

Learning from the Experts Webinar Series

Acoustic Mitigation Technologies for Offshore Wind



Dr. Sarah Courbis

Protected Species and Regulatory
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January 22, 2025

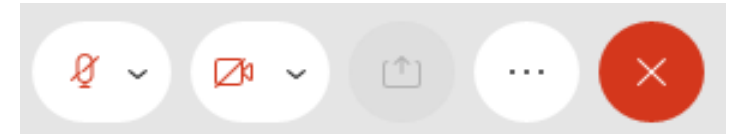
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- > Questions and comments may be submitted in writing through the Q&A feature at any time during the event. Please submit to **All Panelists**.
- > If technical problems arise, please contact Adam.Hauck@nyserda.ny.gov



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Learning from the Experts

This webinar series is hosted by NYSERDA's offshore wind team and features experts in offshore wind technologies, development practices, and related research.

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NYSERDA



Impacts of Sound and Mitigation Technologies for Offshore Wind

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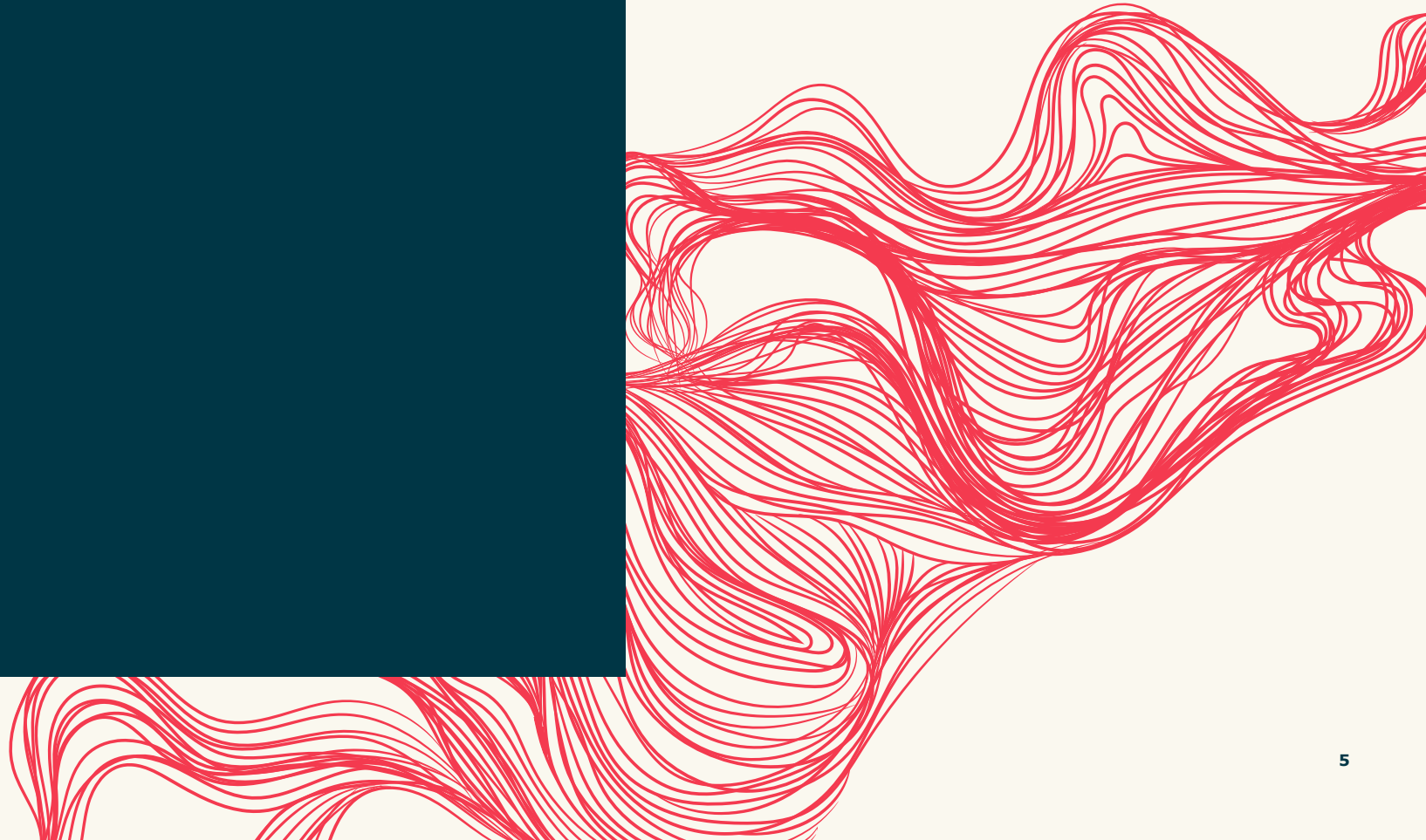
Sarah Courbis, Ph.D.

January 22, 2025



Overview

- **01 – Impacts of Sound**
- **02 – Mitigation and Monitoring Technologies**
- **03 – Use of Technologies by OSW Industry**
- **04 – Requirements & Incentives**
- **05 – Effectiveness of Technologies**
- **06 – Technology Standards**



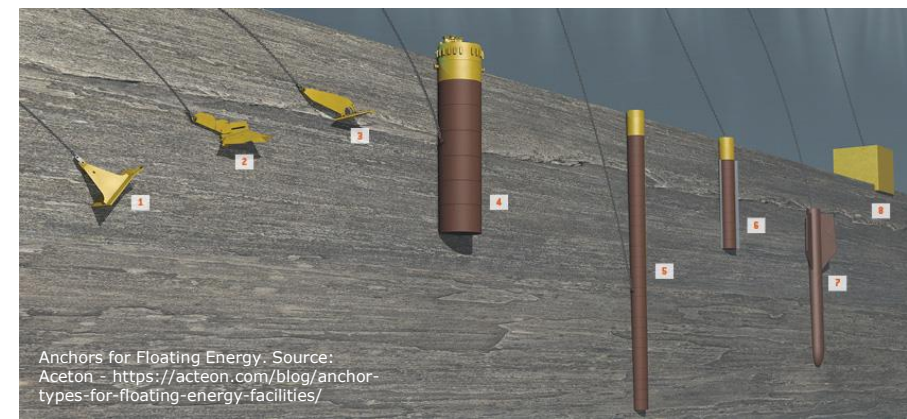
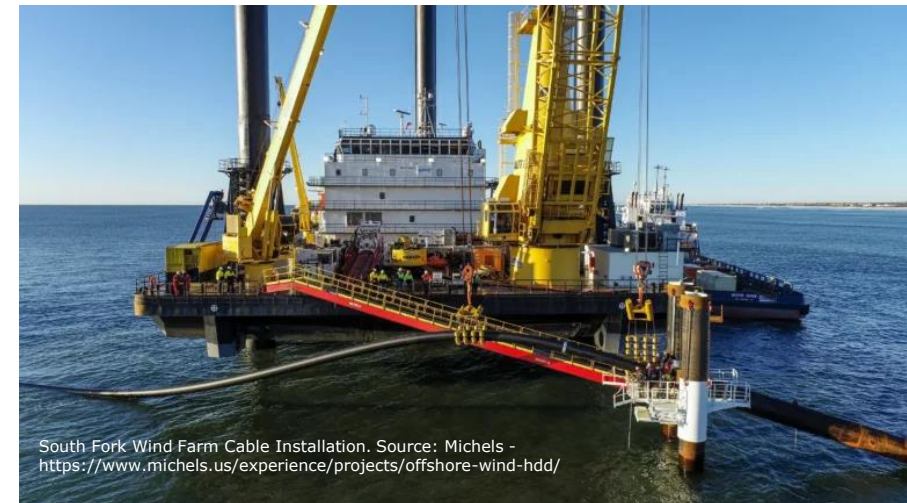
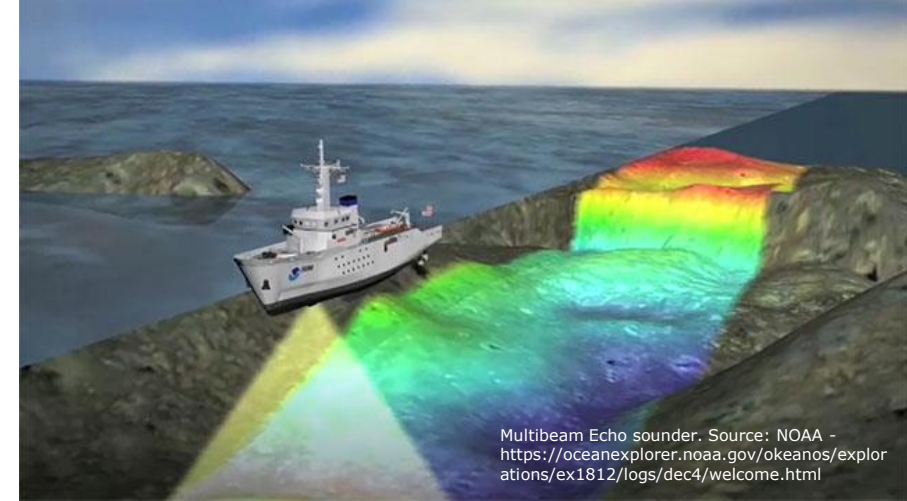
01

Impacts of Sound



Potential Sound Sources

- Geophysical and geotechnical surveys
- Vessels
- Pile driving
- Cable/mooring installation
- Shore crossing/horizontal drilling
- Operational sound



North Atlantic right whale. Source: NOAA - <https://www.fisheries.noaa.gov/species/north-atlantic-right-whale>



American lobster. Source: NOAA - <https://www.fisheries.noaa.gov/species/american-lobster>



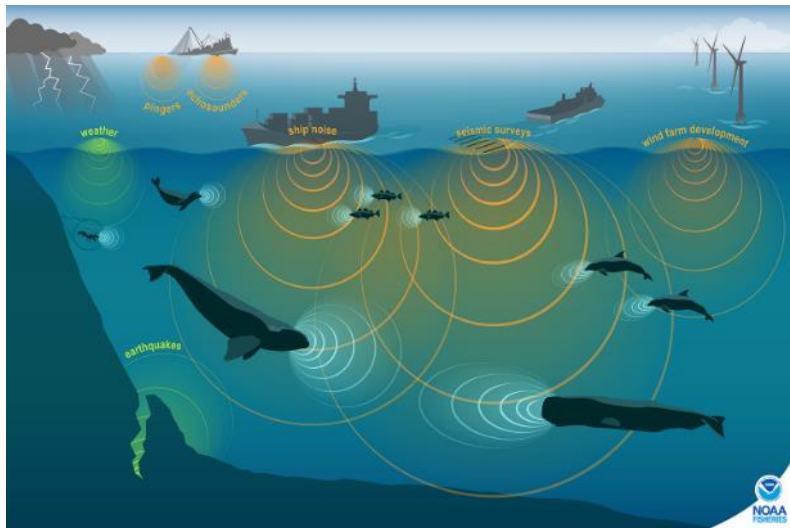
Leatherback sea turtle. Source: NOAA - <https://coastalscience.noaa.gov/news/study-identifies-potential-foraging-areas-used-by-endangered-leatherback-turtles/>

Potential Impacts

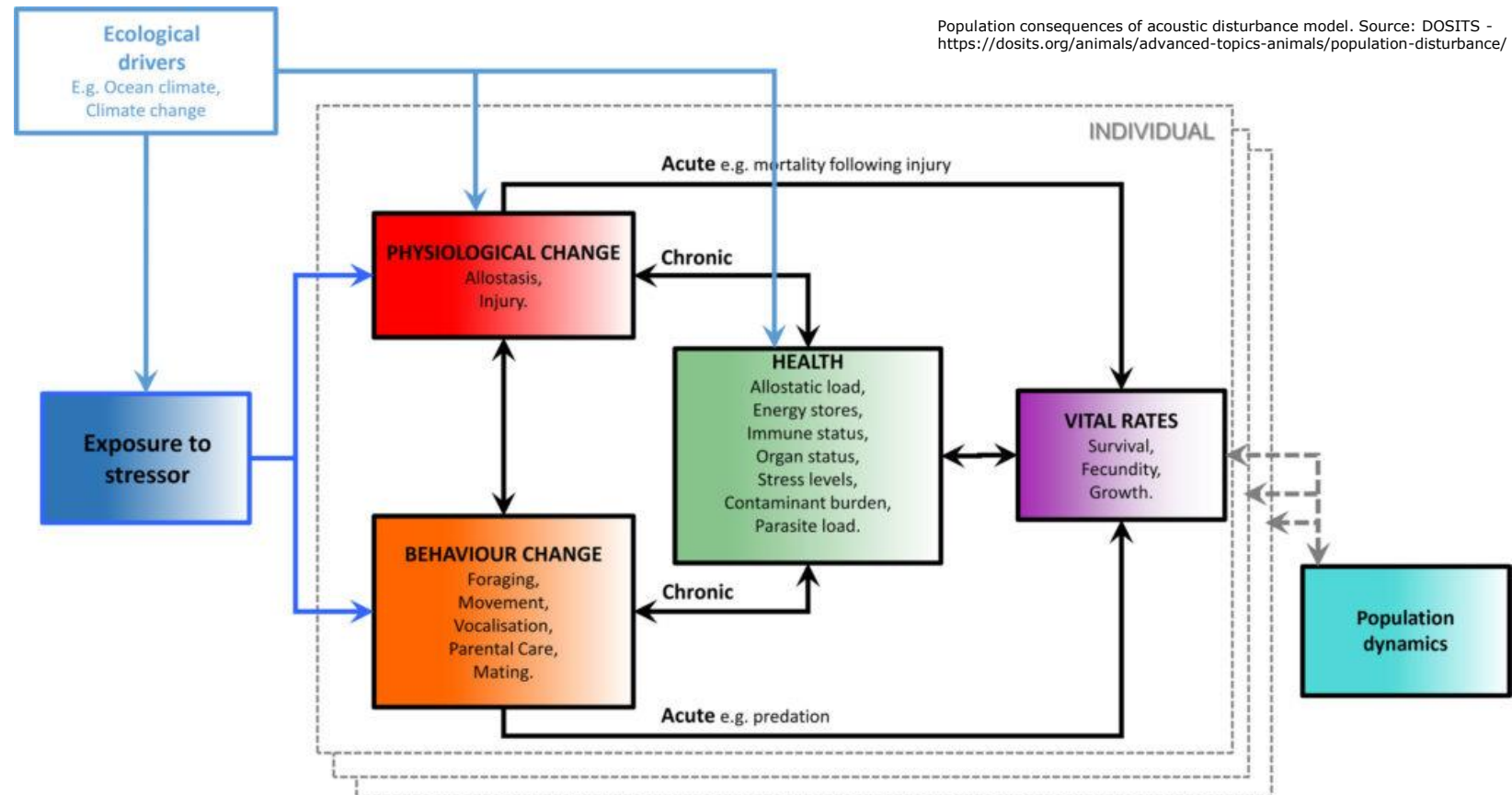
- Behavioral changes
- Masking
- Avoidance/Attraction
- Displacement
- Effects to prey
- Disruption of settlement
- Disruption of growth pattern
- Injury/health effects
- Mortality

Potential Impacts

- Individual effects
- Population level effects
- Cumulative effects



Source: NOAA - <https://www.fisheries.noaa.gov/national/science-data/ocean-noise>



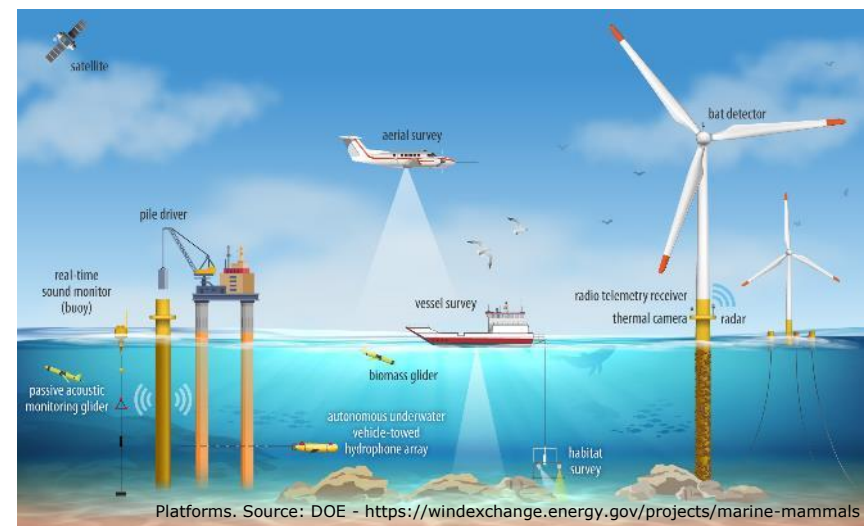
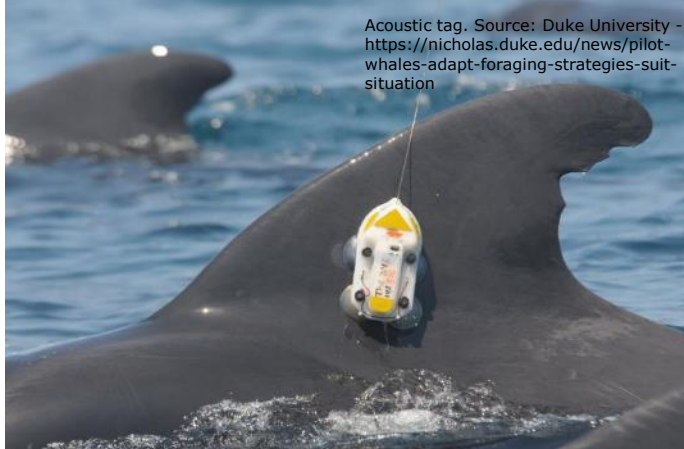
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Mitigation and Monitoring Technologies



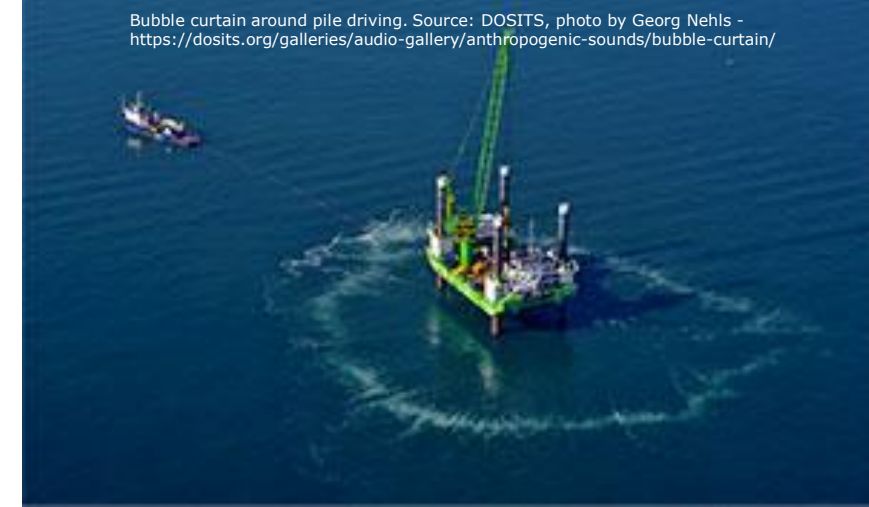
Platforms

- Traditional Vessels
- Traditional aircraft
- Infrastructure
- Remotely Operated Vessels (ROVs)
- Autonomous Surface Vessels (ASVs)
- Autonomous Underwater Vessels (AUVs)
- Drones/Uncrewed Aerial Systems (UASs)
- Buoys
- Satellites
- Tags

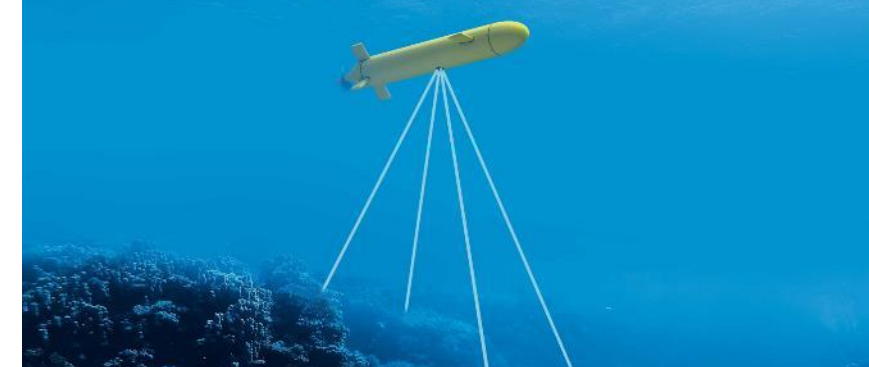


Sound Reduction

- Bubble curtains/cofferdams
- Gravity/suction bucket foundations
- On-pile sound dampening
- Vibratory piling
- Ultra- high or low frequency sources
- Seasonal operations
- Optimized vessel/drone engines/speeds
- Use of ROVs/AUVs close to bottom

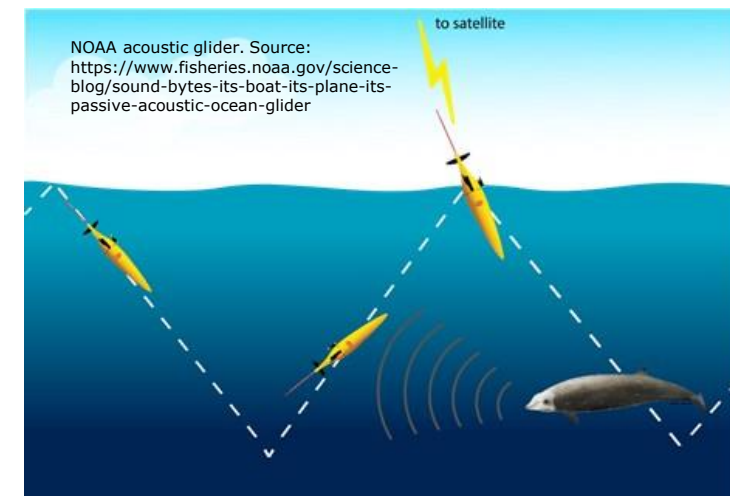
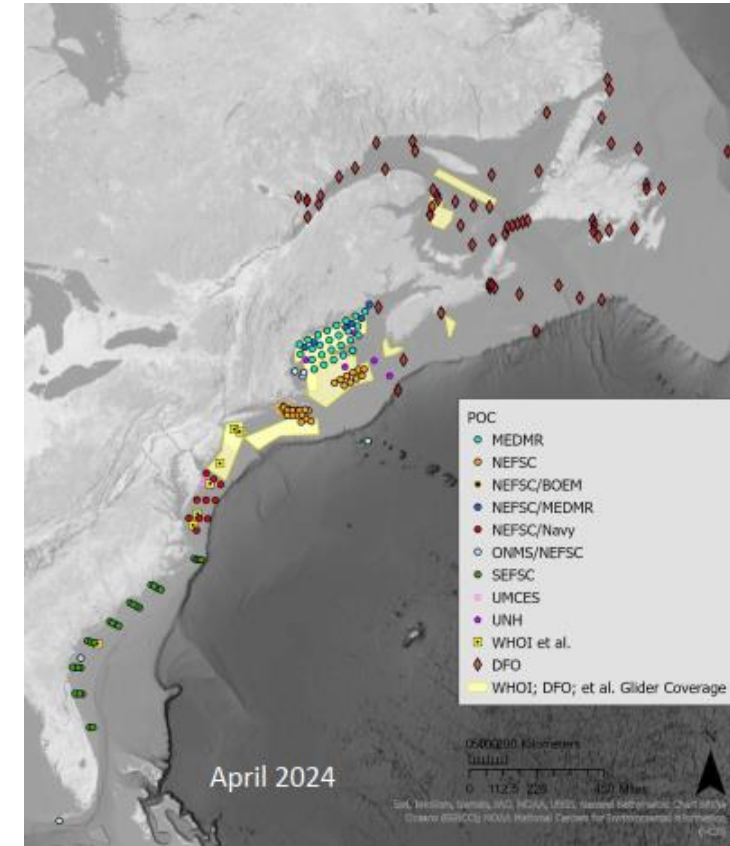
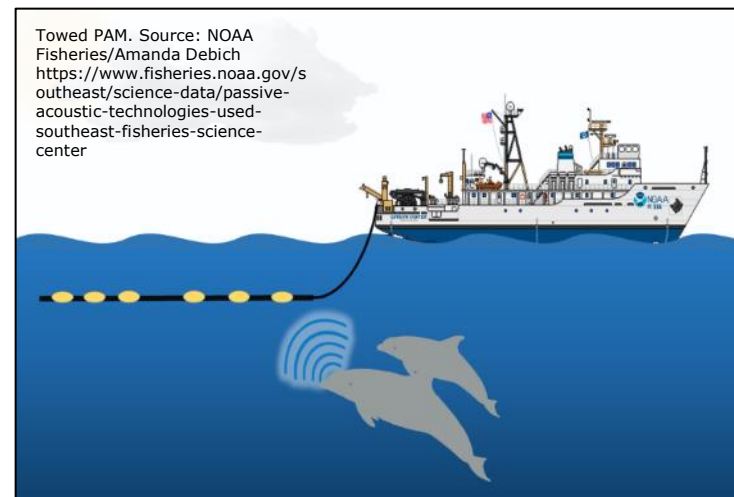
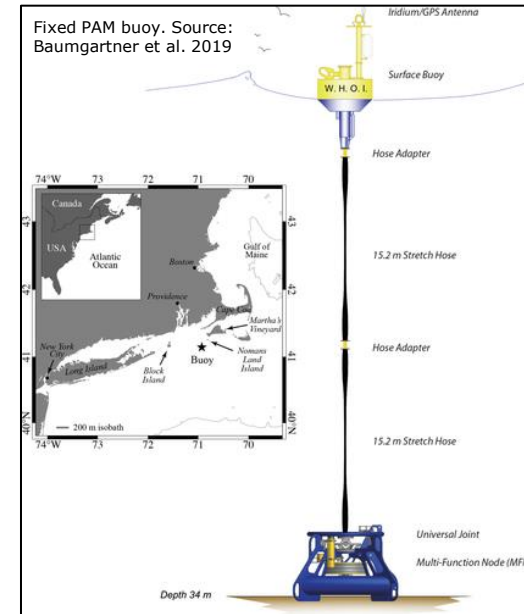


AUV near seafloor with potential beams. Source: Nortek - <https://www.nortekgroup.com/knowledge-center/wiki/new-to-subsea-navigation>



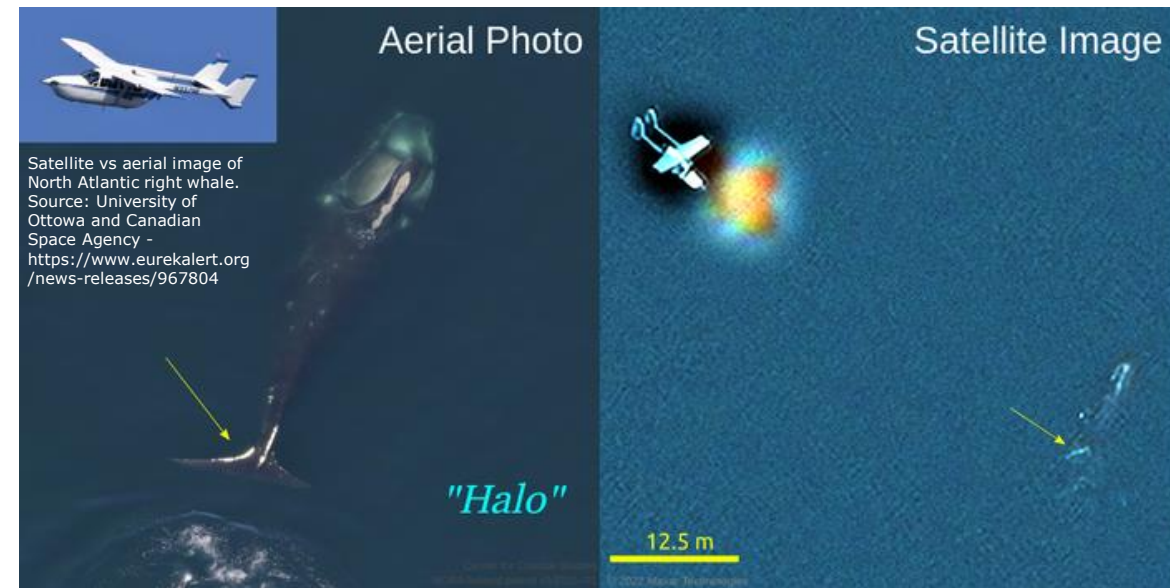
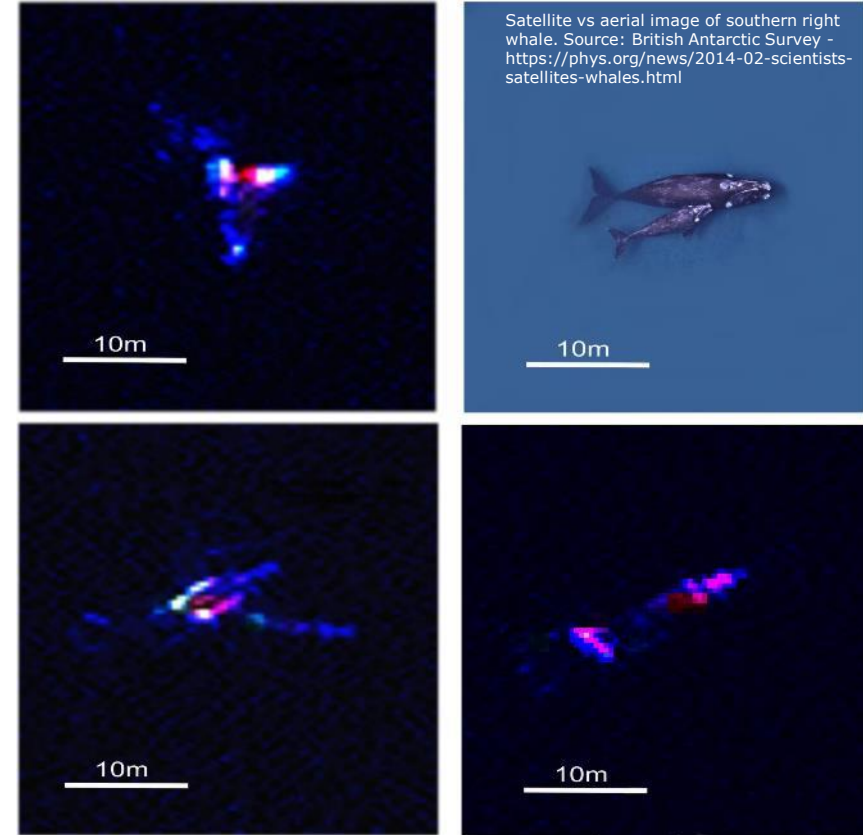
Passive Acoustic Monitoring

- Real-time/archival
- Mobile (towed, AUVs)
- Fixed (buoy)
- Sound source verification
- Threshold testing
- Detection of animals
- Satellites
- Algorithms – detection, identification, localization
- Artificial Intelligence



Other Monitoring

- Cameras
- Infrared
- Thermal
- Night vision
- Radar
- GPS/satellite and other tags
- Satellites
- Artificial Intelligence
- Algorithms – detection, identification, localization



03

Use of Technologies by OSW Industry



OSW Industry

Vineyard Wind Announces Investment In US-Based Bubble Curtain Supplier

ThayerMahan to anchor acoustic mitigation systems headquarters in New Bedford as it expands to further serve the offshore wind industry

11 May 2023 | Vineyard Wind



<https://www.thayermahan.com/press-and-media/vineyard-wind-announces-investment-in-us-based-bubble-curtain-supplier>

Empire Wind and WCS announce extension of acoustic marine monitoring project in New York Bight

07 SEPTEMBER 2022 10:20 (GMT-7)

<https://www.equinor.com/news/us/empire-wind-wcs-extension>

Collaborative Whale Detection Technology Evaluation Virtual Workshop Series

SESSION 3 | NOVEMBER 19, 2024



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PROJECT OVERVIEW:

Technology Development Priorities for Scientifically Robust and Operationally Compatible Wildlife Monitoring and Adaptive Management

Awardee:

Worley Consulting (formerly Advisian)

Technical Challenge Area:

Environment and Conflicting Use

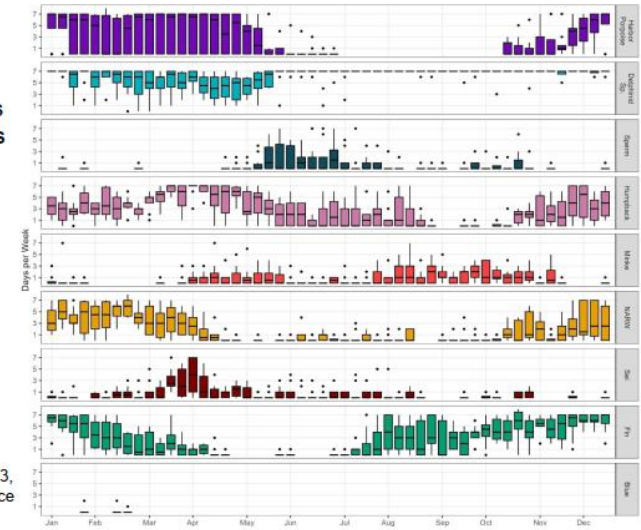
<https://nationaloffshorewind.org/projects/technology-development-priorities-for-scientifically-robust-and-operationally-compatible-wildlife-monitoring-and-adaptive-management/>

OSW Industry

- Valuable research data
 - Technology improvements
 - Behavior
 - Distribution
 - Habitat use/drivers
 - Seasonality
 - Climate change
 - Vessel strike reduction
 - Ambient sound
 - Shipping sound
 - Algorithm development
 - Platforms of opportunity

8 species
and 1 genus
of cetaceans

Van Parijs et al. 2023,
ICES Marine Science



The RWSC, in collaboration with the [Responsible Offshore Science Alliance \(ROSA\)](#) and the [Atlantic Cooperative Telemetry Network \(ACT\)](#) is convening all four Sectors (federal agencies, states, offshore wind companies, eNGOs) to coordinate regional deployment, data management, and analysis of acoustic telemetry data in offshore wind energy areas. Within the RWSC, the [Protected Fish Species Subcommittee](#) and [Sea Turtle Subcommittee](#) lead this work.

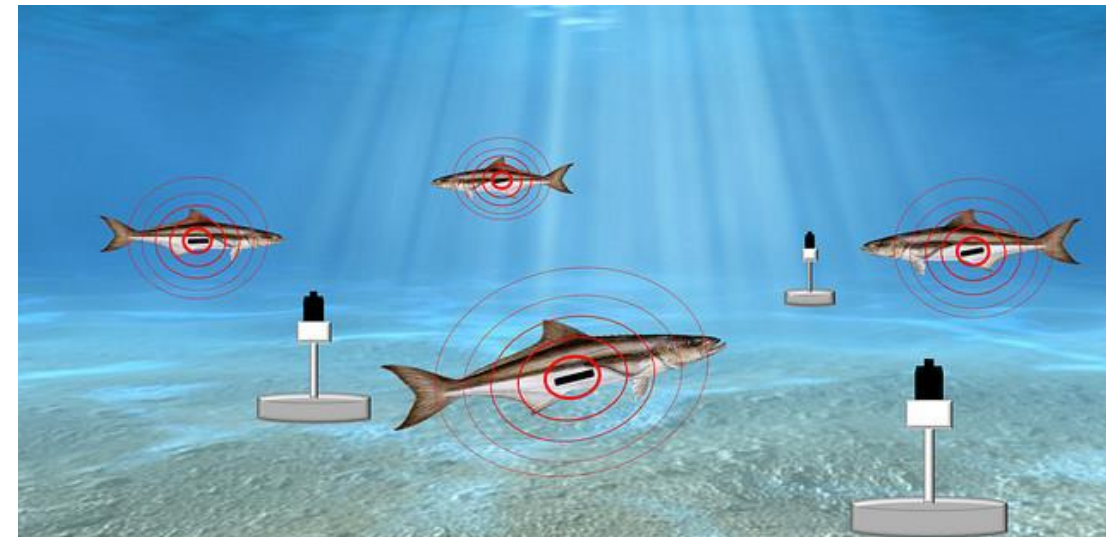
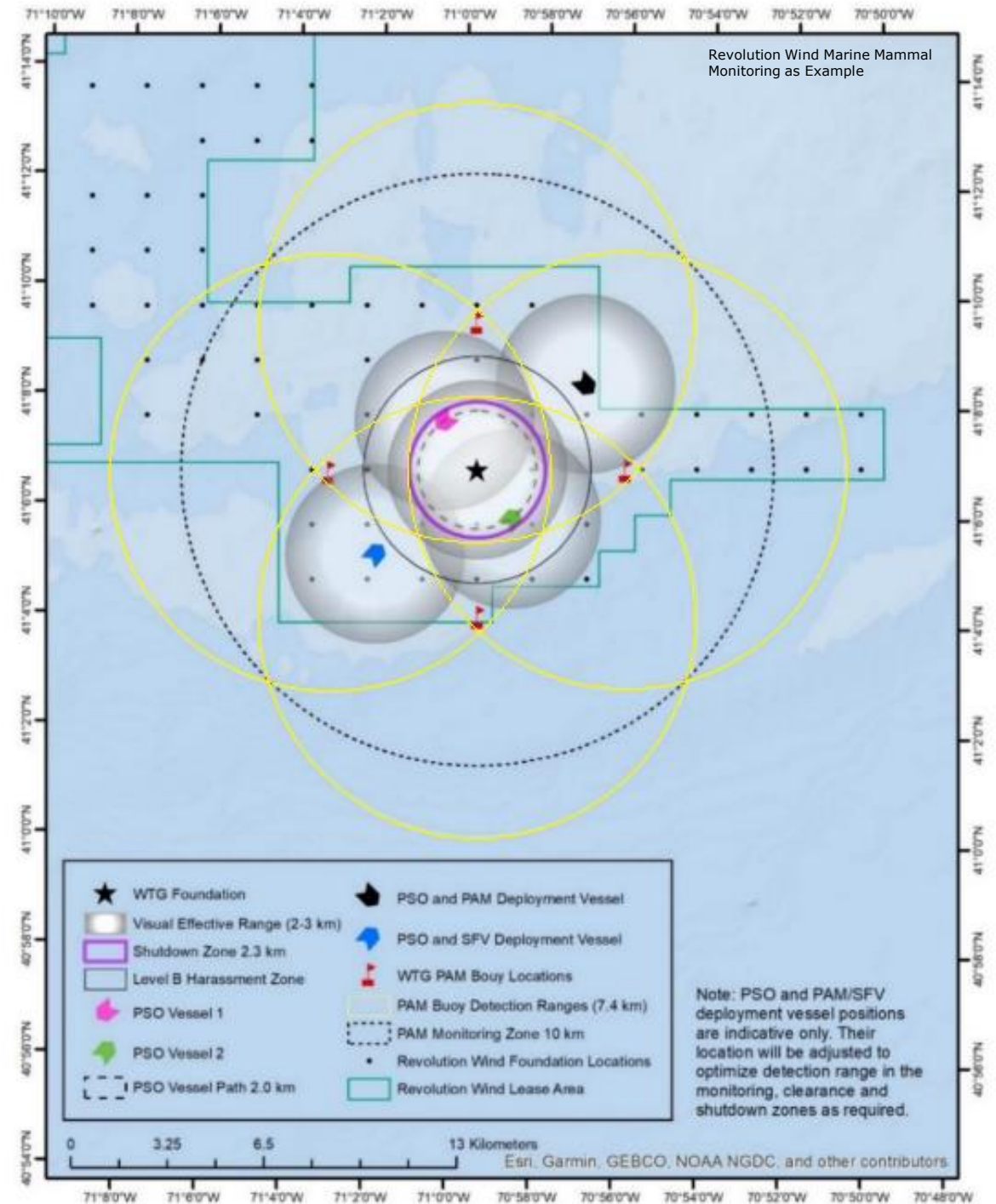


Image: Florida Fish and
Wildlife Conservation
Commission, CC/Flickr.

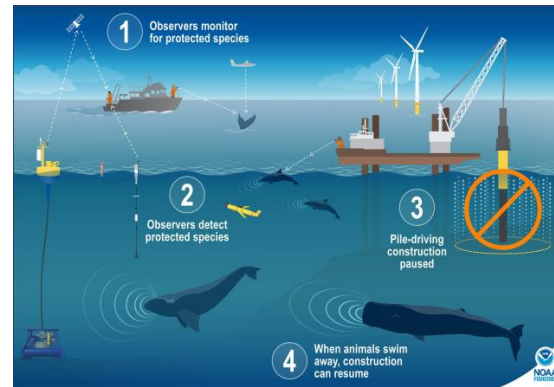
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Requirements & Incentives

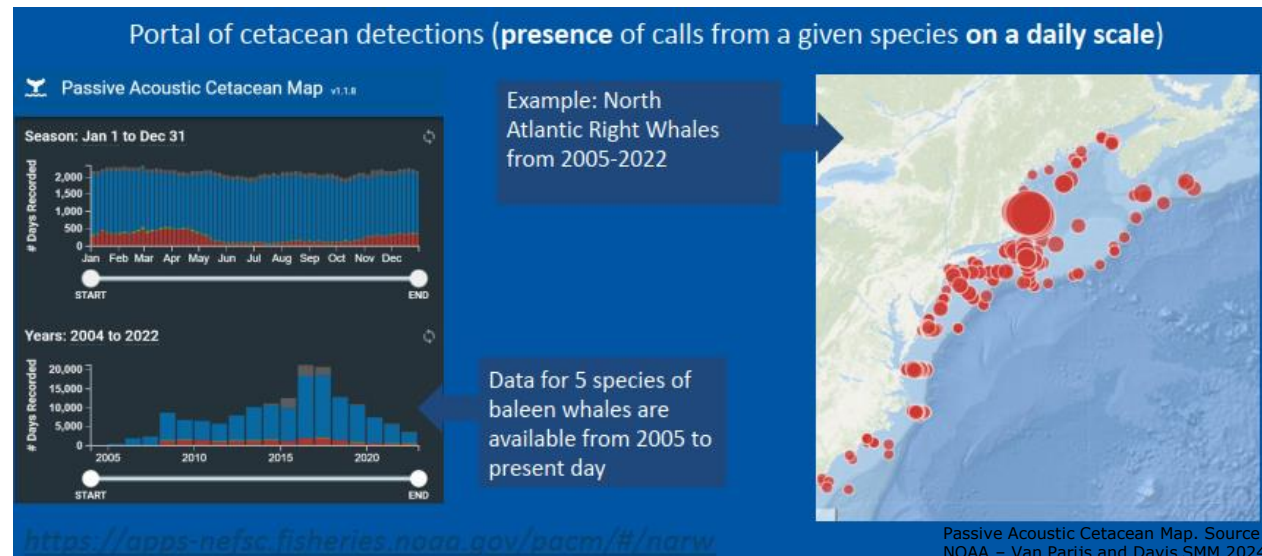
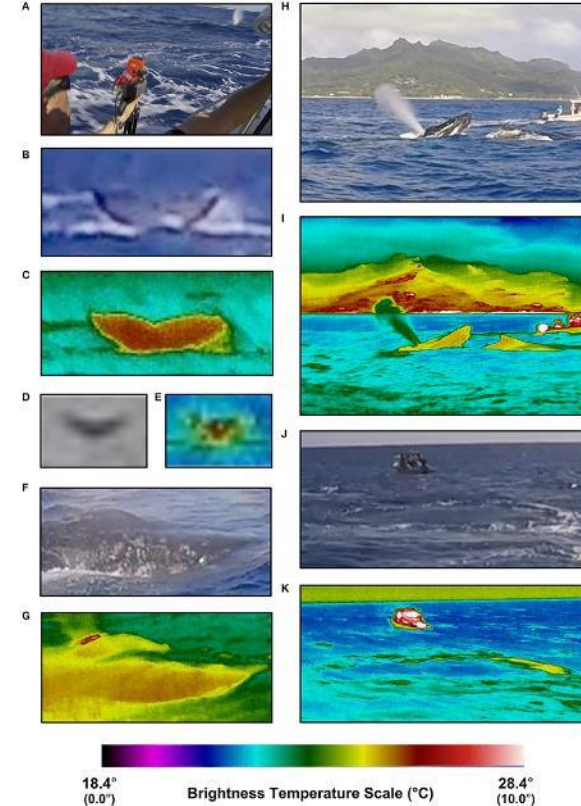


Typical Requirements

- Siting choices
- Seasonal restrictions
- Sound dampening
- Alternative technologies
- Protected species observers
- Soft start
- Clearance
- Shutdown
- Monitoring for thresholds
- Regional collaborations
- Long-term monitoring/adaptive management



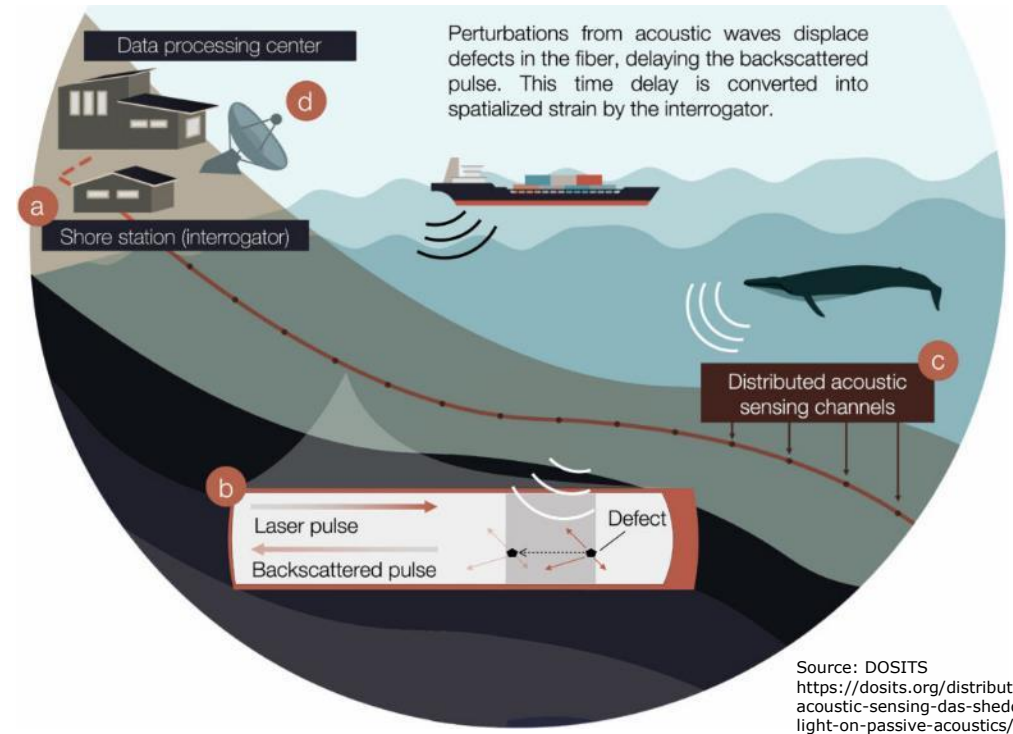
Passive Acoustic Monitoring Systems on US East Coast. Source: NOAA – Van Parijs and Davis SMM 2024



Passive Acoustic Cetacean Map. Source: NOAA – Van Parijs and Davis SMM 2024

Incentives

- Potential to reduce mitigation burden and deploy faster
- Reduce cost of energy – competitive advantage
- Reduce safety risks (tech vs people at sea)
- Stakeholder buy-in and social license
- Reduce risk and uncertainty for projects
- Improve permitting processes
- Improve data beneficial to project planning and operations
- Contribute to conservation and research

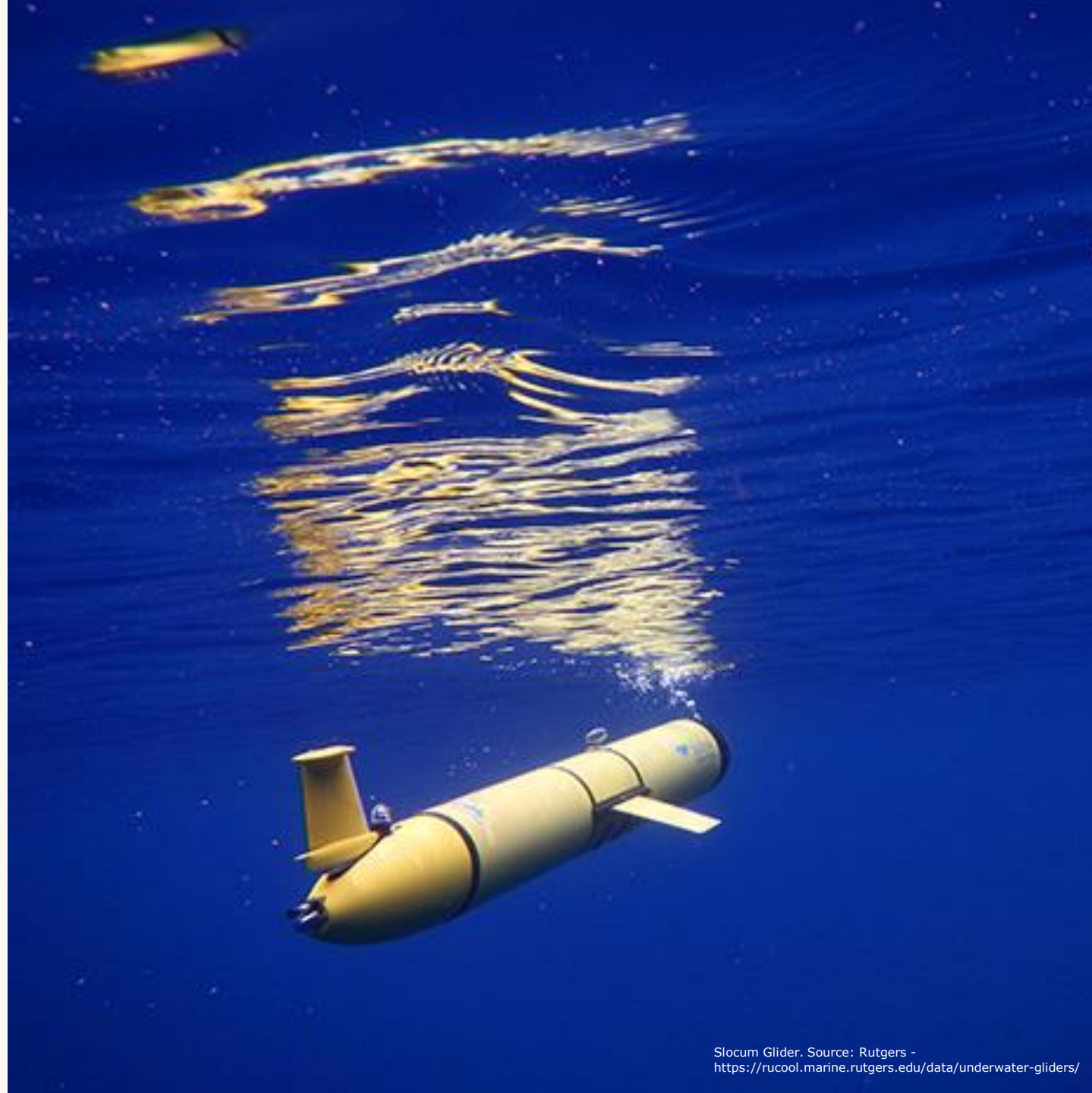


Night foundation installation in Germany. Source: <https://www.upstreamonline.com/rigs-and-vessels/giant-floating-crane-works-round-the-clock-to-install-germanys-largest-offshore-wind-farm/2-1-1659644>



05

Effectiveness of Technologies



Effectiveness

- Sound field verification
- Passive acoustic monitor testing
- Thermal/IR testing
- Verification of detection/classification
- Behavioral response studies
- Observer reports
- Before/after studies



Field Observations During Offshore Wind Structure Installation and Operation, Volume I

Title: [Field Observations During Offshore Wind Structure Installation and Operation, Volume I](#)

Key Researchers: J. L. Amaral, K. Ampela, A. S. Frankel, A. A. Khan, Y.-T. Lin, T. Mason, J. H. Miller, A. E. Newhall, G. R. Potty

As part of the Real-Time Opportunity for Development Environmental Observations (RODEO) Study, underwater sound was measured during the installation of two wind turbines as part of the Coastal Virginia Offshore Wind (CVOW) pilot project. Through coordination with the operator and NOAA, an experiment was conducted that allowed for the measurement of sound from one turbine while a bubble curtain was used for to reduce the sound, and from a turbine without the bubble curtain. Using a variety of instruments that were placed near the installation location and also a variety of techniques to make measurements up to 30 kilometers from the installation, an evaluation of the effectiveness of the bubble curtain was made.

Findings

- The bubble curtain reduced the sound (peak pressure) from 4.2 to 23.1 dB depending on the distance
- The effectiveness of the noise reduction at CVOW was dependent on sound frequency

How BOEM will use this information

- Results will inform environmental assessments of future offshore wind development
- Provide information about the use of mitigation measures such as bubble curtains and their effectiveness

FIT FOR PORPOISE? ASSESSING THE EFFECTIVENESS OF UNDERWATER SOUND MITIGATION MEASURES

Bob RUMES & Steven DEGRAER

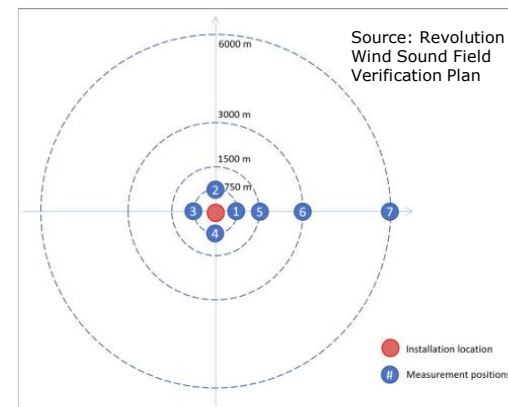


Figure 7-2 Sample sound field verification showing layout of proposed measurement locations. Specific locations are only examples and may change.

Particle motion observed during offshore wind turbine piling operation

Peter Sigray ^a, Markus Linné ^b, Mathias H. Andersson ^b, Andreas Nöjd ^b, Leif K.G. Persson ^b, Andrew B. Gill ^c, Frank Thomsen ^d

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<https://doi.org/10.1016/j.marpolbul.2022.113734>

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Highlights

- Bespoke sensor developed for measuring particle motion of underwater sound
- Measurement of sound pressure level and sound exposure level from piling
- Measurement of efficiency noise reduction for different mitigations techniques

Standards

- Depends on the question
- NOAA & BOEM PAM recommendations
- NMFS PAM Acoustic Reporting System
- Authorization data requirements
- Challenging to get new tech approved

ANSI S3/SC1WG03

Working Group on Towed Array Passive Acoustic Operations for Bioacoustic Applications

Chair: A. M. Thode

Scope: Develop and maintain standards and recommendations for the use of passive acoustic monitoring (PAM) using towed arrays from surface vessels for bioacoustic mitigation or monitoring. Communication and liaison with other ANSI WGs that may use these standards.

Responsible for the following published standards:

[ASA/ANSI S3/SC1.2 – Underwater Passive Acoustic Monitoring for Bioacoustic Applications](#)

Download templates at:
<https://www.fisheries.noaa.gov/resource/document/passive-acoustic-reporting-system-templates>

PAM data format requirements for NMFS PAM Reporting System. Source: Van Parijs & Davis 2024

2024 Update to:

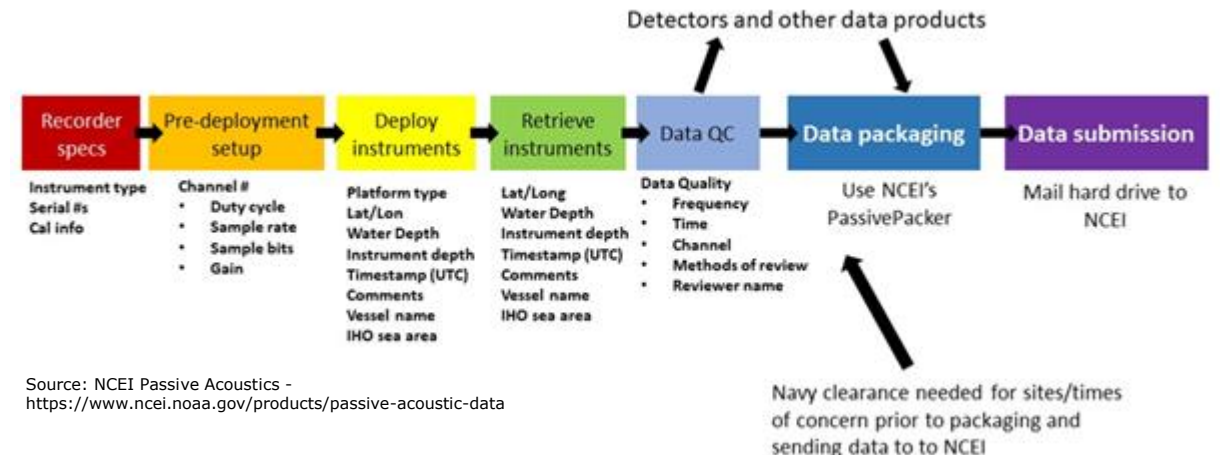
Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 3.0)

Underwater and In-Air Criteria for Onset of Auditory Injury and Temporary Threshold Shifts

Office of Protected Resources
 National Marine Fisheries Service
 Silver Spring, MD 20910

NOAA and BOEM Minimum Recommendations for Use of Passive Acoustic Listening Systems in Offshore Wind Energy Development Monitoring and Mitigation Programs

Sofie M. Van Parijs^{1*}, Kyle Baker², Jordan Carduner³, Jaclyn Daly³, Genevieve E. Davis¹, Carter Esch³, Shane Guan^{4,5}, Amy Scholik-Schlomer³, Nicholas B. Sisson⁶ and Erica Staaterman⁷



Source: NCEI Passive Acoustics - <https://www.ncei.noaa.gov/products/passive-acoustic-data>

A graphic featuring the letters 'Q' and 'A' in a large, bold font. The 'Q' is teal and the 'A' is white. A white ampersand is positioned between them. The 'Q' is partially filled with a dense, wavy pattern of red lines that extends across the left side of the image. The background is split vertically: the left side is white and the right side is teal.

Q & A

Sarah Courbis, Ph.D.
Worley Consulting
Sarah.Courbis@worley.com

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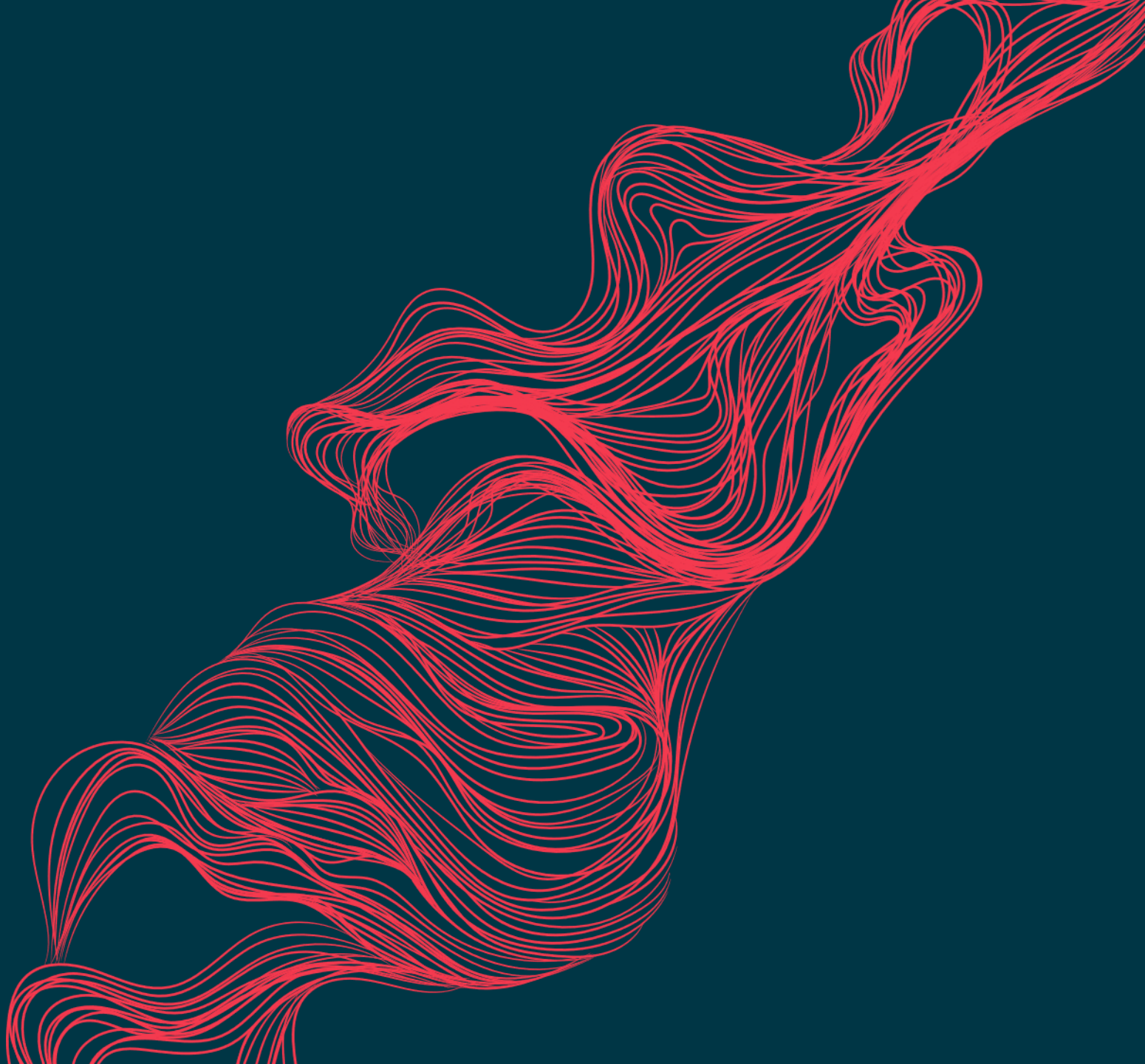
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