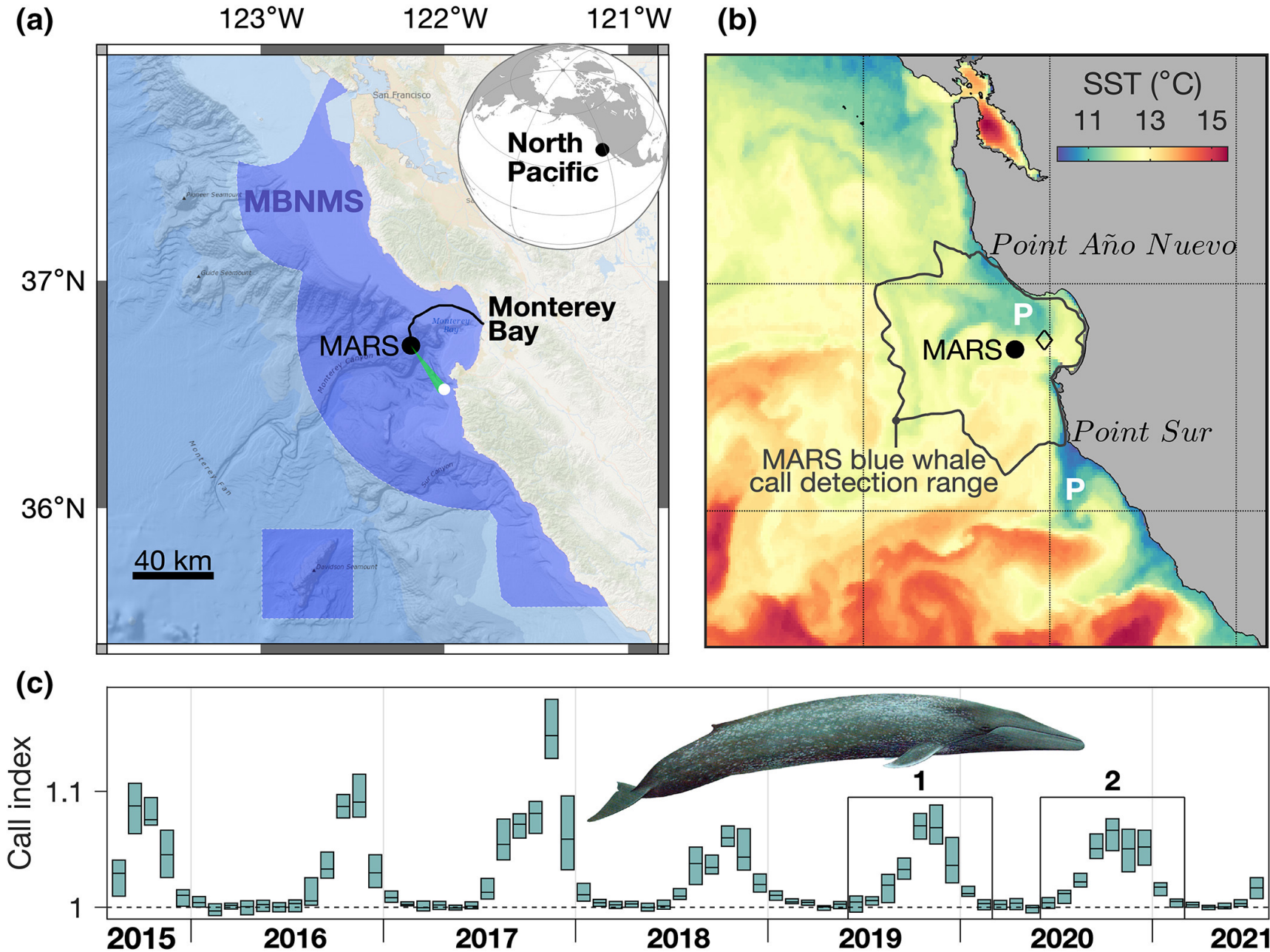
Cascadia  
Research  
Collective



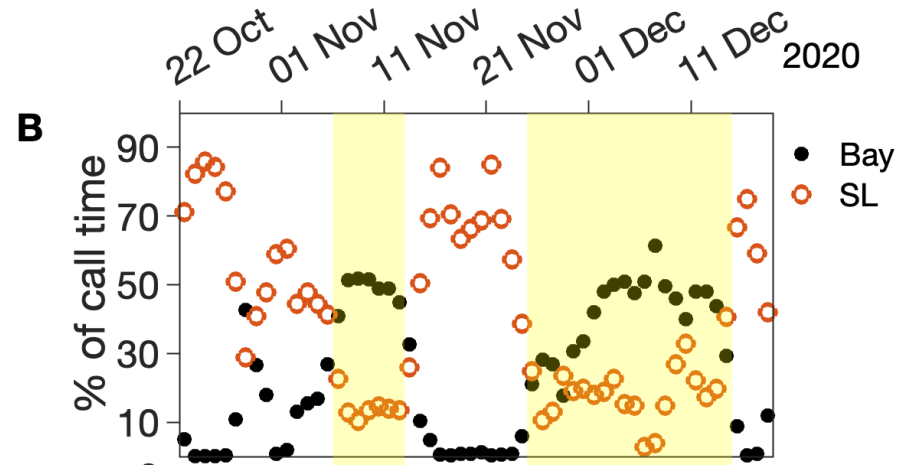
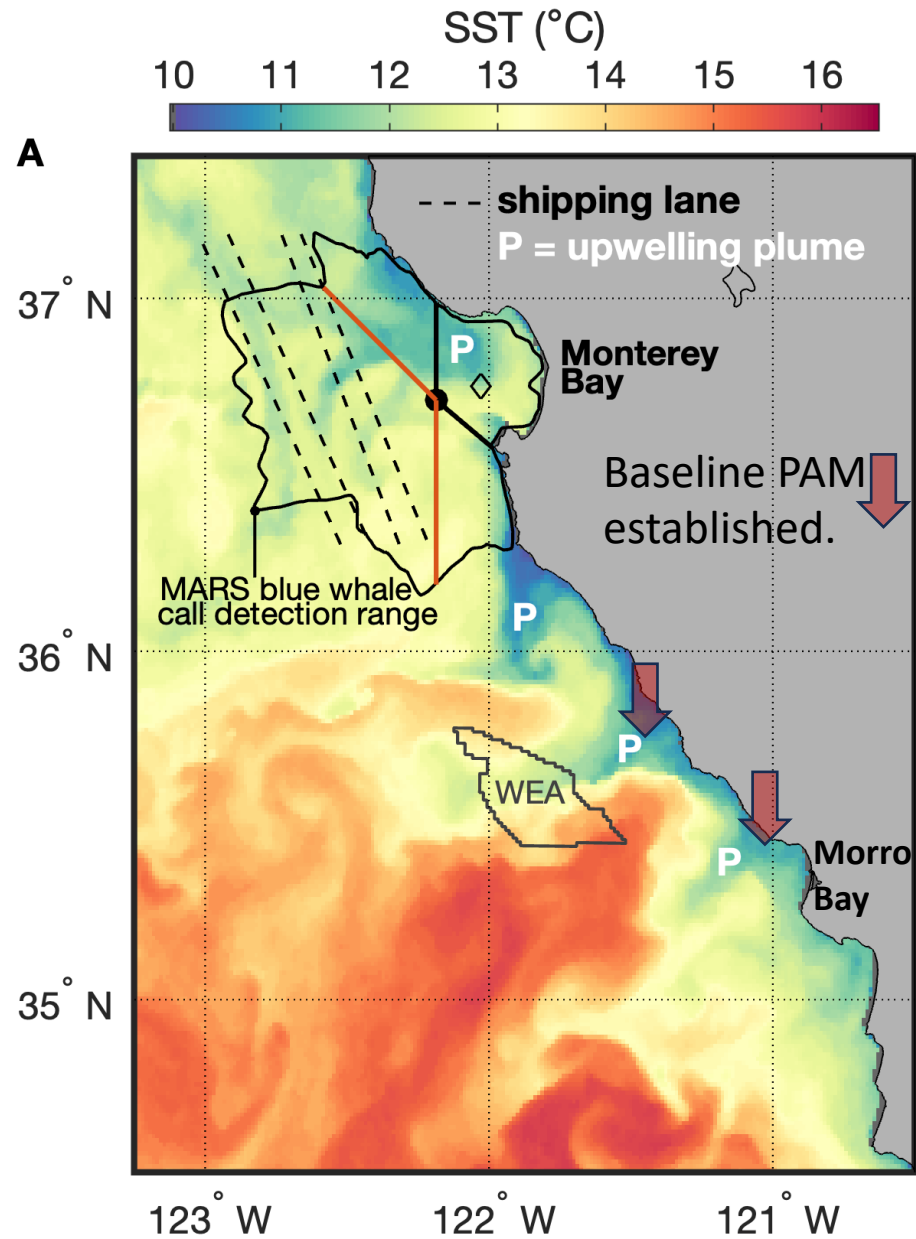
MONTEREY BAY  
NATIONAL MARINE  
SANCTUARY



# To inform protection, we must know where and how species live.



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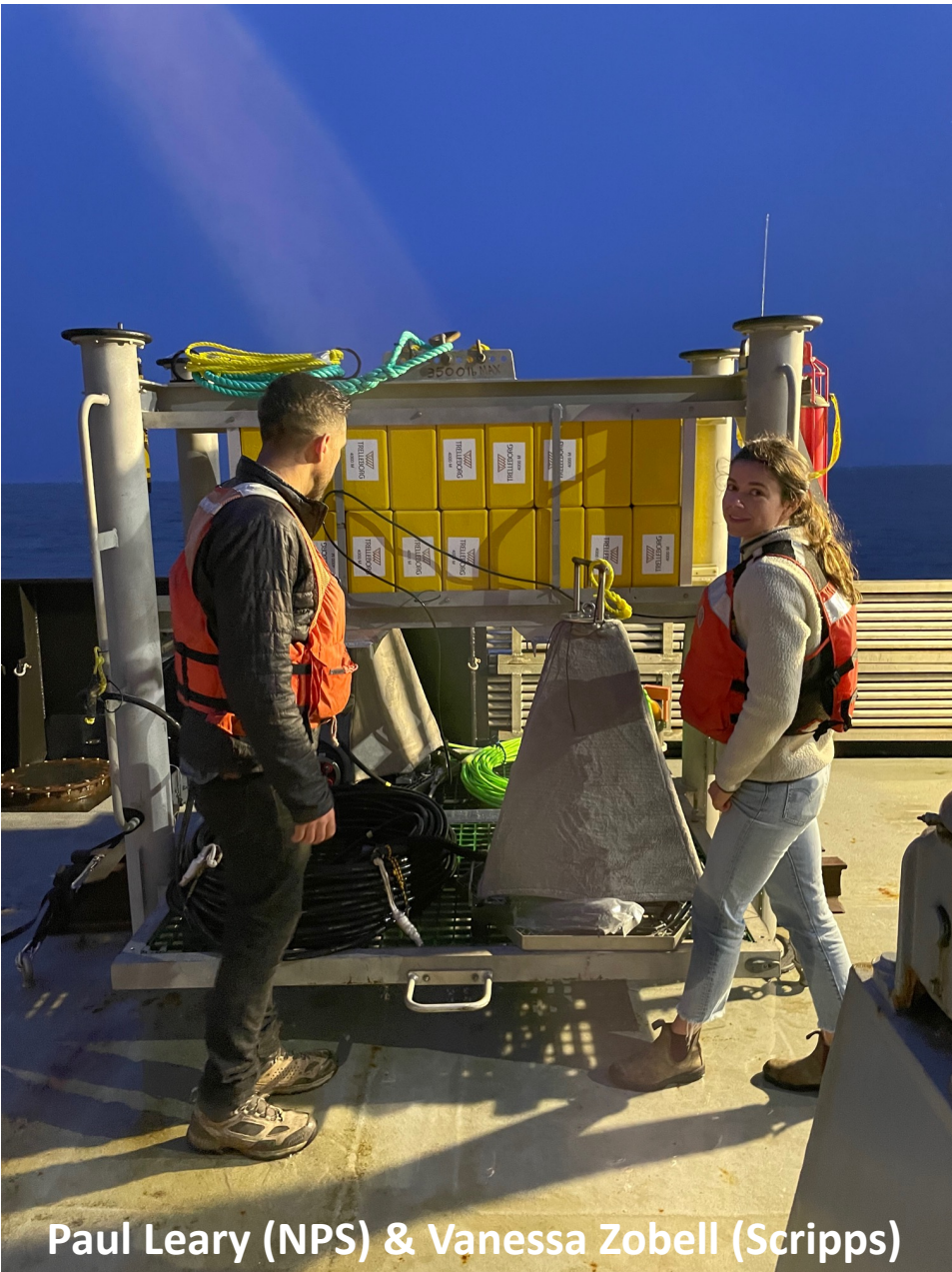




To inform protection, we must know where and how species live.

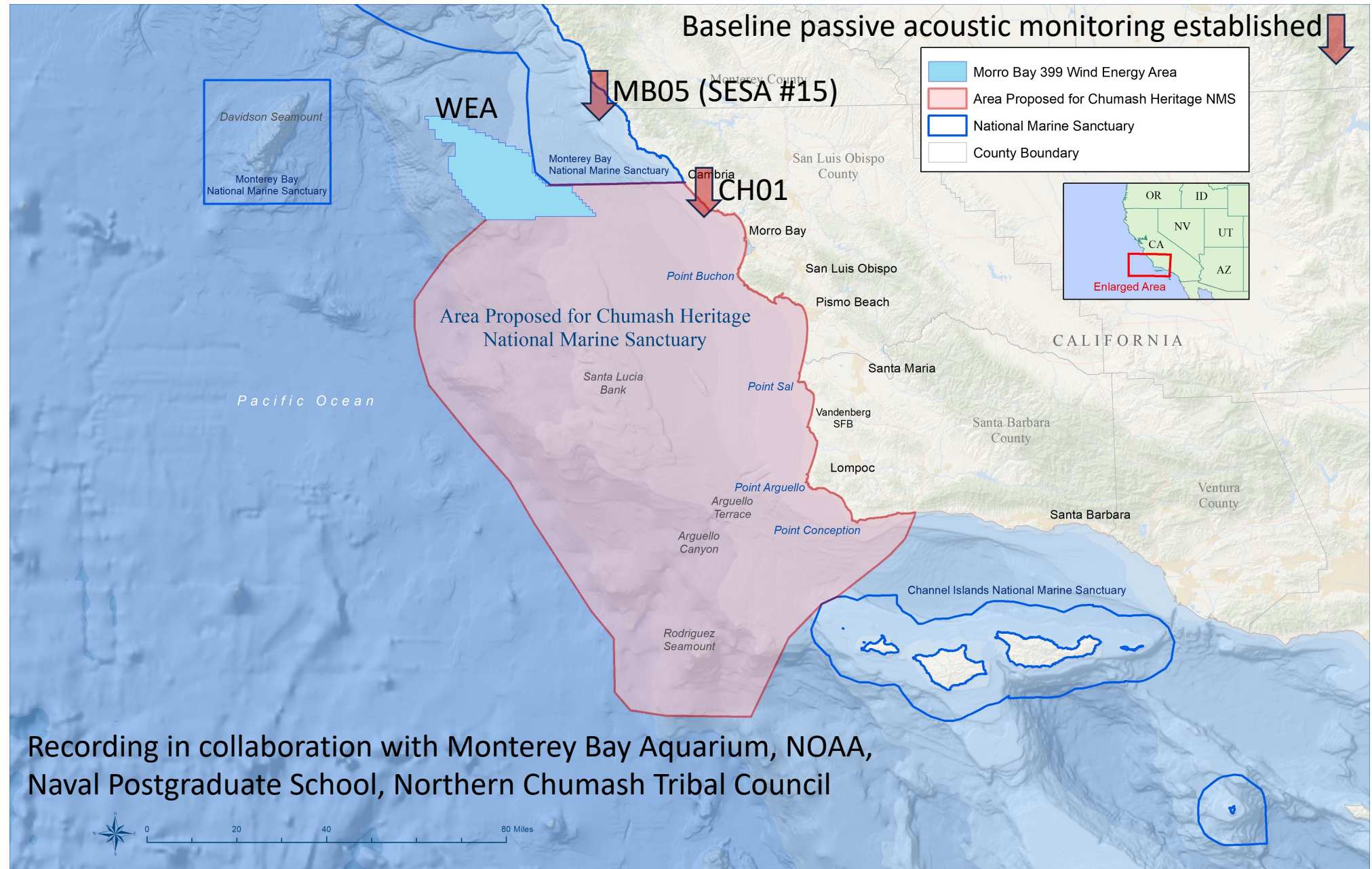
This blue whale movement ecology was discovered with a single, tag-validated acoustic vector sensor.

We are testing multiple acoustic vector sensors to locate whales on the map.



Paul Leary (NPS) & Vanessa Zobell (Scripps)

# Baseline observations within a regional nexus



Recording in collaboration with Monterey Bay Aquarium, NOAA, Naval Postgraduate School, Northern Chumash Tribal Council



# CH01: essential sea otter habitat

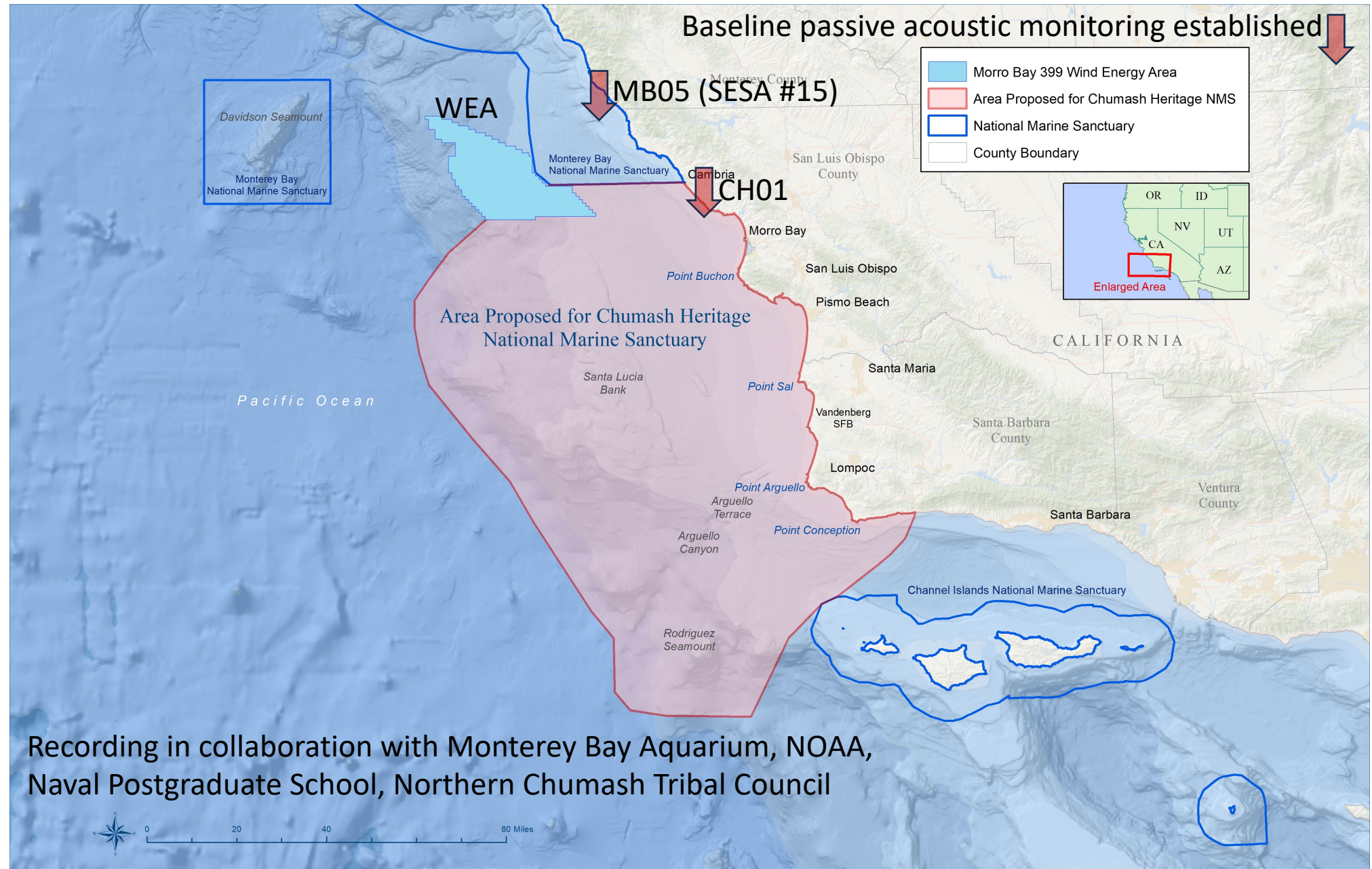


CH01: site selection guided by Michael Harris (CDFW) & Monterey Bay Aquarium.

Photo: Lindsey Peavey Reeves (NOAA)



# Baseline observations within a regional nexus

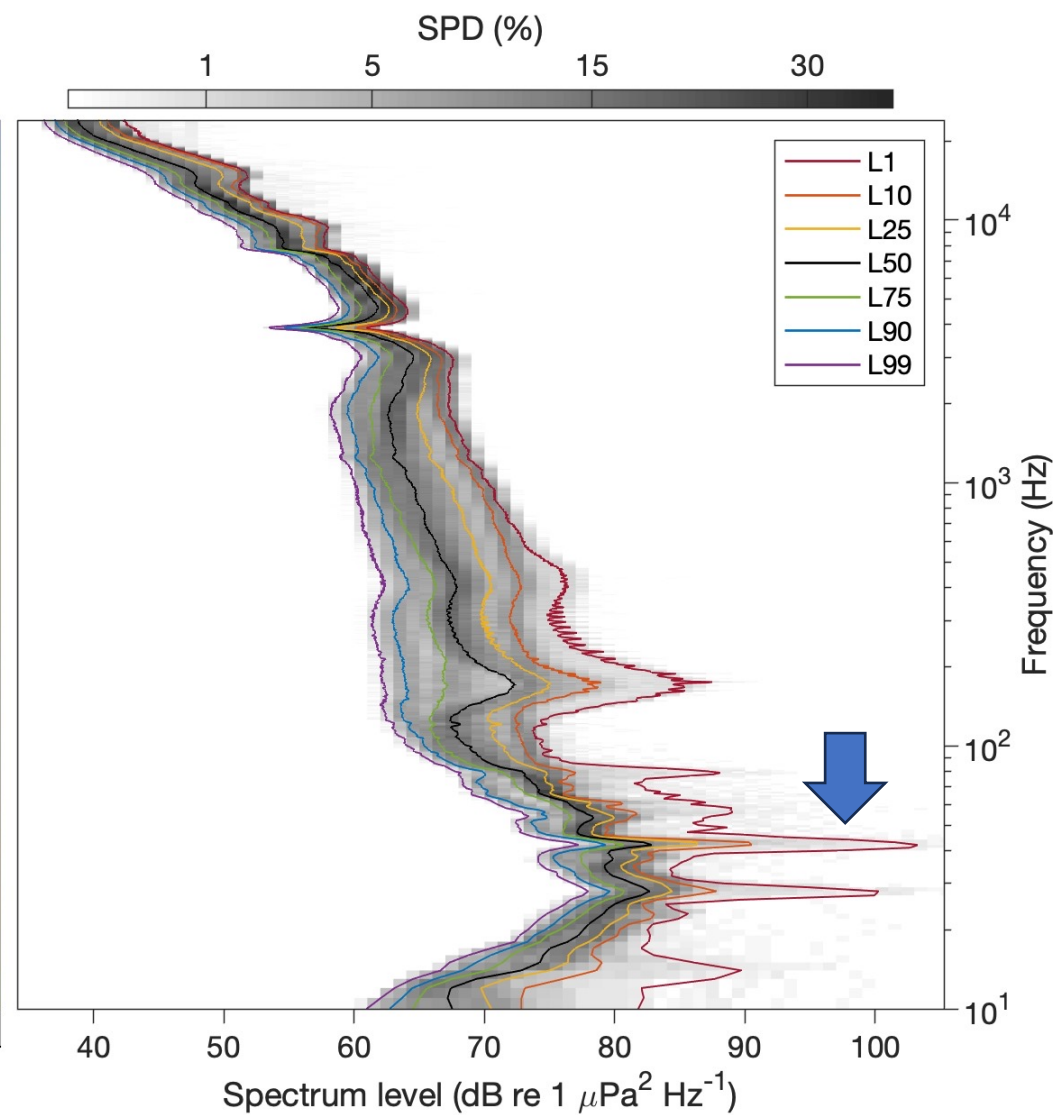
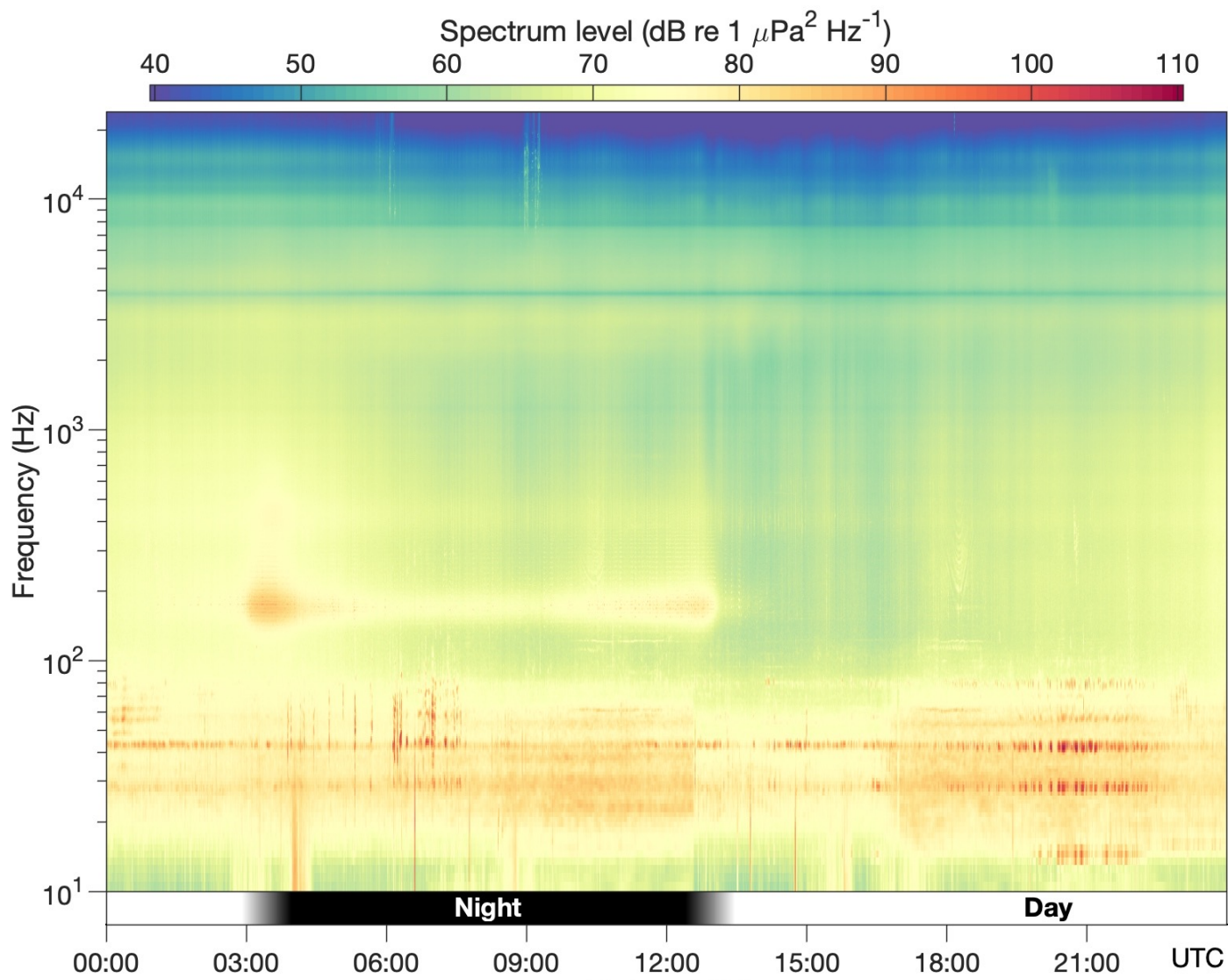


Recording in collaboration with Monterey Bay Aquarium, NOAA, Naval Postgraduate School, Northern Chumash Tribal Council



# MB05: essential blue whale habitat

MB05 / Southern MBNMS, California, USA 35.77°N, 121.43°W

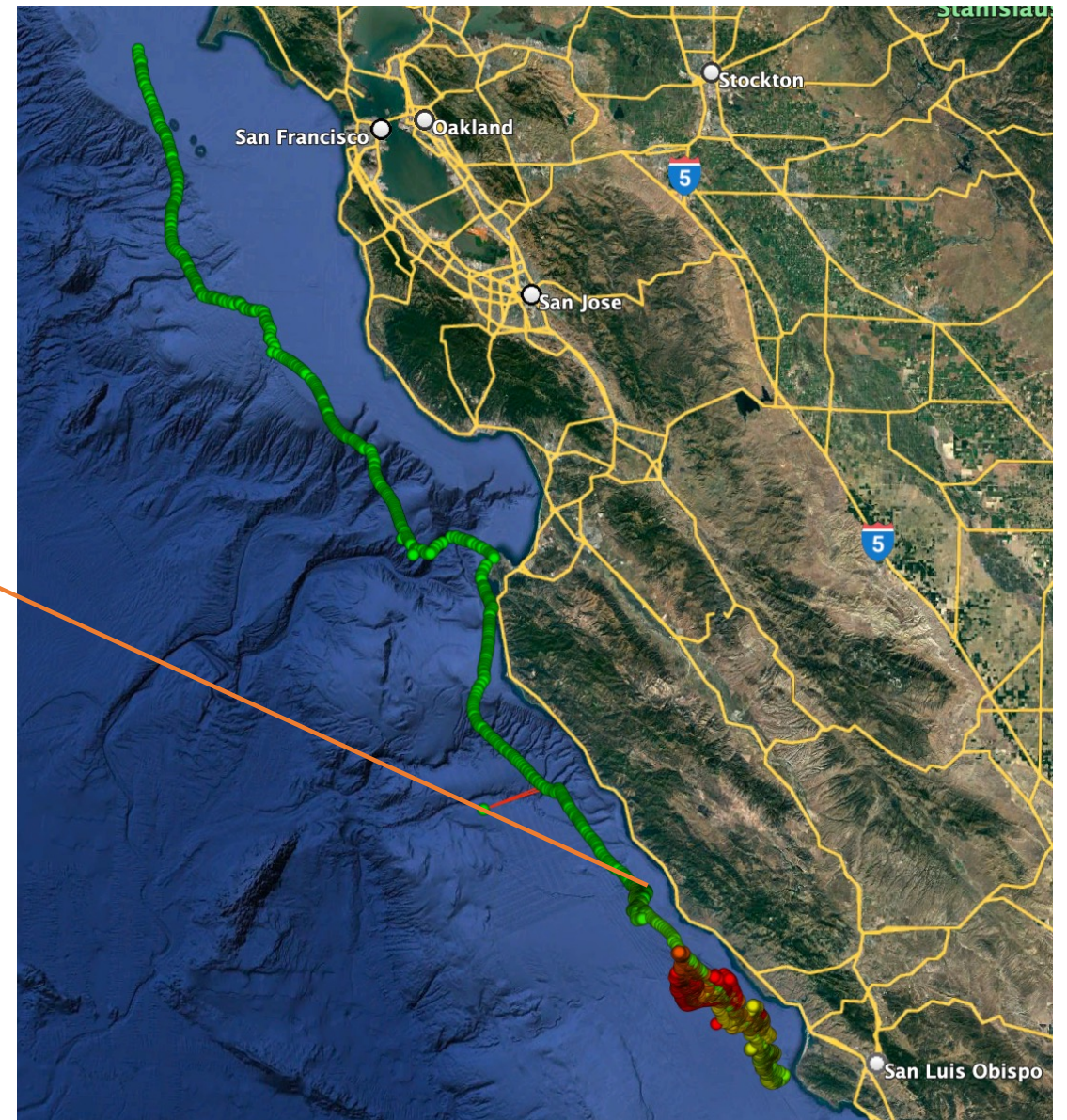
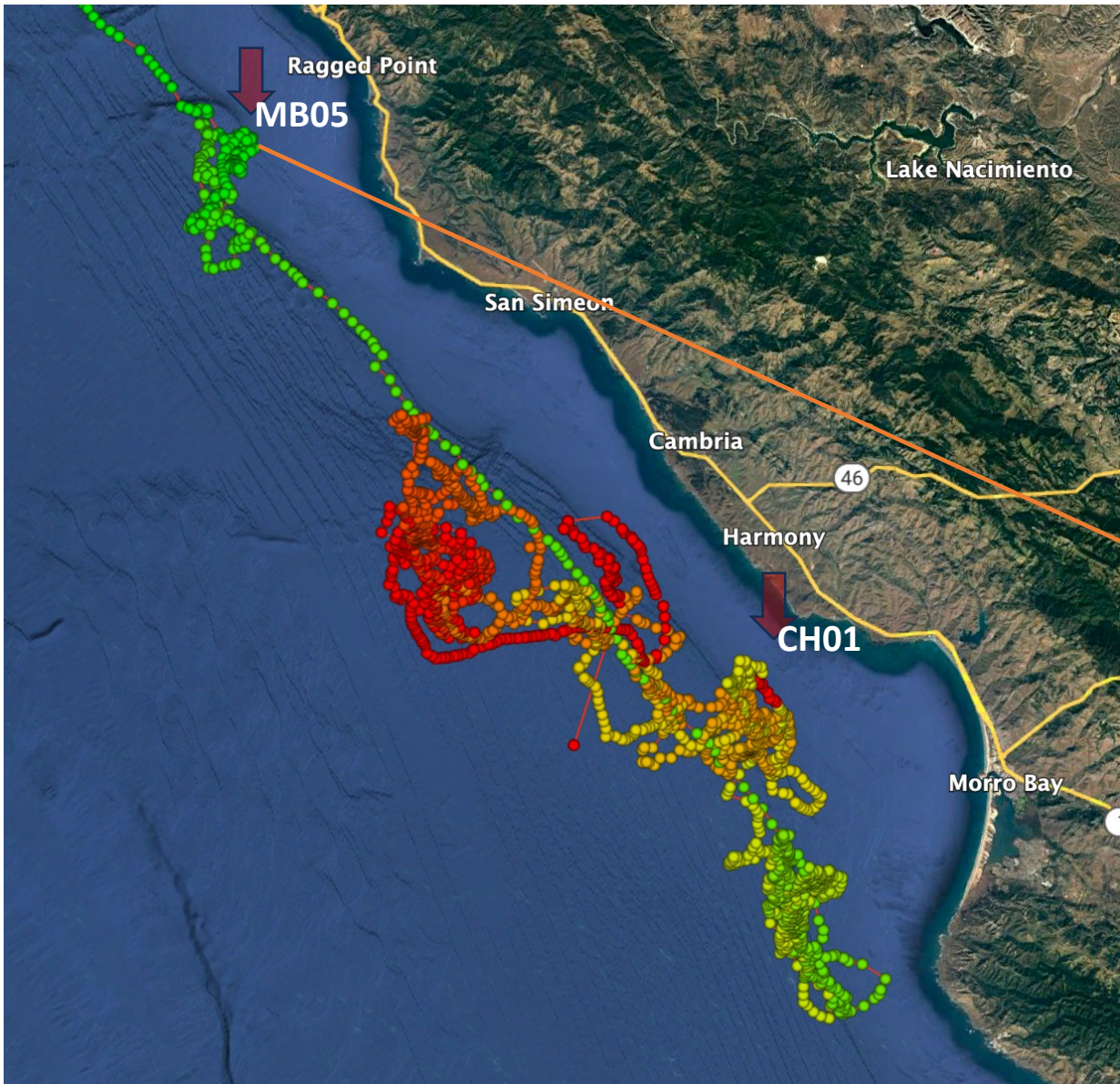


\*Arrival day

13-Aug-2022



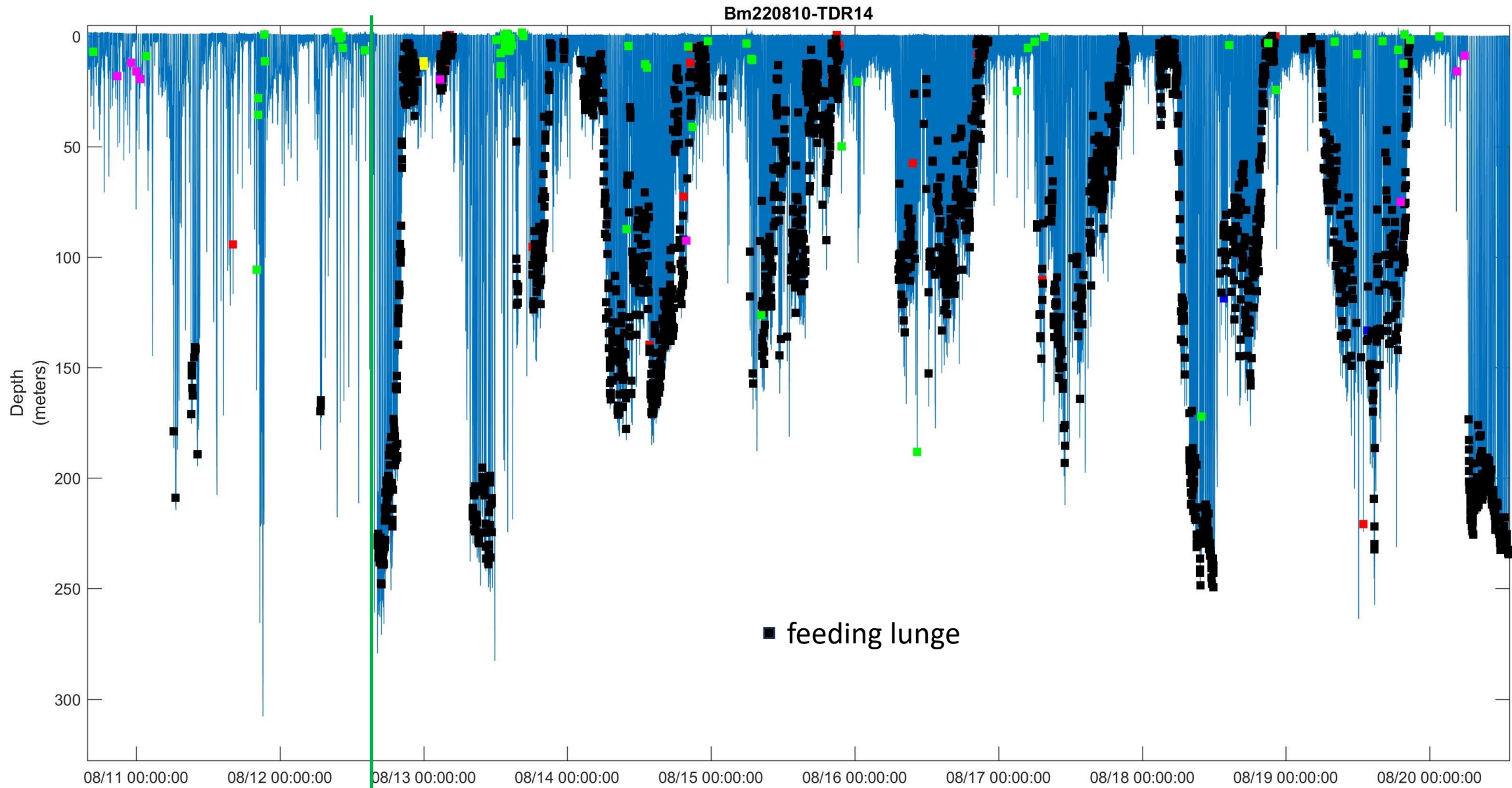
# Morro Bay region: essential blue whale habitat



\* Thanks to J. Fahlbusch, J. Calambokidis (Cascadia Research Collective), W. Oestreich (MBARI)



# Morro Bay region: essential blue whale habitat



Arrival at La Cruz Canyon, SESA #15 in southern MBNMS



# Listening with light: DAS

ORIGINAL RESEARCH article

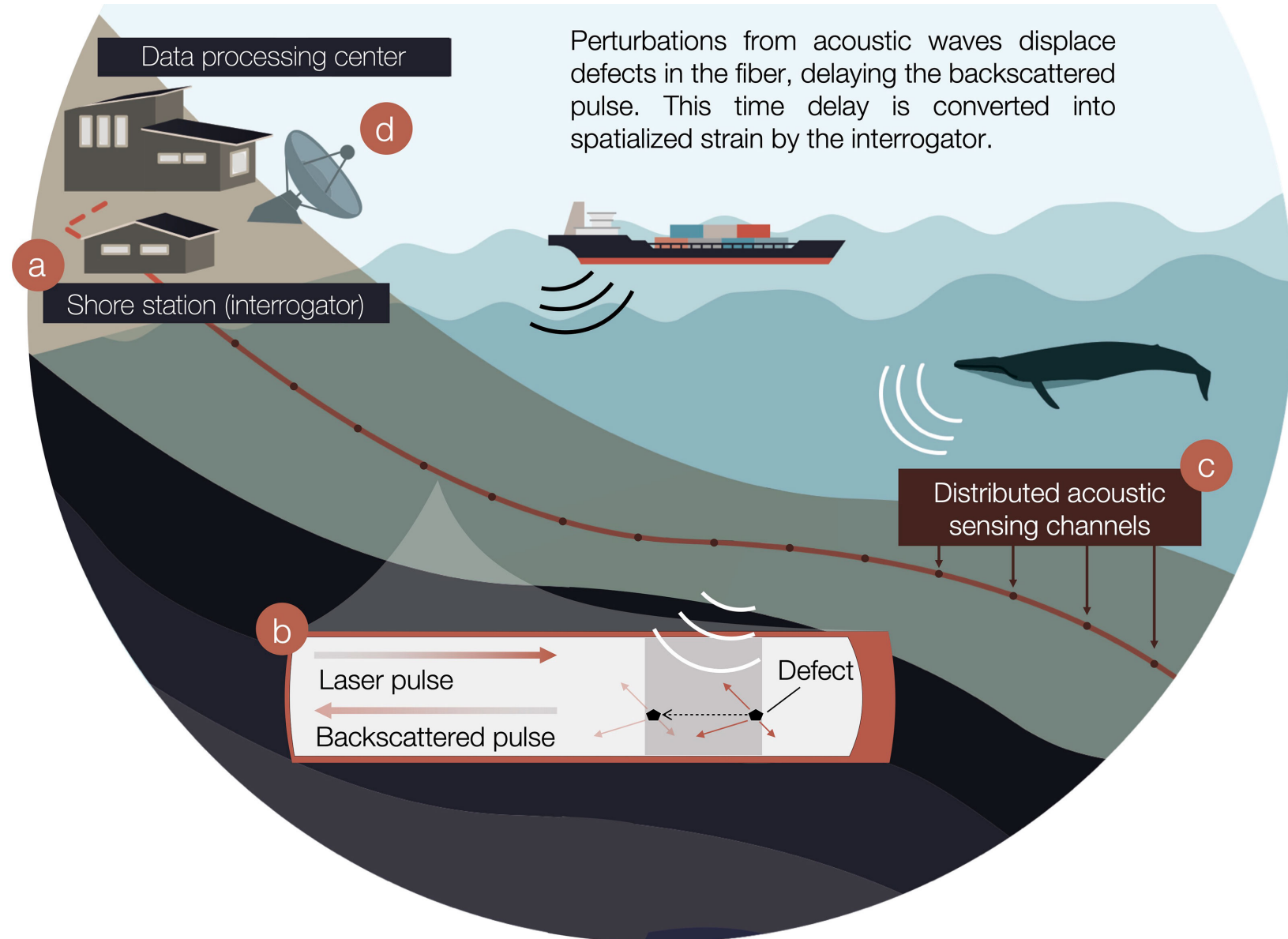
Front. Mar. Sci., 05 July 2022

Sec. Ocean Observation

Volume 9 - 2022 | <https://doi.org/10.3389/fmars.2022.901348>

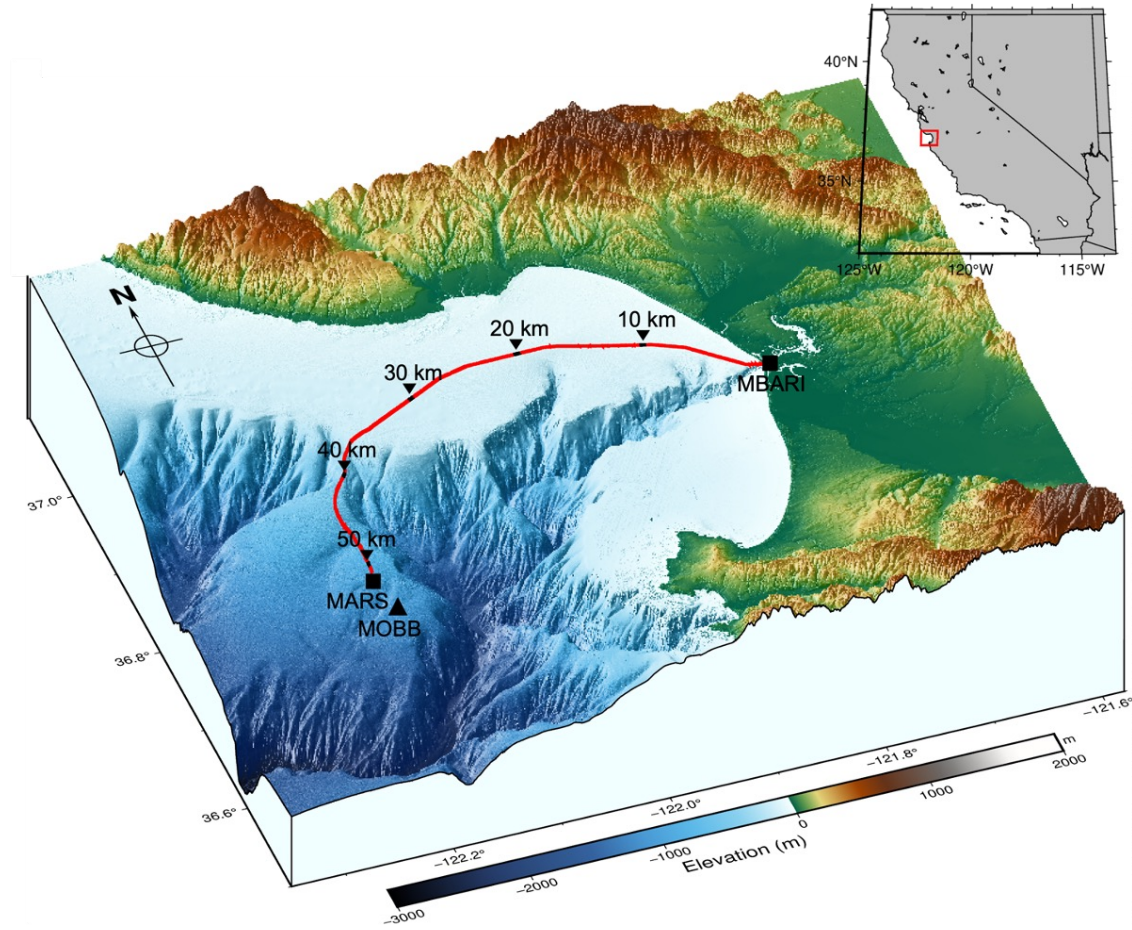
## Eavesdropping at the Speed of Light: Distributed Acoustic Sensing of Baleen Whales in the Arctic

Léa Bouffaut<sup>1,2,3\*</sup>, Kittinat Taweessintanon<sup>1,2,4</sup>, Hannah J. Kriesel<sup>1,2</sup>,  
Robin A. Rørstadbotnen<sup>1,2</sup>, John R. Potter<sup>1,2</sup>, Martin Landrø<sup>1,2</sup>, Ståle E.  
Johansen<sup>2,5</sup>, Jan K. Brenne<sup>2,6</sup>, Aksel Haukanes<sup>6</sup>, Olaf Schjelderup<sup>7</sup> and  
Frode Storvik<sup>7</sup>



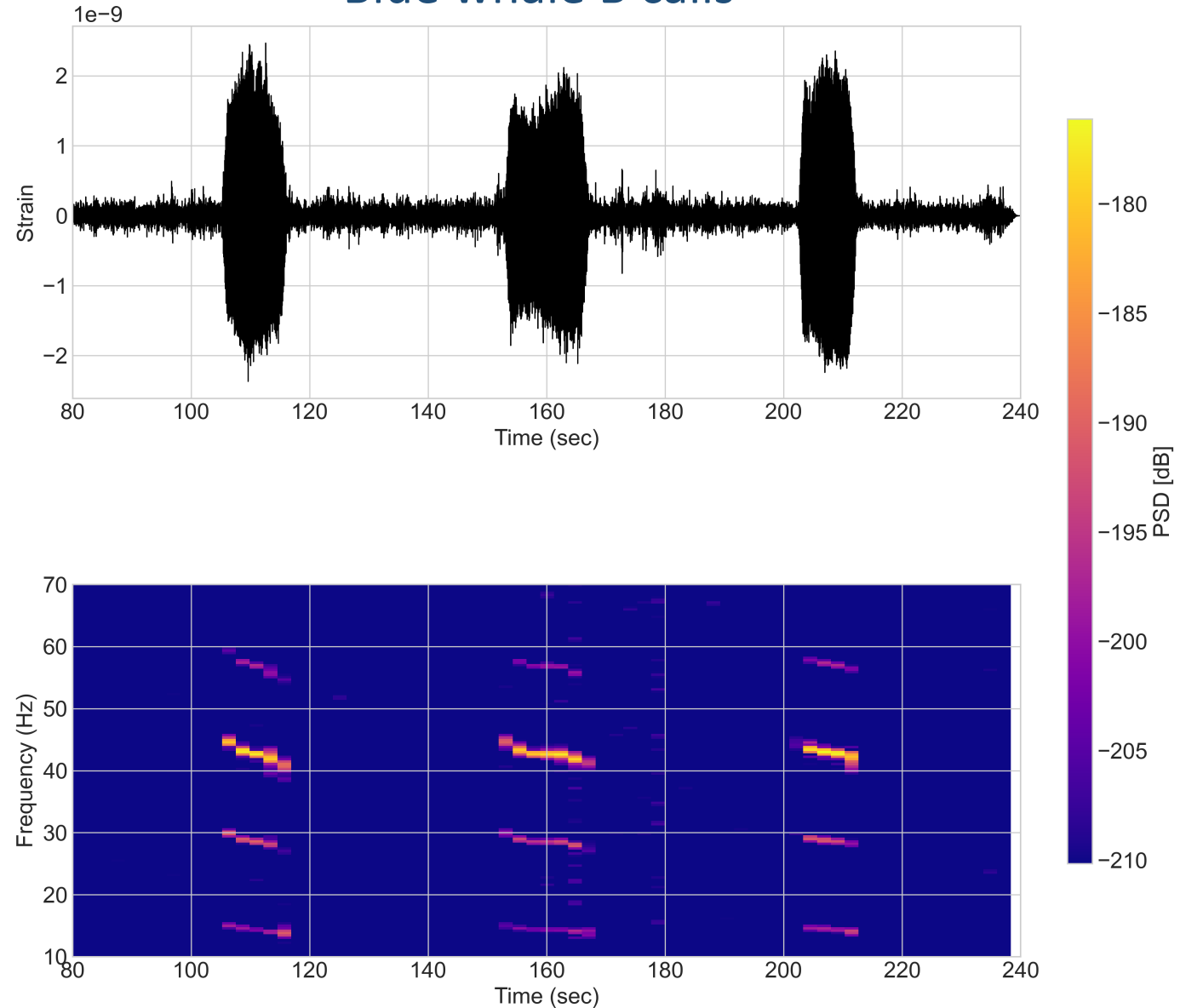


# A blue whale singing near 32 km along the cable



Li-Wei Chen, Richard Allen  
Berkeley Seismological Laboratory

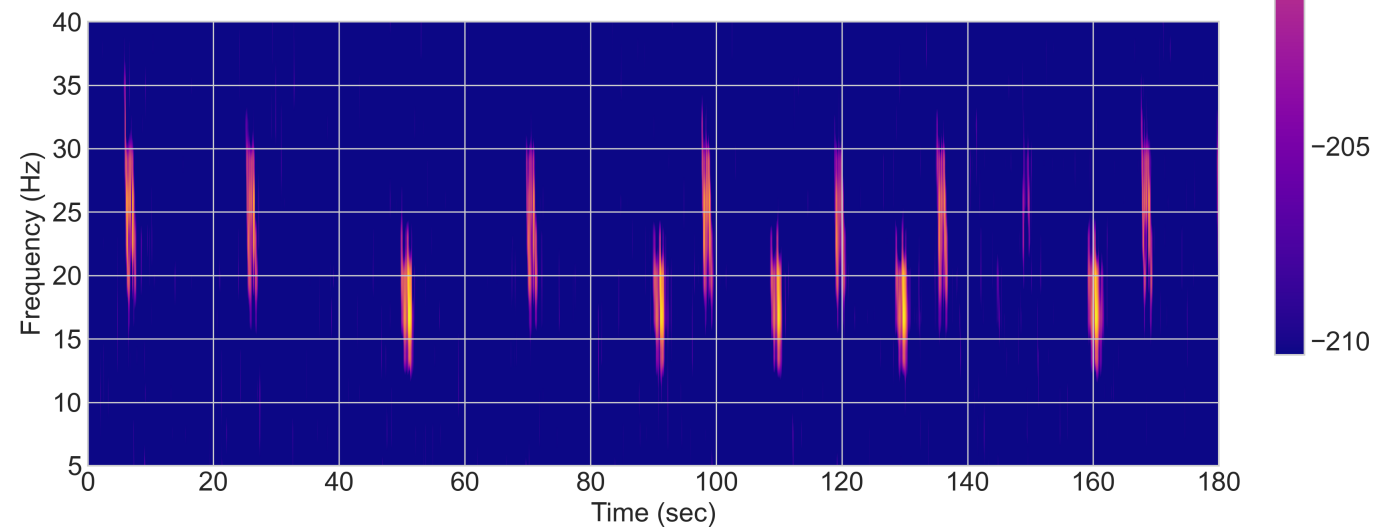
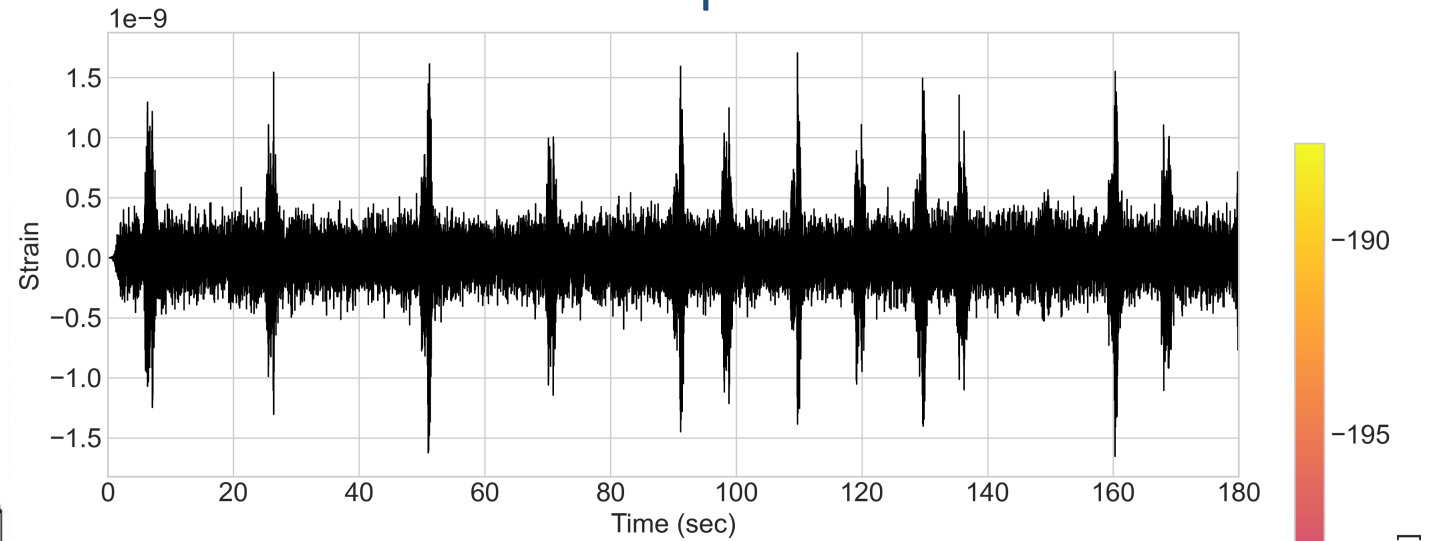
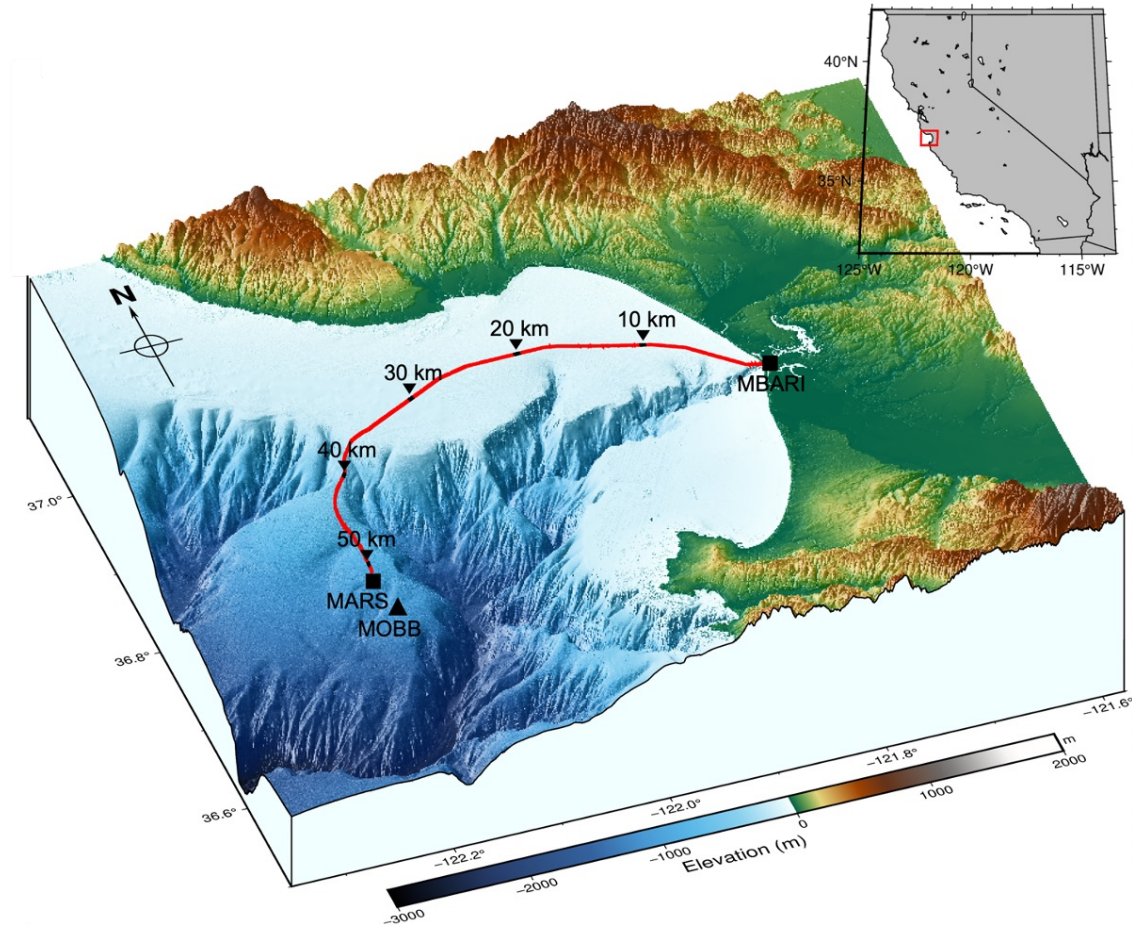
## Blue whale B calls





# A fin whale singing near 50 km along the cable

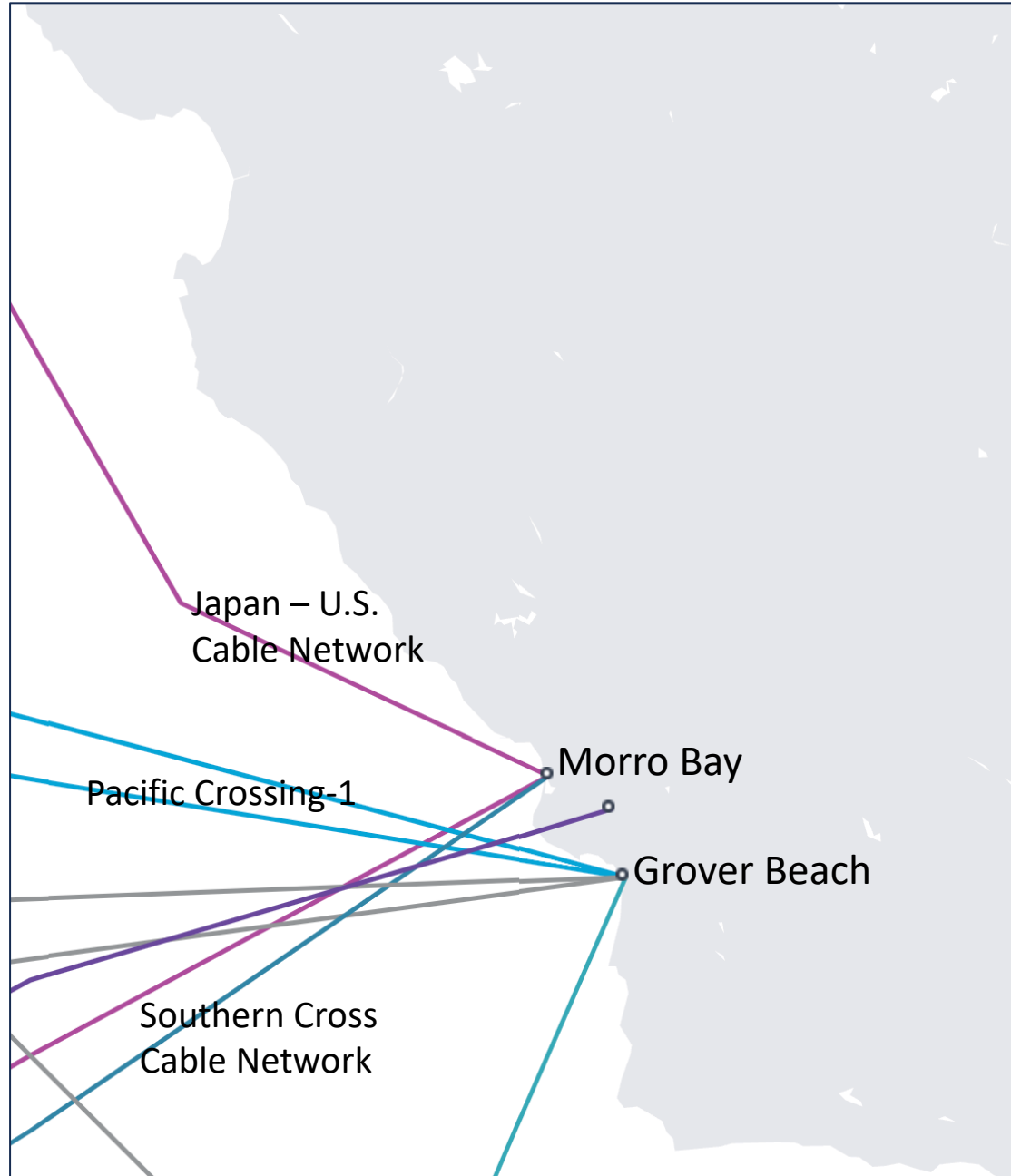
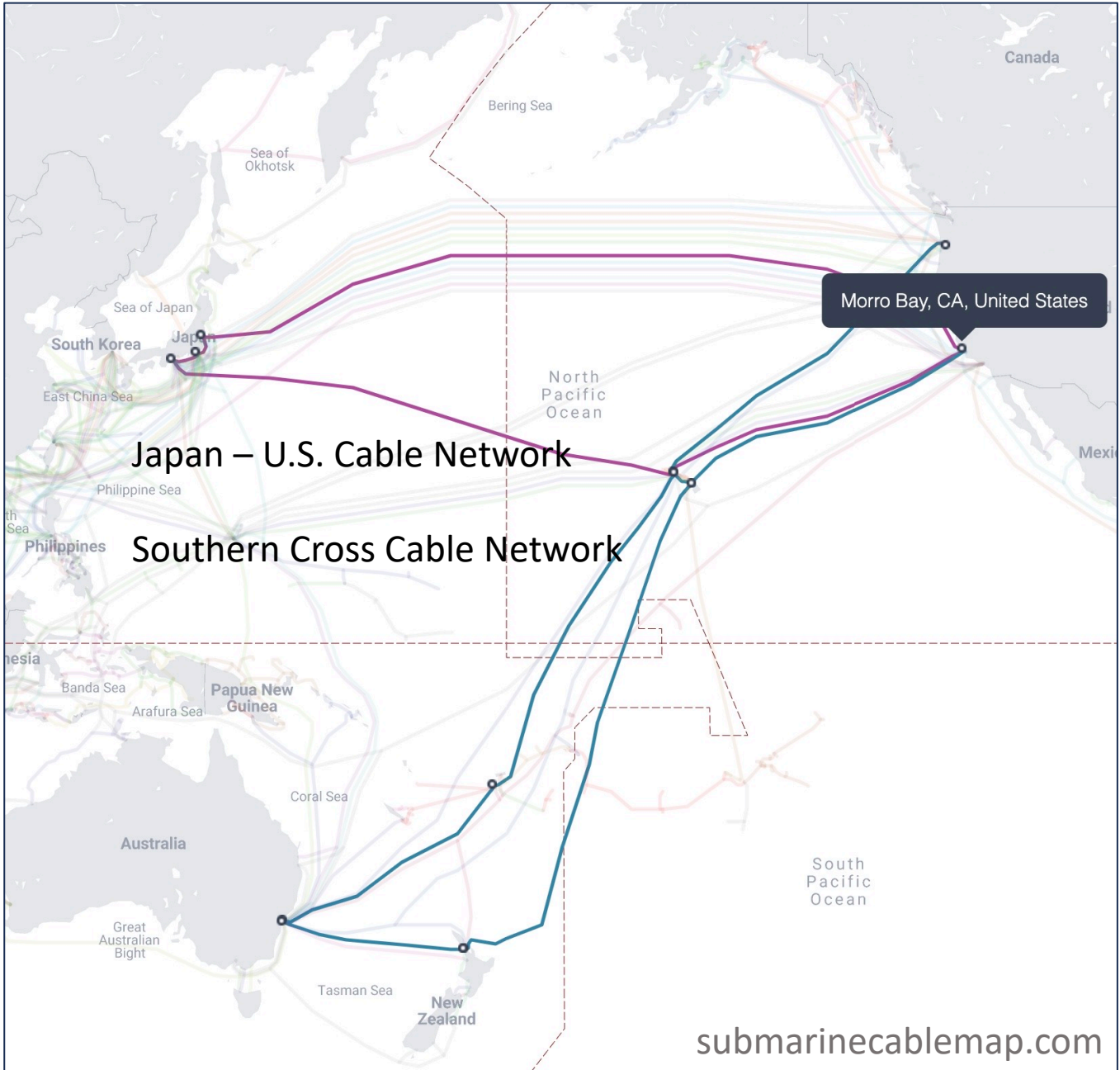
## Fin whale pulses



Li-Wei Chen, Richard Allen  
Berkeley Seismological Laboratory



# Existing submarine cables landing at / near Morro Bay



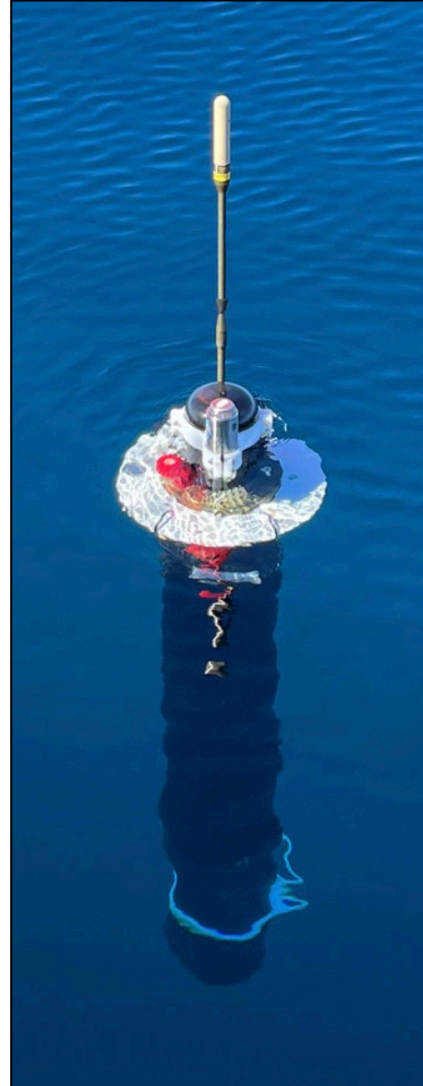


# Other PAM platforms

## Moorings, drifters



## Floats



## Autonomous vehicles





## Summary

The prevalence of acoustic behavior in marine species and the powerful transmission of sound through the ocean make **Passive Acoustic Monitoring (PAM)** essential and effective.

Beyond detection of animal presence, we need to know **where and how species live** in order to inform management.

Great opportunities for technology development and application exist in the integration of population-level (PAM) + individual-level (tag) observations, within the context of ecosystem dynamics.

**The Morro Bay region is a rich nexus** between energy development and technology application for protected species and habitats.