



Rijkswaterstaat
Ministerie van Infrastructuur en Waterstaat

Underwater noise

Hackaton Digishape



Niels Kinneging (WVL)
13 May 2024

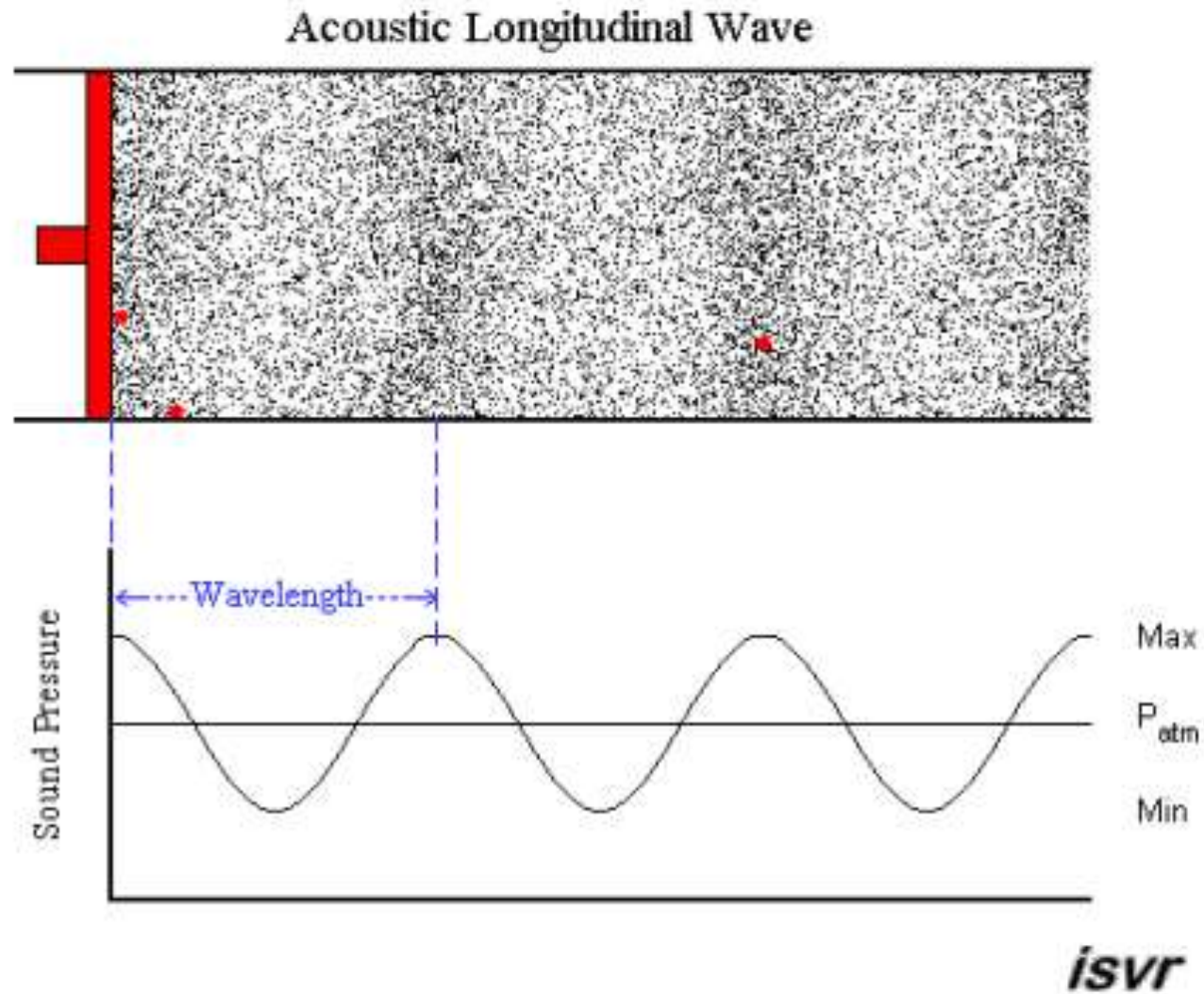




Underwater noise

- Why are we concerned for underwater noise?
- Sources of underwater noise
- Purposes of noise monitoring
- Some remarks on noise data

What is sound?





Natural sources

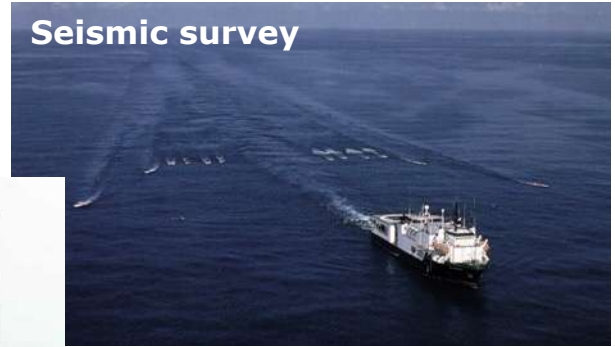
- Wind
- Rain
- Lightning
- Other sources:
 - Marine life (marine mammals, fish, etc.)
 - Waves
 - ...





Human sources

- Subdivision on purpose:
 - Sound as a signal
 - Sound as a by-product (noise)
- Subdivision by type:
 - Impulsive sounds
 - Continuous sound



Ship sound sources

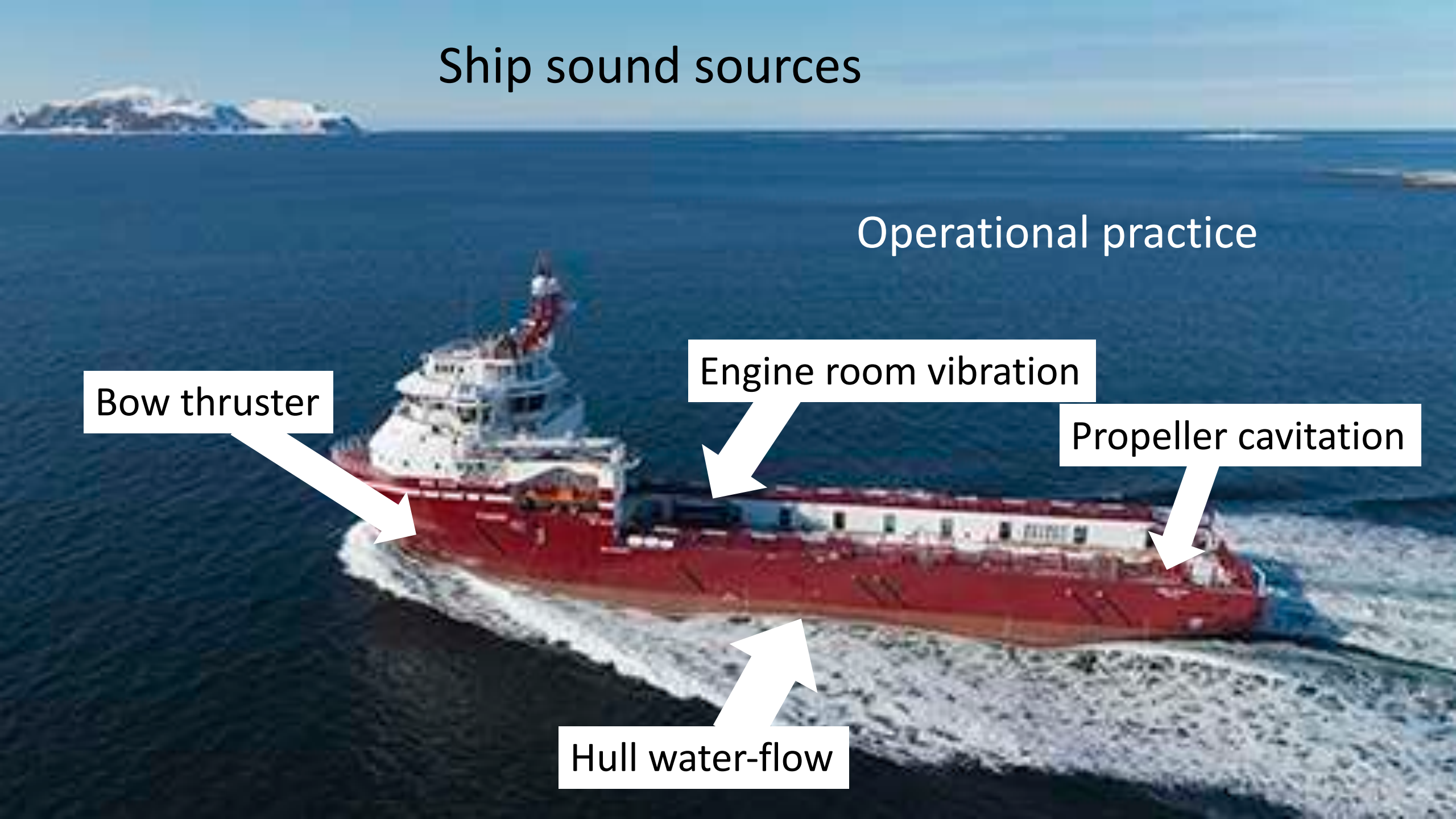
Operational practice

Bow thruster

Engine room vibration

Propeller cavitation

Hull water-flow



Cavitation



By U.S. Navy - Controllable-Pitch Propeller in Large Cavitation Channel.

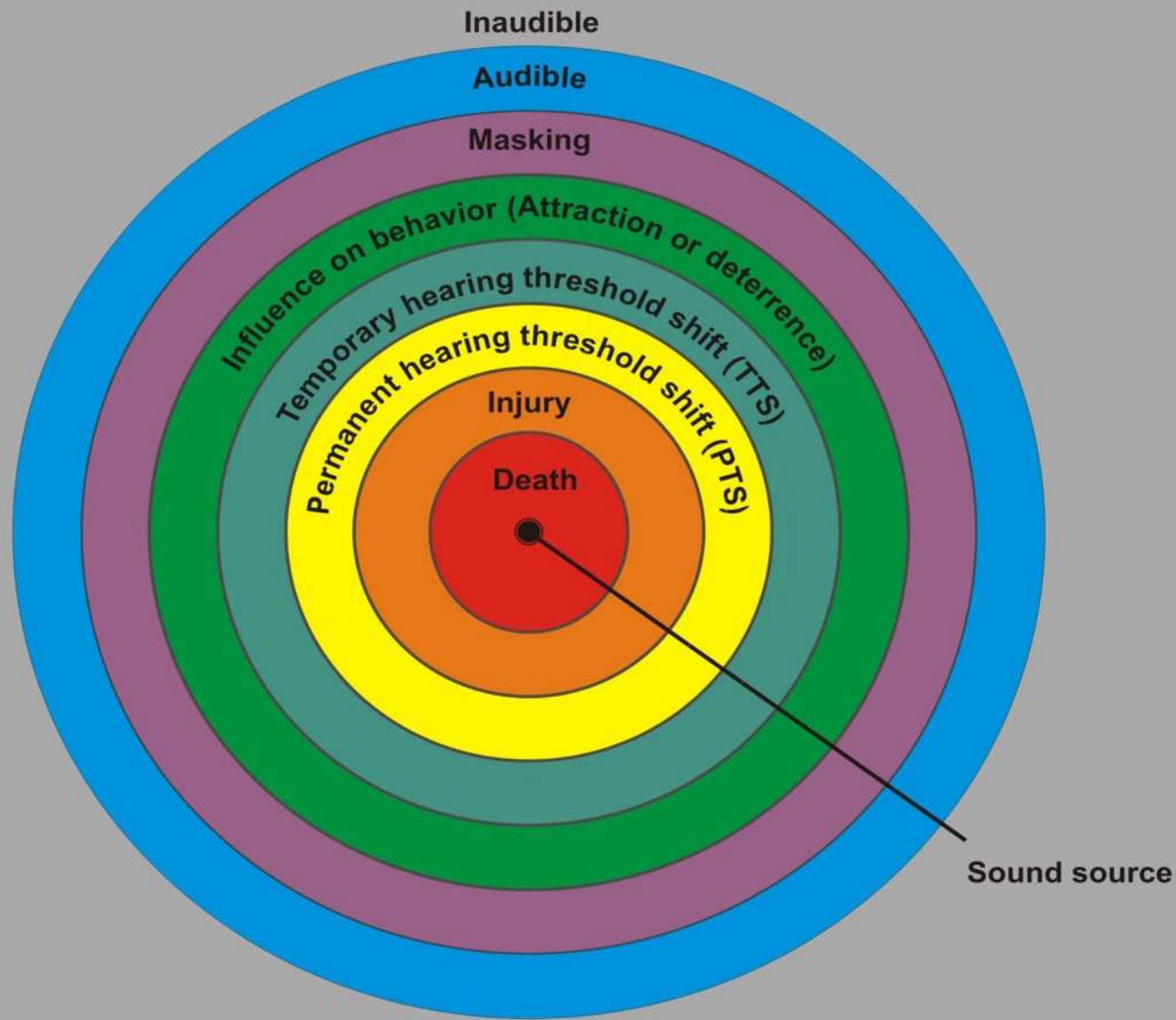


Piling





Ranges of effects of sounds on Marine Mammals



Interreg
North Sea Region
Jomopans



European Regional Development Fund

EUROPEAN UNION

JOMOPANS (2018-2022)

JOINT MONITORING PROGRAMME FOR AMBIENT NOISE IN THE NORTH SEA



Rijkswaterstaat
Ministerie van Infrastructuur en Waterstaat



AARHUS UNIVERSITY



BUNDESAMT FÜR
SEESCHIFFFAHRT
UND
HYDROGRAPHIE



Cefas **FFI** Forsvarets
forskningsinstitutt
Norwegian Defence Research Establishment



FOI



Scottish Government
Riaghaltas na h-Alba
gov.scot

marinescotland

NPL
National Physical Laboratory

Institut royal des
Sciences naturelles
de Belgique
museum



TNO

Interreg
North Sea Region
Jomopans



European Regional Development Fund EUROPEAN UNION



INSTITUTE OF MARINE RESEARCH
FORSKNINGSINSTITUTTET

FFI Forsvarets
forskningsinstitutt
Norwegian Defence Research Establishment



Scottish Government
Riaghaltas na h-Alba
gov.scot



SOLIDUM PETIT IN PROFUNDIS
UNIVERSITAS ARHUSIENSIS



Cefas



Rijkswaterstaat
Ministerie van Infrastructuur en Waterstaat



BSH
BUNDESAMT FÜR
SEESCHIFFFAHRT
UND
HYDROGRAPHIE



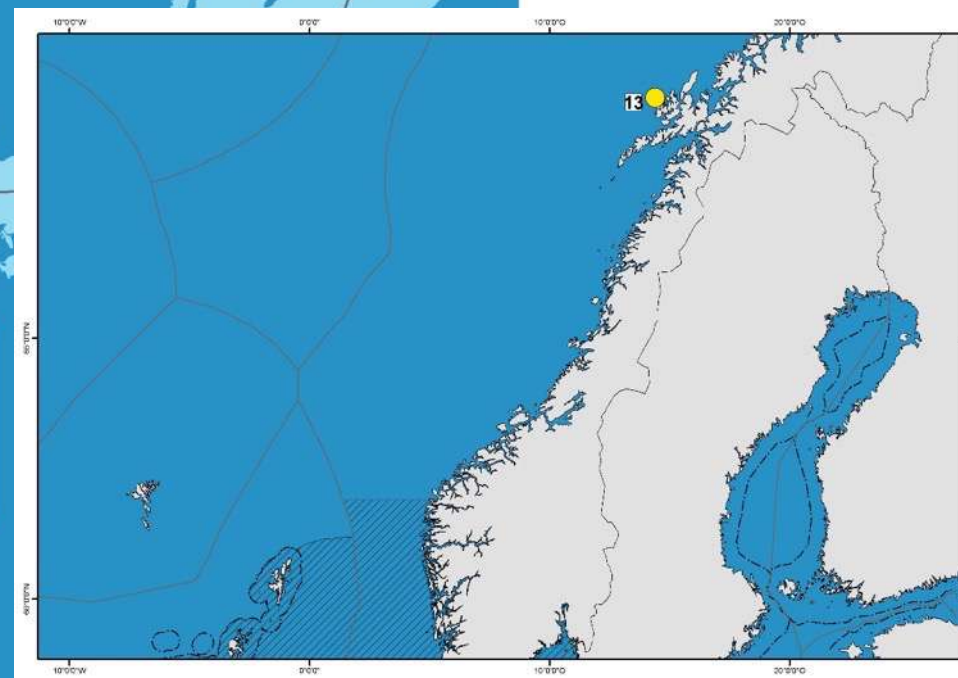
NPL
National Physical Laboratory



TNO



museum
Operational Directorate Natural Environment
OD Nature | OD Natuur | DO Nature



Jomopans
European Regional Development Fund EUROPEAN UNION

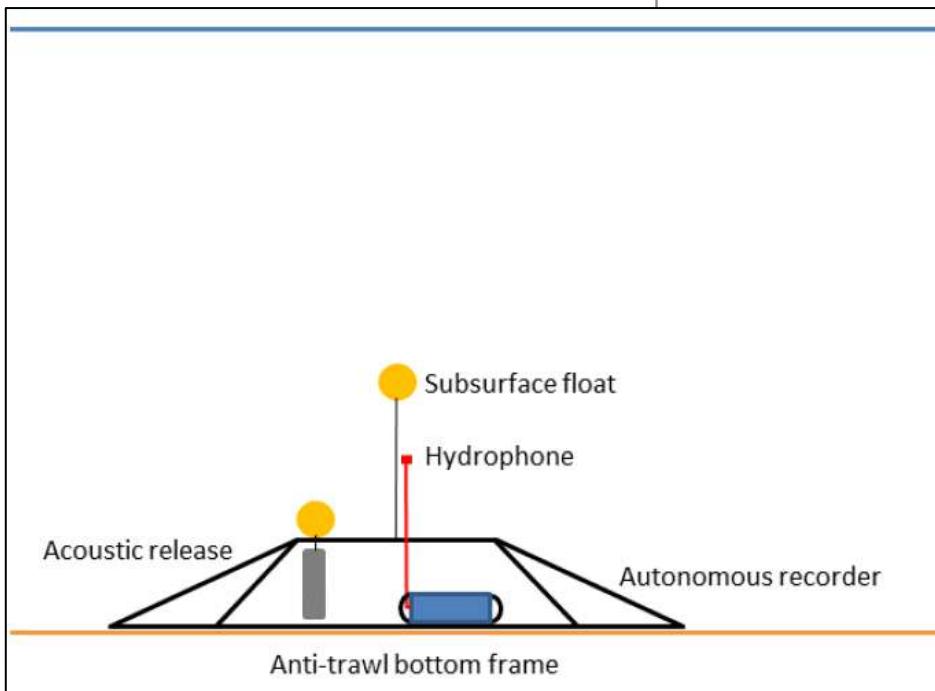
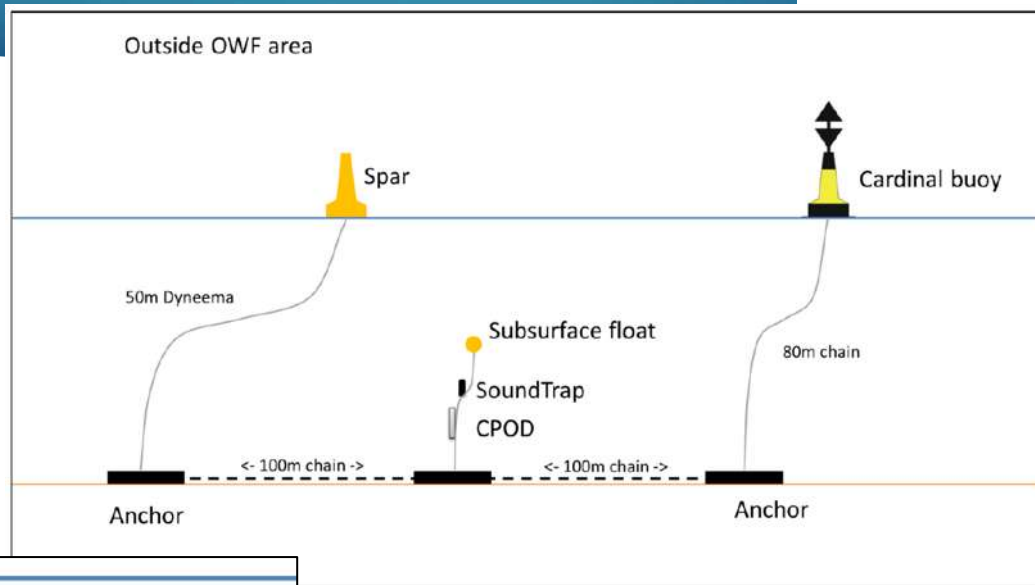
Measurements



CPOD

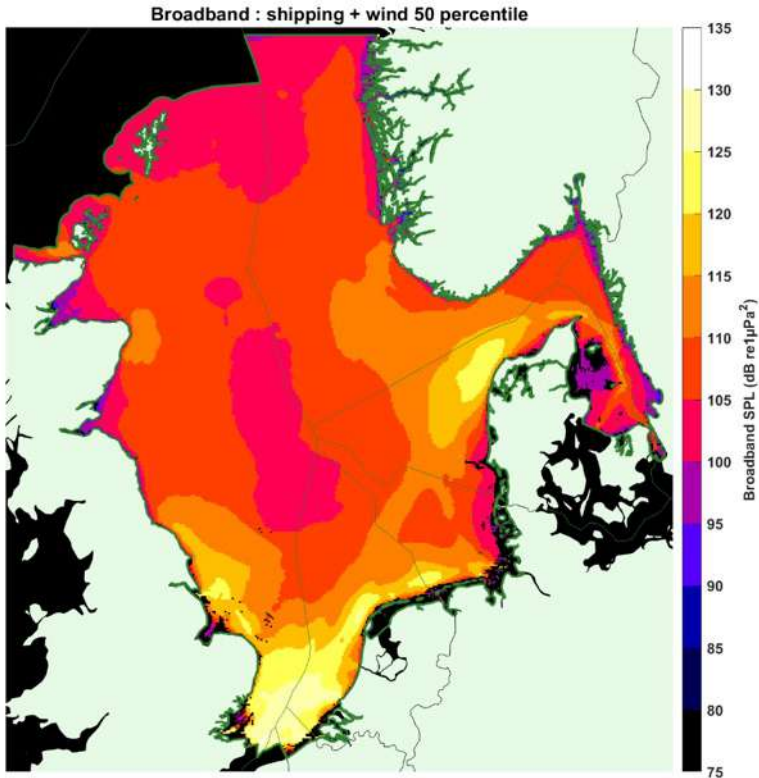


SoundTrap

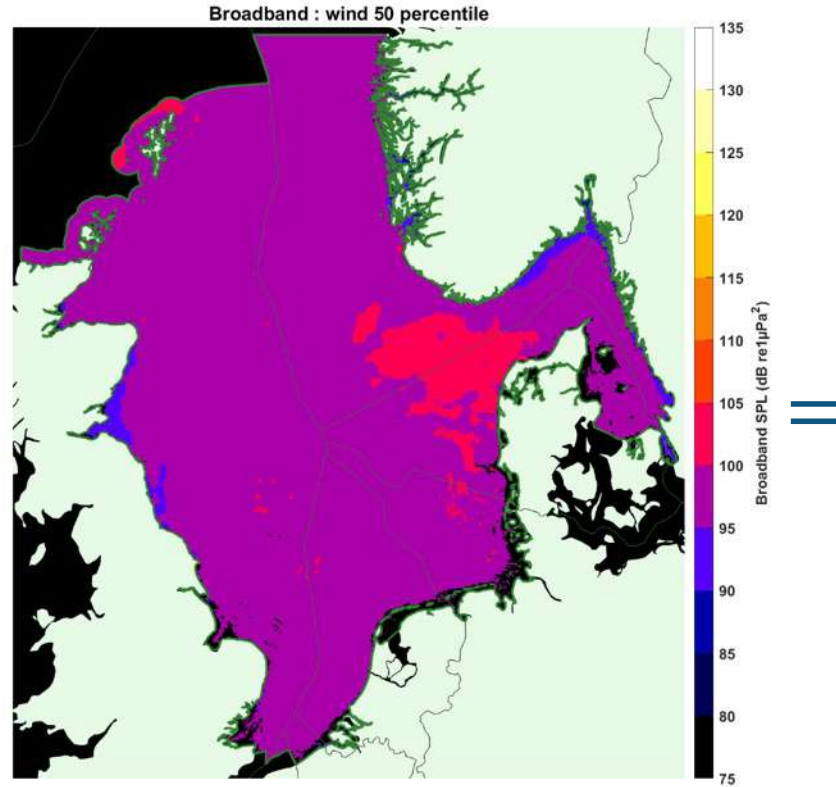


Maps from Jomopans, year 2019

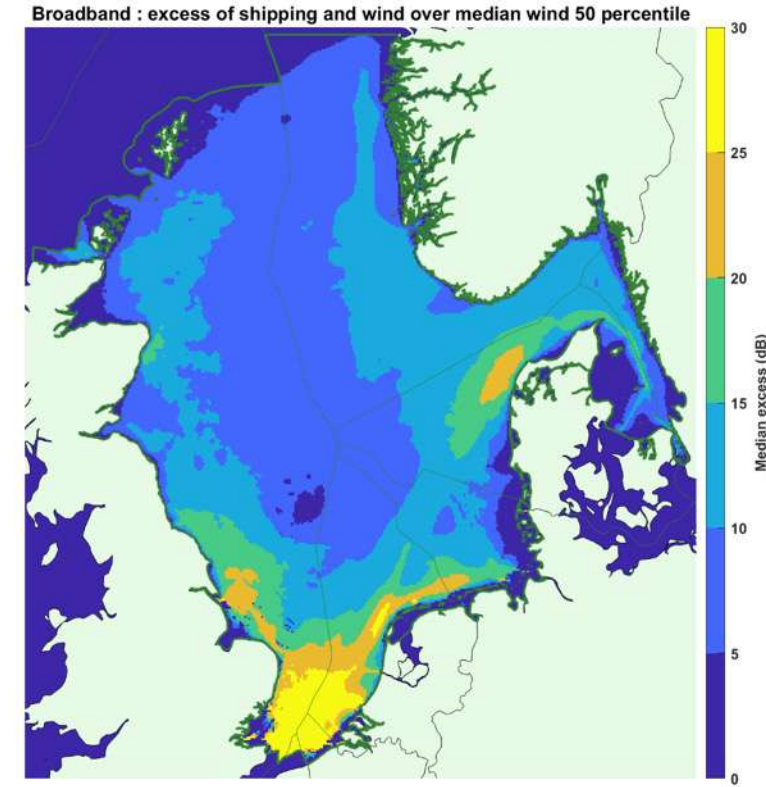
Total SPL



Background level



Excess level



Results Jomopans 2022



Purpose of measurements

- Identification
 - Ships
 - Animals
 - Other
- Assessment
 - Statistical information
 - Full signal
- Surveillance
 - Reponse time
 - Stand-alone vs cabled
 - Legal proof



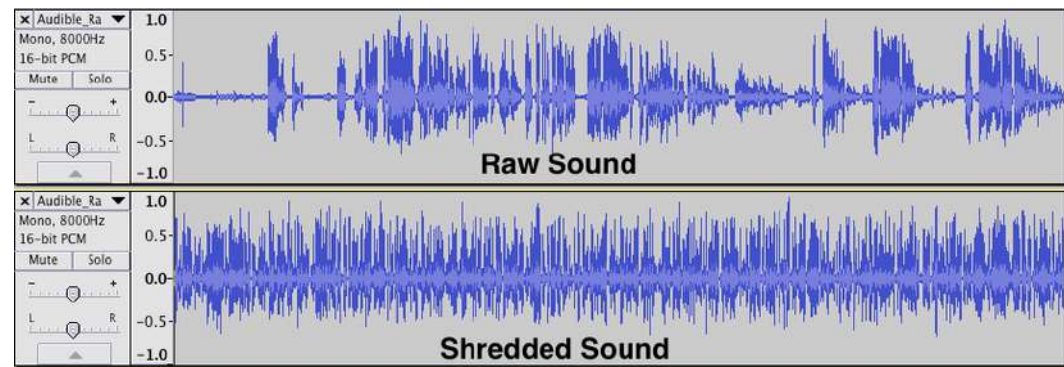
Choices for measurements

- Equipment
 - Hydrophone
 - CPOD
 - Frequency range (24 kHz) > sample rate (48 kHz)
 - Dynamic range > #bits (24 bits – 72 dB)
- Duty cycle
 - Save storage
 - Jomopans Texel: 5 min/15 min
- Calibration
 - Lab calibration
 - Function test in the field



Representation

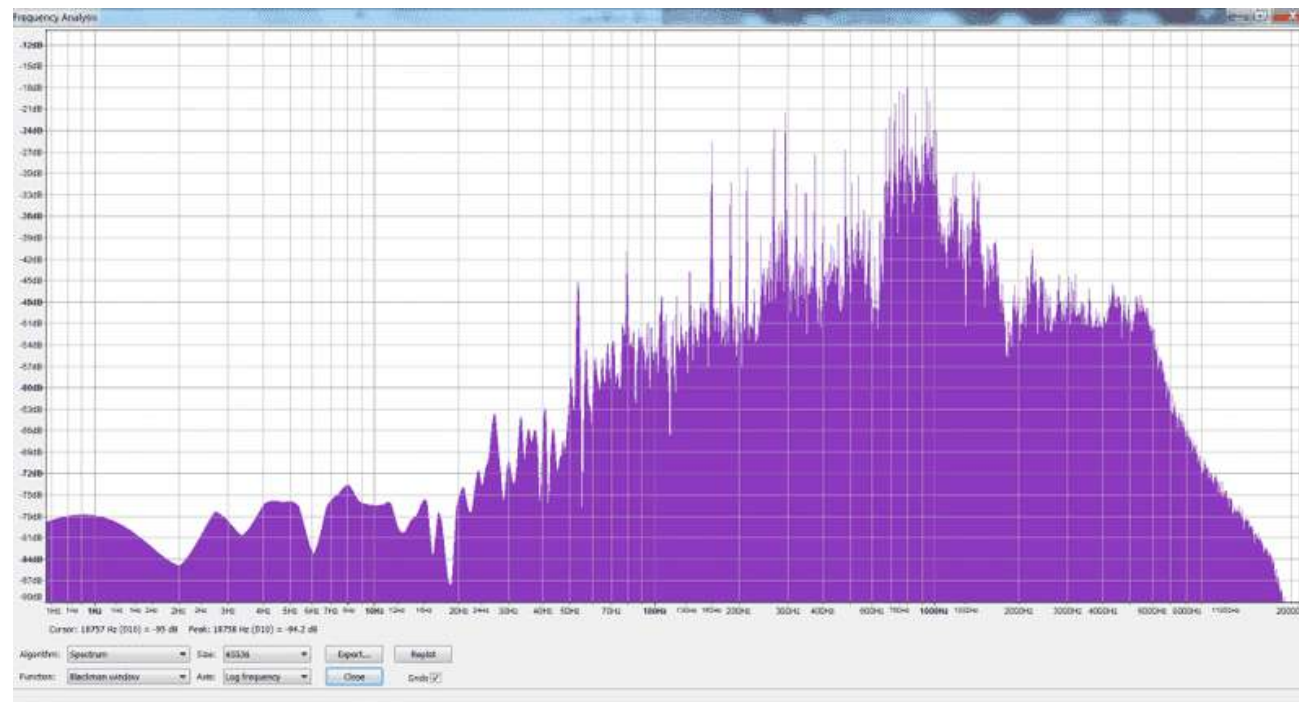
- Raw data
 - MP3 compression





Representation

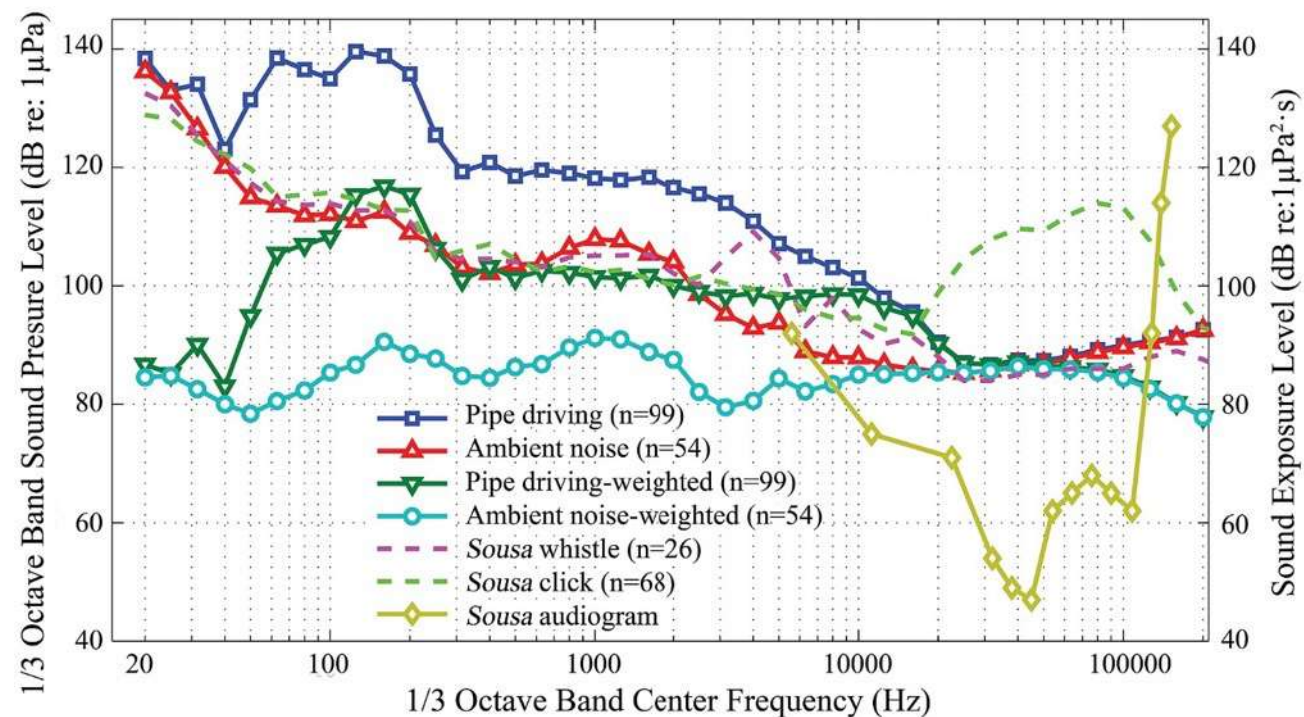
- Raw data
 - MP3 compression
- Sound spectrum
 - Frequency domain





Representation

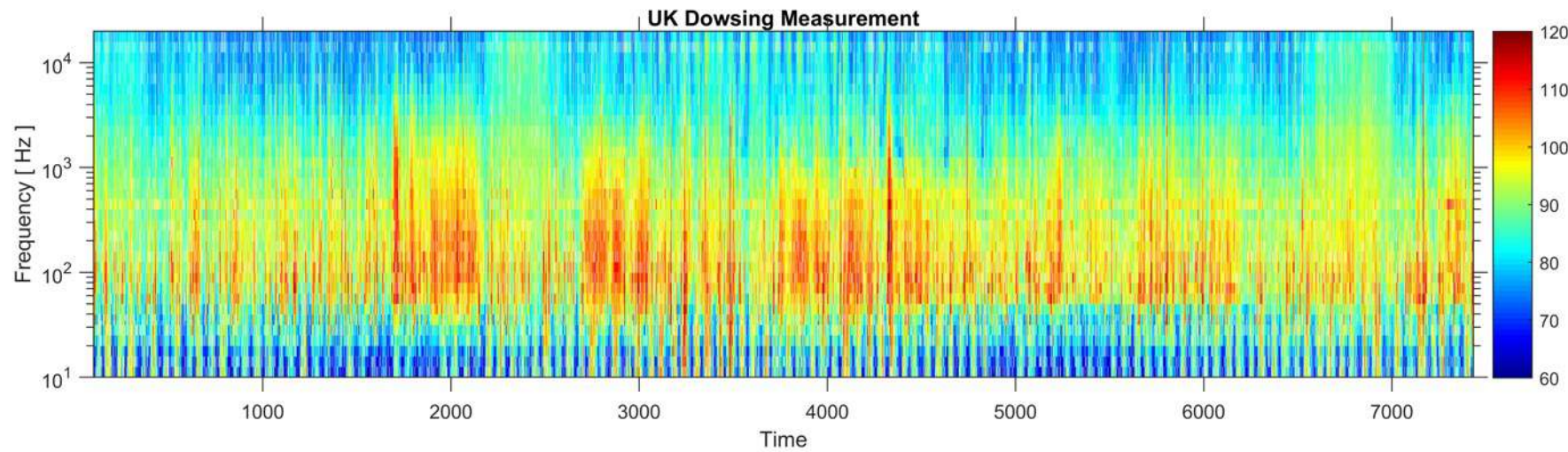
- Raw data
 - MP3 compression
- Sound spectrum
 - Frequency domain
 - 1/3 octave bands





Representation

- Raw data
 - MP3 compression
- Sound spectrum
 - Frequency domain
 - 1/3 octave bands
- Spectrograms
 - Time-frequency plots





SoundCoop

Developing a passive acoustic monitoring cyberinfrastructure center

Carrie C. Wall, Leila T. Hatch, Sofie M. Van Parijs, and Rob Bochenek

